

**COMMONWEALTH OF KENTUCKY**  
**BEFORE THE PUBLIC SERVICE COMMISSION**

In the Matter of:

The Electronic Application of Duke Energy	)	
Kentucky, Inc. for a Certificate of Public	)	
Convenience and Necessity to Close the East	)	Case No. 2021-00290
Landfill at the East Bend Generating Station and for	)	
Approval to Amend its Environmental Compliance	)	
Plan for Recovery by Environmental Surcharge	)	
Mechanism	)	

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**APPLICATION OF DUKE ENERGY KENTUCKY, INC.**

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Now comes Duke Energy Kentucky, Inc. (Duke Energy Kentucky or the Company), by and through counsel, pursuant to KRS 278.020(1), KRS 278.183, and 807 KAR 5:001 Sections 14 and 15, and hereby respectfully requests the Kentucky Public Service Commission (Commission) to issue an Order approving: (1) a Certificate of Public Convenience and Necessity (CPCN) for the construction activities necessary for the closure of the East Landfill located at its East Bend Generating Station (East Bend); (2) amendment of the Company's Environmental Compliance Plan (ECP) to include these closure costs and other asset retirement obligations (AROs), including ongoing groundwater monitoring and other landfill and basin maintenance activities related to environmental compliance; (3) recovery of the costs through the Company' Environmental Surcharge Mechanism (ESM); and (4) any other necessary relief and approvals. In support of this Application, Duke Energy Kentucky states as follows:

**Introduction**

1. Duke Energy Kentucky is a Kentucky corporation with its principal office and principal place of business at 139 East Fourth Street, Cincinnati, Ohio 45202. The Company's

local office in Kentucky is Duke Energy Erlanger Operations Center, 1262 Cox Road, Erlanger, Kentucky 41018. The Company further states that its electronic mail address for purposes of this matter is [KYfilings@duke-energy.com](mailto:KYfilings@duke-energy.com).

2. Duke Energy Kentucky is a utility engaged in the gas and electric business. Duke Energy Kentucky purchases, sells, stores and transports natural gas in the Boone, Bracken, Campbell, Gallatin, Grant, Kenton, and Pendleton Counties. Duke Energy Kentucky also generates electricity, which it distributes and sells, in the Boone, Campbell, Grant, Kenton, and Pendleton Counties.

3. Pursuant to 807 KAR 5:001, Section 14(2), Duke Energy Kentucky states that it was originally incorporated in the Commonwealth of Kentucky on March 20, 1901, and attests that it is currently in good standing in said Commonwealth.

4. Pursuant to KRS 278.380, Duke Energy Kentucky waives any right to service of Commission orders by mail for purposes of this proceeding only. Copies of all orders, pleadings, and other communications related to this proceeding should be directed to:

Rocco O. D'Ascenzo  
Deputy General Counsel  
Duke Energy Kentucky, Inc.  
139 East Fourth Street  
Cincinnati, OH 45202  
rocco.d'ascenzo@duke-energy.com

and

Sarah E. Lawler  
Vice President, Rates and Regulatory Strategy Ohio/Kentucky  
Duke Energy Kentucky, Inc.  
139 East Fourth Street  
Cincinnati, OH 45202  
sarah.lawler@duke-energy.com

## Background

5. On or about December 5, 2003, in Case No. 2003-00252, the Commission approved Duke Energy Kentucky's acquisition of three generating stations from Duke Energy Ohio; East Bend, Miami Fort Unit 6 and Woodsdale. Effective January 1, 2006, Duke Energy Kentucky completed the acquisition of these three generating stations. Effective December 31, 2014, Duke Energy Kentucky became the sole owner of East Bend, having completed the purchase of The Dayton Power and Light Company's 31 percent interest in the station as authorized by the Commission in Case No. 2014-00201.<sup>1</sup>

6. Duke Energy Kentucky currently operates two landfills at East Bend, the East and West Landfills, that are used for the disposal of waste products resulting from the Company's flue gas desulfurization (FGD) and other waste material (Generator Waste). The Landfills are used, incidentally, in the production and furnishing of electric service as it serves as a means for storage and disposal of generator waste material produced by East Bend. The presence of these onsite landfills has permitted Duke Energy Kentucky to manage its costs of providing safe and reliable electric service by eliminating the need to transport and pay for disposal of the Generator Waste in commercial landfills.

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<sup>1</sup> *In the Matter of the Application of Duke Energy Kentucky, Inc., for (1) A Certificate of Public Convenience and Necessity Authorizing the Acquisition of the Dayton Power & Light Company's 31% Interest in the East Bend Generating Station; (2) Approval of Duke Energy Kentucky, Inc.'s Assumption of Certain Liabilities in Connection with the Acquisition; (3) Deferral of Costs Incurred as Part of the Acquisition; and (4) All Other Necessary Waivers, Approvals, and Relief*, Case No. 2014-00201 (Ky.P.S.C. Dec. 4, 2014).

## **Request for Certificate of Public Convenience and Necessity**

7. As explained in the Company's Application in Case No. 2015-00089 (West Landfill CPCN Application), the West Landfill was needed to support the continued operation of East Bend and to replace the East Landfill, which was reaching capacity.<sup>2</sup> The West Landfill CPCN Application fully explained and supported the need to construct the West Landfill in order to support the operation of East Bend. Now, the East Landfill has reached its capacity and must be closed in compliance with applicable environmental regulations.

8. The closure of the East Landfill will not adversely impact the continued operation of East Bend as the West Landfill is also permitted to receive the same various forms of Generator Waste as the East Landfill. As directed by this Commission, the Company is required to seek Commission approval for a CPCN prior to construction of each of the phases of the West Landfill.<sup>3</sup> To date, the Company has received Commission approval for the first two cells of the West Landfill. Future cell construction will be timed so that the West Landfill can continue to operate without any interruption and in a way that reduces construction and operational costs. The West Landfill is designed to accept at least 30 years of Generator Waste from the East Bend Station, as well as other permitted stations, as is necessary to ensure there is sufficient dry fly ash material to make the Poz-o-tec byproduct necessary to operate East Bend's FGD handling process.

9. The East Landfill closure activities will include, but are not limited to, engineering and design of the final closure cap, temporary closure caps until the final cap is constructed, soil and overseeding to create greenspace, permanent stormwater drainage and

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<sup>2</sup> *In the Matter of the Application of Duke Energy Kentucky, Inc., for a Declaratory Order that the Construction of a New Landfill constitutes an Ordinary Extension in the Usual Course of Business or, in the Alternative, for a Certificate of Public Convenience and Necessity*, Case No. 2015-00089 (Ky.P.S.C. Jul. 24, 2015).

<sup>3</sup> *Id.* at 11.

installation of a permanent access road. Post closure activities will include continued oversight for groundwater monitoring, mowing, maintenance, and upkeep of the landfill slopes.

10. Statement of Need (807 KAR 5:001 § 15(2)(a)): The East Landfill has reached its permitted capacity and now must be closed in compliance with applicable environmental regulations as explained in the Direct Testimony of Tammy Jett accompanying this application. As a prudent operator, Duke Energy Kentucky must take necessary steps to close the landfill in place, with appropriate caps and engineering to ensure the site remains safe.

11. Duke Energy Kentucky continues to believe that continuing to operate its own, onsite landfill disposal system is the best way to address Generator Waste disposal. Maintaining an onsite disposal facility minimizes any transportation expenses and disposal fees, and avoids contractual limitations, such as volume constraints, terms of use, and renegotiations that Duke Energy Kentucky would incur if it were to use a third-party commercial landfill.

12. Duke Energy Kentucky respectfully requests this Commission grant approval to commence construction activities to close the East Landfill, and for the necessary ongoing post-closure activities that are required (e.g. ground water monitoring, mowing, etc..) to maintain the landfill and former basin sites in a safe manner.

13. In accordance with 807 KAR 5:001 Section 12(2)(a)-(i), Duke Energy Kentucky is filing the following information in Exhibit 1, which is incorporated herein and made a part of this Application filed in this proceeding:

<u>Exhibit 1</u>	<u>Description</u>	<u>807 KAR 5:001</u>
<u>Page</u>		<u>Section Reference</u>
	Financial Exhibit	12(2)
1	Amount and kinds of stock authorized	12(2)(a)
1	Amount and kinds of stock issued and outstanding	12(2)(b)
1	Terms of preference or preferred stock	12(2)(c)

1	Brief description of each mortgage on property of Duke Energy Kentucky	12(2)(d)
2	Amount of bonds authorized and issued and related information	12(2)(e)
2	Notes outstanding and related information	12(2)(f)
2-3	Other indebtedness and related information	12(2)(g)
4	Dividend information	12(2)(h)
4-6	Detailed Income Statement and Balance Sheet	12(2)(i)

14. 807 KAR 5:001, Section 15 sets forth the requirements to receive a CPCN.

- a. In accordance with Section 15(2)(a), the application herein describes the facts relied upon to show the closure of the East Landfill is required by public convenience or necessity in that closure is necessary for the Company to continue to comply with environmental regulations and will allow Duke Energy Kentucky to continue to provide safe, reliable, and reasonably priced retail electric service to customers by not having to procure third-party disposal services for Generator Waste material.
- b. In accordance with Section 15(2)(b), the Company has previously filed with the Commission the applicable franchises from the proper public authorities. In addition, Exhibit 2 of this application includes a copy of the environmental permit for the East Landfill closure.
- c. In accordance with Section 15(2)(c) and (d), Exhibit 3 includes overhead maps of the site showing the location of the East Landfill and closure construction. Exhibit 4 includes the design plans, specifications, and drawings of the East Landfill closure.
- d. In accordance with Section 15(2)(e), the Company states that the total, fully loaded projected costs for East Landfill closure is \$22.6 million, including contingency and escalation. In addition, the Company

anticipates ongoing closure and maintenance costs of approximately \$234,458 and \$1,025,000 per year at the East Landfill and West Landfill respectively. Duke Energy Kentucky seeks to recover these costs through its ESM as part of its ECP. Duke Energy Kentucky expects to finance the costs of construction with a combination of new debt and equity and through ongoing operations. The mix of debt and equity used to finance the project will be determined so as to allow Duke Energy Kentucky to maintain its investment-grade credit rating.

- e. In accordance with Section 15(2)(f), the ongoing costs of operation, consisting of post-closure maintenance, is estimated to be approximately \$1,025,000 per year.

**Request for Recovery by Environmental Surcharge and to Amend Duke Energy Kentucky's Environmental Compliance Plan.**

15. Duke Energy Kentucky is seeking Commission authorization to amend its Environmental Compliance Plan, (ECP) to include the construction and post closure maintenance activities associated with closure of the East Landfill. Closure will enable Duke Energy Kentucky to continue complying with the U.S. Environmental Protection Agency (U.S. EPA) federal Hazardous and Solid Waste Management System, Disposal of Coal Combustion Residual (CCR Rule), as well as other environmental compliance regulations. In addition, the Company is amending its existing plan to include additional ash-related maintenance and post closure activities associated with its coal ash AROs, previously approved by the Commission in Case No. 2015-00187. The Company has incurred additional post-closure and ongoing maintenance expenses that were not previously included in the Company's ARO, including, but not limited to,

ongoing groundwater monitoring required in compliance with the CCR Rule for the Company's landfills and former basin.

16. This Application and supporting testimony and exhibits are available for public inspection at Duke Energy Kentucky's local Kentucky office located at Duke Energy Erlanger Operations Center, 1262 Cox Road, Erlanger, Kentucky 41018. The Company is giving notice to the public of the proposal to recover the cost East Landfill closure and post closure maintenance through its existing environmental surcharge by newspaper publication. The Company is also posting this Application on its website at [www.duke-energy.com](http://www.duke-energy.com). An initial Certificate of Notice and Publication is filed with this Application as Exhibit 5. A Certification of Completed Notice and Publication will be filed with the Commission upon completion of same pursuant to 807 KAR 5:001, Section 17(3)(b).

17. Pursuant to KRS 278.183(1), Duke Energy Kentucky is "entitled to the current recovery of its costs of complying with the Federal Clean Air Act as amended and those federal, state, or local environmental requirements which apply to coal combustion wastes and byproducts from facilities utilized for production of energy from coal in accordance with the utility's compliance plan."

18. A detailed summary of the facts and compliance requirements supporting this Application is set forth in the direct testimony and exhibits of the Company's witnesses:

- a. The testimony of Cecil Gurganus, Vice President of Midwest Generation, describes the need to close the East Bend East Landfill to meet environmental compliance regulations impacting the operation of East Bend;



- b. The testimony of Adam Deller, Senior Engineer, describes the engineering and construction aspects of East Landfill closure and the estimated costs;
- c. The testimony of Tammy Jett, Principal Environmental Specialist in the Environmental Health and Safety (EHS) Programs and Environmental Sciences Department, discusses the environmental regulations that necessitate closure of the East Landfill;
- d. The testimony of David Raiford, Manager Accounting I, discusses ARO accounting and the treatment of ash-related AROs in the ESM; and
- e. The testimony of Theodore Czupik, Rates and Regulatory Strategy Manager, provides an overview of the estimated impact of the East Landfill closure on Rider ESM and the estimated monthly bill impact for residential and non-residential customers.

19. Duke Energy Kentucky is not proposing any changes to its Environmental Surcharge Mechanism tariff sheet, K.Y.P.S.C. No. 19, Sheet No. 76 other than to change the issue and effective date and to include the closure project and all other post-closure Ash related maintenance activities in the ARO. Duke Energy Kentucky is filing its ESM tariff sheet as Exhibit 6 to this application for the purpose of obtaining the Commission's approval of the recovery of costs of in its ECP by the proposed assessment through this tariff provision. In accordance with KRS 278.183(2), the ESM tariff has an issue date of September 9, 2021, and is proposed to be effective on October 11, 2021, to begin recovery of construction activities following Commission approval of the requested CPCN. The Company projects that bills issued following Commission approval will reflect the revised environmental surcharge.

**WHEREFORE**, Duke Energy Kentucky respectfully requests the Kentucky Public Service Commission to enter an order: 1) granting Duke Energy Kentucky a Certificate of Public Convenience and Necessity to close its East Bend, East Landfill; 2) approving the amendment to Duke Energy Kentucky's ECP to include closure construction and post closure maintenance costs, as well as other ash-related post closure maintenance for previously established AROs; 3) approving the proposed ESM tariff for recovery of the costs of for bills rendered following Commission approval; 4) recovery of the overall ROE requested herein; and 5) granting such other relief as Duke Energy Kentucky may be entitled under the law.

Respectfully submitted,

DUKE ENERGY KENTUCKY, INC.

/s/ Rocco O. D'Ascenzo

Rocco O. D'Ascenzo (92796)

Deputy General Counsel

Duke Energy Business Services LLC

139 East Fourth Street, 1303-Main

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**CERTIFICATE OF SERVICE**

This is to certify that the foregoing electronic filing is a true and accurate copy of the document being filed in paper medium; that the electronic filing was transmitted to the Commission on September 9<sup>th</sup>, 2021; and that there are currently no parties that the Commission has excused from participation by electronic means in this proceeding.

John G. Horne, II  
The Office of the Attorney General  
Utility Intervention and Rate Division  
700 Capital Avenue, Ste 118  
Frankfort, Kentucky 40601

*/s/Rocco D'Ascenzo*  
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Rocco D'Ascenzo

**FINANCIAL EXHIBIT**

(1) **Section 12(2)(a) Amount and kinds of stock authorized.**

1,000,000 shares of Capital Stock \$15 par value amounting to \$15,000,000 par value.

(2) **Section 12(2)(b) Amount and kinds of stock issued and outstanding.**

585,333 shares of Capital Stock \$15 par value amounting to \$8,779,995 total par value. Total Capital Stock and Additional Paid-in Capital as of June 30, 2021:

Capital Stock and Additional Paid-in Capital  
As of June 30, 2021  
(\$ per 1,000)

Capital Stock	\$8,780
Premiums thereon	18,839
Total Capital Contributions from Parent (since 2006)	133,594
Contribution from Parent Company for Purchase of Generation Assets	<u>140,061</u>
Total Capital Stock and Additional Paid-in-Capital	<u>\$301,274</u>

(3) **Section 12(2)(c) Terms of preference or preferred stock, cumulative or participating, or on dividends or assets or otherwise.**

There is no preferred stock authorized, issued or outstanding.

(4) **Section 12(2)(d) Brief description of each mortgage on property of applicant, giving date of execution, name of mortgagor, name or mortgagee, or trustee, amount of indebtedness authorized to be secured, and the amount of indebtedness actually secured, together with any sinking fund provision.**

Duke Energy Kentucky does not have any liabilities secured by a mortgage.

(5) **Section 12(2)(e) Amount of bonds authorized, and amount issued, giving the name of the public utility which issued the same, describing each class separately, and giving the date of issue, face value, rate of interest, date of maturity and how secured, together with the amount of interest paid thereon during the last fiscal year.**

The Company has fourteen outstanding issues of unsecured senior debentures issued under an Indenture dated December 1, 2004, between itself and Deutsche Bank Trust Company Americas, as Trustee, as supplemented by four Supplemental Indentures. The Indenture

allows the Company to issue debt securities in an unlimited amount from time to time. The Debentures issued and outstanding under the Indenture are the following:

<u>Supplemental Indenture</u>	<u>Date of Issue</u>	<u>Principal Amount Authorized and Issued</u>	<u>Principal Amount Outstanding</u>	<u>Rate of Interest</u>	<u>Date of Maturity</u>	<u>Interest Paid Year 2020</u>
1 <sup>st</sup> Supplemental	3/7/2006	65,000,000	65,000,000	6.200%	3/10/2036	4,030,000
3 <sup>rd</sup> Supplemental	1/5/2016	45,000,000	45,000,000	3.420%	1/15/2026	1,539,000
3 <sup>rd</sup> Supplemental	1/5/2016	50,000,000	50,000,000	4.450%	1/15/2046	2,225,000
4 <sup>th</sup> Supplemental	9/7/2017	30,000,000	30,000,000	3.350%	9/15/2029	1,005,000
4 <sup>th</sup> Supplemental	9/7/2017	30,000,000	30,000,000	4.110%	9/15/2047	1,233,000
4 <sup>th</sup> Supplemental	9/7/2017	30,000,000	30,000,000	4.260%	9/15/2057	1,278,000
5 <sup>th</sup> Supplemental	10/3/2018	25,000,000	25,000,000	4.010%	10/15/2023	1,002,500
5 <sup>th</sup> Supplemental	10/3/2018	40,000,000	40,000,000	4.180%	10/15/2028	1,672,000
5 <sup>th</sup> Supplemental	12/12/2018	35,000,000	35,000,000	4.620%	12/15/2048	1,617,000
6 <sup>th</sup> Supplemental	7/17/2019	40,000,000	40,000,000	4.320%	7/15/2049	1,718,400
7 <sup>th</sup> Supplemental	9/26/2019	95,000,000	95,000,000	3.230%	10/01/2025	3,111,118
7 <sup>th</sup> Supplemental	9/26/2019	75,000,000	75,000,000	3.560%	10/01/2029	2,707,083
8 <sup>th</sup> Supplemental	9/15/2020	35,000,000	35,000,000	2.650%	9/15/2030	-
8 <sup>th</sup> Supplemental	9/15/2020	35,000,000	35,000,000	3.660%	9/15/2050	-
			630,000,000			23,138,101

(6) **Section 12(2)(f) Each note outstanding, giving date of issue, amount, date of maturity, rate of interest, in whose favor, together with amount of interest paid thereon during the last fiscal year.**

Not applicable.

(7) **Section 12(2)(g) Other indebtedness, giving same by classes and describing security, if any, with a brief statement of the devolution or assumption of any portion of such indebtedness upon or by person or corporation if the original liability has been transferred, together with amount of interest paid thereon during the last fiscal year.**

The Company has two series of Pollution Control Revenue Refunding Bonds issued under a Trust Indenture dated as of August 1, 2006 and a Trust Indenture dated as of December 1, 2008, between the County of Boone, Kentucky and Deutsche Bank National Trust Company as Trustee. The Company's obligation to make payments equal to debt service on the Bonds is evidenced by a Loan Agreement dated as of August 1, 2006 and December 1, 2008 between the County of Boone, Kentucky and Duke Energy Kentucky. The Bonds issued under the Indentures are as follows:

Indenture	Date of Issue	Principal Amount Authorized and Issued	Principal Amount Outstanding	Rate of Interest	Date of Maturity	Interest Paid Year 2020
Series 2010	11/24/2010	26,720,000	26,720,000	3.86% <sup>(1)</sup>	8/1/2027	189,440
Series 2008A	12/01/2011	50,000,000	<u>50,000,000</u>	1.12% <sup>(2)</sup>	8/1/2027	<u>798,137</u>
			<u>76,720,000</u>			<u>987,577</u>

(1) The bonds were issued at a variable-rate and were swapped to a fixed rate of 3.86% for the life of the debt. The average floating-rate of interest on the bonds for 2020 was 0.61%.

(2) The interest rate represents the average floating-rate of interest on the bonds for 2020. The interest rate on the bonds resets on the first day of every month based on 70% of the sum of one-month LIBOR and a credit spread of 1.125%.

The Company had no outstanding financing leases as of June 30, 2021.

The Company had \$56,652,000 of money pool borrowings outstanding as of June 30, 2021, \$25,000,000 of which is classified as Long-Term Debt payable to affiliated companies. This obligation, which is short-term by nature, is classified as long-term due to Duke Energy Kentucky's intent and ability to utilize such borrowings as long-term financing.

(8) **Section 12(2)(h) Rate and amount of dividends paid during the last five (5) previous fiscal years, and the amount of capital stock on which dividends were paid each year.**

**DIVIDENDS PER SHARE**

Year Ending	Per Share	Total	No. of Shares	Par Value of Stock
December 31, 2016	17.08	10,000,000	585,333	8,779,995
December 31, 2017	0.00	0	585,333	8,779,995
December 31, 2018	0.00	0	585,333	8,779,995
December 31, 2019	0.00	0	585,333	8,779,995
December 31, 2020	0.00	0	585,333	8,779,995

(9) **Section 12(2)(i) Detailed Income Statement and Balance Sheet**

See the attached pages for the detailed Income Statement for the twelve months ended June 30, 2021 and the detailed Balance Sheet as of June 30, 2021.

Duke Energy Kentucky, Inc.

Monthly Supplemental Financial Statements  
Balance Sheet - Page 1  
As of June 30, 2021  
(Unaudited)

	<u>Total Company</u>
<u>Assets</u>	
Utility Plant in Service	2,907,890,009
Construction Work in Progress	95,397,692
Less: Accumulated Depreciation	<u>(1,064,158,371)</u>
Net Utility Plant	<u>1,939,129,330</u>
Nonutility Property	1,220,439
Other Investments	1,500
Other Special Funds	14,339,458
Long Term Portion of Derivative Instrument Assets	<u>200,597</u>
Total Other Property & Investments	<u>15,761,994</u>
Cash	5,260,514
Working Funds	-
Temporary Cash Investments	-
Customer Accounts Receivable	5,922,249
Other Accounts Receivable	2,048,533
Less: Provision for Uncollectibles	<u>(317,773)</u>
Notes Receivable from Assoc. Co.	13,628,243
Accounts Receivable from Assoc. Co.	<u>(2,878,509)</u>
Fuel Stock	23,746,245
Gas Stored Underground Inventory	-
Plant Materials & Operating Supplies	17,942,014
Other Materials & Supplies	-
Stores Expense Undistributed	336,259
Prepayments	1,453,090
Emission Allowances	19,535
Derivative Instrument Assets	3,002,239
Interest & Dividends Receivable	-
Misc Current and Accrued Assets	4,750,888
Rents Receivable	<u>15,406</u>
Total Current & Accrued Assets	<u>74,928,933</u>
Unamortized Debt Expense	2,948,348
Other Regulatory Assets	137,520,354
Preliminary Survey & Investigation	366,399
Clearing Accounts	71,195
Temporary Facilities	-
Miscellaneous Deferred Debits	2,430,548
Unamortized Loss on Reacquired Debt	455,842
Accumulated Deferred Income Taxes	69,978,864
Unrecovered Purchased Gas Costs	<u>(2,311,068)</u>
Total Deferred Debits	<u>211,460,482</u>
TOTAL ASSETS AND OTHER DEBITS	<u><u>2,241,280,739</u></u>

Duke Energy Kentucky, Inc.

Monthly Supplemental Financial Statements  
Balance Sheet - Page 2  
As of June 30, 2021  
(Unaudited)

	Total Company
<u>Proprietary Capital</u>	
Common Stock Issued	8,779,995
Premium on Capital Stock	18,838,946
Other Paid-in Capital Stock	273,655,189
Retained Earnings	497,793,036
Accumulated Other Comprehensive Income	-
Total Proprietary Capital	<u>799,067,166</u>
<u>Liabilities</u>	
Bonds	706,720,000
Advances from Associated Companies	25,000,000
Less: Unamortized Discount on Long-Term Debt	(180,170)
Total Long-Term Debt	<u>731,539,830</u>
Obligations Under Capital Leases - Noncurrent	8,541,343
Asset Retirement Obligation	76,248,880
Long-Term Portion of Derivative Instrument Liabilities	4,334,682
Accum. Misc. Operating Provisions	31,120,339
Total Other Noncurrent Liabilities	<u>120,245,244</u>
Accounts Payable	31,668,532
Notes Payable to Assoc. Co.	31,652,001
Accounts Payable to Assoc. Co.	12,426,507
Customer Deposits	8,765,404
Taxes Accrued	11,066,254
Interest Accrued	7,636,996
Tax Collections Payable	1,733,573
Misc. Current & Accrued Liabilities	9,133,673
Obligations Under Capital Leases - Current	305,159
Derivative Instrument Liabilities	5,344,901
Less: Long-Term Portion of Derivative Instrument Liabilities	(4,334,682)
Total Current & Accrued Liabilities	<u>115,398,318</u>
Customer Advances for Construction	1,643,018
Accum. Deferred Investment Tax Credits	3,587,448
Other Deferred Credits	14,273,261
Other Regulatory Liabilities	134,600,903
Accumulated Deferred Income Taxes	320,925,551
Total Deferred Credits	<u>475,030,181</u>
TOTAL PROPRIETARY CAPITAL, LIABILITIES, AND OTHER DEFERRED CREDITS	<u><u>2,241,280,739</u></u>



Duke Energy Kentucky, Inc.

Monthly Supplemental Financial Statements  
Income Statement  
For the 12 Months Ended June 30, 2021  
(Unaudited)

	<u>Total Company</u>
<u>Revenues</u>	
Residential Sales	216,820,449
Commercial Sales	158,516,486
Industrial Sales	57,935,871
Sales to Public Authorities	9,800,761
Public Street & Highway Lighting	1,665,435
Inter-Departmental Sales	72,279
Misc. Service Revenues	341,381
Revenues from Transportation	6,701,027
Sales for Resale	15,772,895
Rents from Property	1,461,838
Other Revenues	<u>8,685,910</u>
Total Revenues	<u>477,774,332</u>
<u>Operating Expenses</u>	
Operation Expense	260,596,535
Maintenance Expense	32,481,976
Depreciation Expense	68,510,114
Amortization and Depletion	8,031,645
Taxes Other than Income Taxes	18,153,581
Income Taxes - Federal & Other	5,496,094
Provision for Deferred Income Taxes - Net	4,854,941
Investment Tax Credit Adjustment	-
Total Operating Expenses	<u>398,124,886</u>
NET OPERATING INCOME	<u>79,649,446</u>
<u>Other Income &amp; Deductions</u>	
Revenues from Merchandising, Jobbing and Contract Work	1,241,340
Less: Expense of Merchandising, Jobbing and Contract Work	(115,587)
Revenues from Nonutility Operations	962,018
Interest & Dividend Income	916,956
AFUDC	(401,891)
Gain on Disposition of Property	-
Loss on Disposition of Property	-
Misc. Income Deductions	(3,232,312)
Taxes Other than Income Taxes	(49,062)
Income Taxes - Federal & Other	(1,763,672)
Provision for Deferred Income Taxes - Net	1,615,822
Total Other Income & Deductions	<u>(826,388)</u>
<u>Interest Charges</u>	
Interest on Long Term Debt	(25,444,939)
Amortization of Debt Disc. And Expense	(487,974)
Amortization of Loss on Reacquired Debt	(136,673)
Interest on Debt to Assoc. Co.	(189,519)
Other Interest Expense	(1,329,467)
Less: Allowance for Borrowed Fund Used During Construction - Credit	(501,361)
Net interest Charges	<u>(28,089,933)</u>
Extraordinary Items after Taxes	-
NET INCOME	<u>50,733,125</u>



Kentucky Energy and Environment Cabinet  
Department for Environmental Protection  
Division of Waste Management

**PERMIT**

**Facility:** **Duke Energy - East Bend Station**  
6293 Beaver Rd  
Union, KY 41091

**Permittee:** **Duke Energy**  
1000 E Main St Rm WP994  
Plainfield, IN 46168

**Agency Interest:** **Duke Energy KY East Bend**  
6293 Beaver Rd  
Union, KY 41091

The Division has issued the permit under the provisions of KRS Chapter 224 and regulations promulgated pursuant thereto. This permitted activity or activities are subject to all conditions and operating limitations contained herein. Issuance of this permit does not relieve the permittee from the responsibility of obtaining any other permits, licenses or approvals required by this Division or other state and local agencies.

No deviation from the plans and specifications submitted with your application or any condition specified herein is allowed, unless authorized in writing from the Division. Violation of the terms and conditions specified herein may render this permit null and void. All rights of inspection by representatives of the Division are reserved. Conformance with all applicable Waste Management Regulations is the responsibility of the permittee.

**Agency Interest ID #:** 176

**Solid Waste Permit #:** SW00800006

**County:** Boone

**Permitted Activities:**

Subject Item	Activity	Type	Status
ACTV004	Special Waste Landfill-Coal/00800006	Construction/Operation	Converted
ACTV006	Special Waste Landfill-Coal/00800006	Construction/Operation	Converted
ACTV008	Coal Combustion Residuals Surface Impoundment/00800006	Registered Permit by Rule	Converted
ACTV012	CCR Unit - Landfill/00800006	Construction/Operation	Active
ACTV013	CCR Unit - Landfill/00800006	Construction/Operation	Active
ACTV014	CCR Unit - Impoundment/00800006	Activity Terminated	Terminated

Permit Number: SW00800006

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**Acreage Summary:**

**Waste Disposal Area (in Acres):**

Activity	Disposal Area
CCR Unit - Landfill	162.00
CCR Unit - Landfill	203.70
<b>Total Disposal Area</b>	<b>365.70</b>
<b>Total Permitted Area</b>	<b>470.40</b>

**Cost Estimate Summary:**

Coverage Type	Cost Estimate	Effective	Comments
Closure	\$18,992,117.00	04/16/2021	Approved under APE20200002
Post-Closure	\$13,878,600.00	04/16/2021	Approved under APE20200002

**Financial Assurance Summary:**

The owner or operator shall maintain the following financial assurance approved by the Division in compliance with KRS Chapter 224.40-650, KRS Chapter 224.50-862, 401 KAR 45:080, and 401 KAR 48:310:

Instrument Type	Instrument Number	Amount	Date Received	Comments
Surety Bond	B8087915	\$10,000.00	05/17/1984	
Corporate Financial Test	1	\$16,099,479.00	11/01/2019	
Corporate Financial Test	0	\$16,771,248.00	11/30/2020	

**First Operational Permit Effective Date: 07/16/1982 -- ACTV0004, Inert Landfill Activity**

**Permit Effective Date: 07/16/1992**

**Permit Expiration Date: Life of Facility**

**Permit issued: 04/16/2021**

Sincerely,

 Recoverable Signature

*Robin Green*

for

**Danny Anderson, P.E.  
Manager, Solid Waste Branch**

Permit Number: SW00800006

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**Permit Conditions:**

**Facility Information and/or Conditions:**

1. The closure cost estimate for ACTV0012 (East Landfill) is \$9,272,969 and the post-closure care estimate is \$6,826,500. This estimate was approved and updated under APE20200002.
2. The closure cost estimate for ACTV0013 (West Landfill) is \$9,719,148 and the post-closure care estimate is \$7,052,100. This estimate was approved and updated under APE20200002.

**Subject Items**

**ACTV0004 - Special Waste Landfill-Coal**

**Variances, Alternate Specifications and Special Conditions:**

1. General: The East Landfill consists of approximately 162 acres of disposal area and 185 acres of total permitted area; it has been converted from a Special Waste Landfill (ACTV004) to a CCR Unit - Landfill (ACTV012) on September 6, 2019. The landfill is a CCR Unit as defined by 401 KAR 46:101 and is subject to the standards pursuant to 401 KAR 46:110, and the landfill remains subject to the procedural requirements in 401 KAR Chapter 45. [401 KAR 45:020, 401 KAR 45:025, 401 KAR 45:030, 401 KAR 45:040, 401 KAR 45:050, 401 KAR 45:080, 401 KAR 45:140, 401 KAR 46:110]

**Approved Applications - The owner or operator shall comply with applicable statutes and regulations and the following approved applications:**

1. 06-07-82 - First Operational Permit for Inert Landfill (effective on 7-16-82)
2. 04-05-84 - Modification for Inert Landfill
3. 07-15-87 - Renewal for Inert Landfill
4. 03-01-96 - Permit Renewal - conversion to Special Waste (effective date 7-16-92)
5. 07-24-96 - Groundwater Monitoring Plan - LI1MOGW1
6. 01-16-97 - Modification Add/Delete Waste Sources - MOAD1
7. 11-12-97 - Modification Add/Delete Waste Sources - MOAD2
8. 11-27-00 - Modification Add/Delete Waste Sources - MOAD3
9. 11-22-04 - APE20040001 - Minor Modification - Add/Delete Modification
10. 04-05-05 - APE20040005 - Minor Modification - Add/Delete Modification
11. 06-07-05 - AIN20010001 - Groundwater Assessment Plan
12. 07-13-05 - APE20050001 - Minor Modification - Leachate Collection System
13. 12-12-05 - AIN20050001 - Groundwater Assessment Plan - East Landfill
14. 10-04-06 - APE20060001 - Permit Transfer (to Union Light, Heat, and Power Coop)
15. 10-04-06 - APE20060006 - Minor Modification - Change the Active Area from 40 Acres to 55 Acres
16. 12-06-06 - AIN20060001 - Groundwater Assessment Report - East Landfill
17. 02-16-07 - APE20070001 - Construction Progress Report - Cells P-15 & P16
18. 03-20-07 - APE20060007 - Permit Transfer (to Duke Energy Kentucky, Inc.)
19. 08-15-07 - APE20070003 - Minor Modification - Add Source (bottom ash and plastic for truck lining from Miami Fort)
20. 08-15-07 - APE20070007 - Minor Modification previously labeled as APE20070005 - Add Source (Gypsum from Killen Station)

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21. 04-14-11 - CMN20100015 - Acceptance Letter Issued, Groundwater Assessment Report Update - Ash Pond and East Landfill
22. 07-06-12 - APE20120005 - Minor Modification - Add Source (Fly Ash from Spurlock Station)
23. 08-15-12 - AIN20110002 - Groundwater Assessment Report Update - East Landfill
24. 09-22-14 - APE20140004 - Minor Modification - Add Source (Fly Ash from Ghent Generating Station)
25. 05-06-15 - AIN20140003 - Revised Groundwater Assessment Plan - Site-Wide
26. 06-08-15 - AIN20150002 - Groundwater Assessment Report Update - East Landfill
27. 08-18-16 - APE20160004 - Minor Modification - Add Source (Fly Ash from Gallagher Generating Station & Clifty Creek Generating Station)
28. 08-18-16 - APE20150007 - Minor Modification - Chimney Drain, Waste Boundary, and Waste Placement Lift Thickness
29. 09-06-19 - See the CCR Unit - Landfill activity [ACTV0012] for additional information

**ACTV0006 - Special Waste Landfill-Coal**

**Variances, Alternate Specifications and Special Conditions:**

1. Construction Requirements: The owner or operator shall proof-roll all sub-subgrade and subgrade areas in accordance with approved applications and permit. All proof-rolls shall be completed using a minimum 100,000 pound loaded four (4) tire scraper with a minimum capacity of 20 cubic yards or approved equivalency. The Solid Waste Branch must be notified at least 48 hours prior to proof-rolling of the final subgrade surface. [401 KAR 45:110 Section 2, 401 KAR 45:140]

2. General: The West Landfill consists of approximately 203.7 acres of disposal area and 232 acres of total permitted area; it has been converted from a Special Waste Landfill (ACTV006) to a CCR Unit - Landfill (ACTV013) on September 6, 2019. The landfill is a CCR Unit as defined by 401 KAR 46:101 and is subject to the standards pursuant to 401 KAR 46:110, and the landfill remains subject to the procedural requirements in 401 KAR Chapter 45. [401 KAR 45:020, 401 KAR 45:025, 401 KAR 45:030, 401 KAR 45:040, 401 KAR 45:050, 401 KAR 45:080, 401 KAR 45:140, 401 KAR 46:110]

**Approved Applications - The owner or operator shall comply with applicable statutes and regulations and the following approved applications:**

1. 12-08-2008 - APE20070004 - New Special Waste Activity - West Special Waste Landfill
2. 03-09-2011 - APE20100002 - Groundwater Monitoring Plan Modification - West Special Waste Landfill
3. 02-28-2012 - APE20110004 - Construction Progress Report - Floodplain Area Filling (2.1 acres)
4. 07-06-2012 - APE20120005 - Minor Modification - Add Source (Fly Ash from Spurlock Station)
5. 09-22-2014 - APE20140004 - Minor Modification - Add Source (Fly Ash from Ghent Generating Station)
6. 11-18-2015 - APE20150007 - Minor Modification - Updated Attachment 41 Construction Quality Control Plan
7. 06-13-2016 - APE20150008 - Minor Modification - Sediment Pond and Surface Water Controls
8. 08-18-2016 - APE20160004 - Minor Modification - Add Source (Fly Ash from Gallagher Generating Station & Clifty Creek Generating Station)
9. 10-27-2016 - APE20160007 - Minor Modification - Chimney Drain System
10. 03-23-2017 - APE20170002 - Minor Modification - Surface Water Monitoring Plan Revision
11. 09-08-2017 - APE20170005 - Construction Progress Report - Cell 1 (38.32 acres), Sediment Pond and Contact Water Ditch
12. 09-06-2019 - See the CCR Unit - Landfill activity [ACTV0013] for additional information

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## **ACTV0008 - Coal Combustion Residuals Surface Impoundment**

### **Variations, Alternate Specifications and Special Conditions:**

1. General: The Coal Combustion Residuals Surface Impoundment consisted of approximately 53.4 acres and was converted from a Coal Combustion Residuals Surface Impoundment (ACTV008) to a CCR Unit - Impoundment (ACTV014) on September 6, 2019. [401 KAR 45:140, 401 KAR 46:110]

### **Approved Applications - The owner or operator shall comply with applicable statutes and regulations and the following approved applications:**

1. 10-04-06 - APE20060001 - Permit Transfer (to Union Light, Heat, and Power Coop)
2. 03-20-07 - APE20060007 - Permit Transfer (to Duke Energy Kentucky, Inc.)
3. 08-15-07 - AIN20070001 - Groundwater Assessment Plan - Ash Pond
4. 07-16-10 - AIN20080001 - Groundwater Assessment Report - Ash Pond
5. 04-14-11 - CMN20100015 - Acceptance Letter Issued, Groundwater Assessment Report Update - Ash Pond and East Landfill
6. 08-15-12 - AIN20110001 - Groundwater Assessment Report Update - Ash Pond
7. 05-06-15 - AIN20140003 - Revised Groundwater Assessment Plan - Site-Wide
8. 06-08-15 - AIN20150001 - Groundwater Assessment Report Update - Ash Pond
9. 09-06-19 - See the CCR Unit - Impoundment activity [ACTV0014] for additional information

## **ACTV0012 - CCR Unit - Landfill**

### **Variations, Alternate Specifications and Special Conditions:**

1. The East Landfill consists of approximately 162 acres of disposal area and 185 acres of total permitted area; it has been converted from a Special Waste Landfill (ACTV004) to a CCR Unit - Landfill (ACTV012) on September 6, 2019. The landfill is a CCR Unit as defined by 401 KAR 46:101 and is subject to the standards pursuant to 401 KAR 46:110, and the landfill remains subject to the procedural requirements in 401 KAR Chapter 45. [401 KAR 45:020, 401 KAR 45:025, 401 KAR 45:030, 401 KAR 45:040, 401 KAR 45:050, 401 KAR 45:080, 401 KAR 45:140, 401 KAR 46:110]

2. General: The owner or operator of a Coal Combustion Residuals (CCR) Unit shall comply with KRS Chapter 224 and 401 KAR Chapter 46 for the construction, operation, maintenance, and closure of a CCR Unit and other provisions pursuant to 401 KAR Chapters 30, 40, and 45 as applicable. The owner or operator shall comply with the applicable provisions in the Approved Applications listed on this permit document for ACTV0004 - Special Waste Landfill-Coal and with all provisions in the Approved Applications listed on this permit document for ACTV0012 - CCR Unit - Landfill. [401 KAR 45:030, 401 KAR 45:140]

3. General: The owner or operator shall submit the \$15,000 annual fee no later than July 31 of each year pursuant to 401 KAR 46:120. Applications and reports specific to only the landfill, or only other CCR Units, for this facility shall not be subject to the filing fees pursuant to 401 KAR 45:250. [401 KAR 46:120 Section 4]

4. Construction: While the Construction Progress Report (CPR) describing construction of the East Landfill (accepted on September 6, 2019) identifies the landfill as a CCR Unit that is subject to the provisions of Chapter 46, this CPR (APE20190004) relevantly depicts the area(s) of constructed cap prior to October 19, 2015, in

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accordance with the technical standards of the permit issued in accordance with 401 KAR Chapter 45. [401 KAR 45:140, 401 KAR 46:110]

5. **Groundwater Well Construction:** The approval of the Monitoring Well Construction Progress Report (CPR) associated with tracking number APE20190006 in no way constitutes the acceptance of any monitoring well construction, modification, or abandonment activities conducted previously and not specified in this permit. Approval of the CPR does not constitute Division of Waste Management acceptance of any well or well network as being appropriate for monitoring groundwater in any particular aquifer or aquifer zone at any CCR Unit pursuant to the provision(s) of 401 KAR Chapter 46. [401 KAR 45:140 Section 2, 401 KAR 6:350]

6. **Financial Assurance:** The owner or operator shall provide site-wide financial assurance to the Division of Waste Management for both the East and West Landfills by December 1, 2021. The financial assurance amount shall meet or exceed the Closure and Post-Closure cost estimates associated with the action referenced as APE20200002, approved on April 16, 2021. [401 KAR 45:080, 401 KAR 46:110]

**Approved Applications - The owner or operator shall comply with applicable statutes and regulations and the following approved applications:**

1. 09-06-19 - See the Special Waste Landfill - Coal activity [ACTV0004] for additional information and site history
2. 09-06-19 - Construction Progress Report, Portions of East Landfill Cap Constructed Prior to October 19, 2015 - APE20190004
3. 09-04-20 - Monitoring Well Construction Progress Report - APE20190006
4. 04-16-21 - Final Cover Plan Minor Modification - APE20200002

## **ACTV0013 - CCR Unit - Landfill**

**Variances, Alternate Specifications and Special Conditions:**

1. **General:** The West Landfill consists of approximately 203.7 acres of disposal area and 232 acres of total permitted area; it has been converted from a Special Waste Landfill (ACTV006) to a CCR Unit - Landfill (ACTV013) on September 6, 2019. The landfill is a CCR Unit as defined by 401 KAR 46:101 and is subject to the standards pursuant to 401 KAR 46:110, and the landfill remains subject to the procedural requirements in 401 KAR Chapter 45. [401 KAR 45:020, 401 KAR 45:025, 401 KAR 45:030, 401 KAR 45:040, 401 KAR 45:050, 401 KAR 45:080, 401 KAR 45:140, 401 KAR 46:110]

2. **General:** The owner or operator of a Coal Combustion Residuals (CCR) Unit shall comply with KRS Chapter 224 and 401 KAR Chapter 46 for the construction, operation, maintenance, and closure of a CCR Unit and other provisions pursuant to 401 KAR Chapters 30, 40, and 45 as applicable. The owner or operator shall comply with the applicable provisions in the Approved Applications listed on this permit document for ACTV0006 - Special Waste Landfill-Coal and with all provisions in the Approved Applications listed on this permit document for ACTV0013 - CCR Unit - Landfill. [401 KAR 45:030, 401 KAR 45:140]

3. **General:** The owner or operator shall submit the \$15,000 annual fee no later than July 31 of each year pursuant to 401 KAR 46:120. Applications and reports specific to only the landfill, or only other CCR Units, for this facility shall not be subject to the filing fees pursuant to 401 KAR 45:250. [401 KAR 46:120 Section 4]

4. **Construction:** The owner or operator shall construct the landfill in accordance with 401 KAR 46:110, Section

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3, which includes meeting all material specifications and required testing for the alternate composite liner as specified in the approved application(s). [401 KAR 46:110 Section 3]

5. Groundwater Well Construction: The approval of the Monitoring Well Construction Progress Report (CPR) associated with tracking number APE20190006 is limited to the construction activities specifically listed herein. This approval in no way constitutes the acceptance of any monitoring well construction, modification, or abandonment activities conducted previously and not specified in this permit. Approval of the CPR does not constitute Division of Waste Management acceptance of any well or well network as being appropriate for monitoring groundwater in any particular aquifer or aquifer zone at any CCR Unit pursuant to the provision(s) of 401 KAR Chapter 46. [401 KAR 45:140 Section 2, 401 KAR 6:350]

6. Financial Assurance: The owner or operator shall provide site-wide financial assurance to the Division of Waste Management for both the East and West Landfills by December 1, 2021. The financial assurance amount shall meet or exceed the Closure and Post-Closure cost estimates associated with the action referenced as APE20200002, approved on April 16, 2021. [401 KAR 45:080, 401 KAR 46:110]

### **Approved Applications - The owner or operator shall comply with applicable statutes and regulations and the following approved applications:**

1. 09-06-19 - See the Special Waste Landfill - Coal activity [ACTV0006] for additional information and site history
2. 09-06-19 - Alternate Performance Standard, Alternate Liner Demonstration - APE20190001
3. 05-01-20 - Alternate Performance Standard, Alternate Liner Demonstration - APE20190008
4. 09-04-20 - Monitoring Well Construction Progress Report - APE20190006
5. 09-04-20 - Construction Progress Report - West Landfill Cell 2 Liner Construction - APE20200003

## **ACTV0014 - CCR Unit - Impoundment**

### **Variations, Alternate Specifications and Special Conditions:**

1. General: The Coal Combustion Residuals Surface Impoundment consisted of approximately 53.4 acres and was converted from a Coal Combustion Residuals Surface Impoundment (ACTV008) to a CCR Unit - Impoundment (ACTV014) on September 6, 2019; at the time, the impoundment was a CCR Unit as defined by 401 KAR 46:101. The CCR Unit was clean closed, and the permitted activity was terminated by the Cabinet on May 1, 2020. [401 KAR 45:140, 401 KAR 46:110]

### **Approved Applications - The owner or operator shall comply with applicable statutes and regulations and the following approved applications:**

1. 09-06-19 - See the Coal Combustion Residuals Surface Impoundment activity [ACTV0008] for additional information and site history
2. 09-06-19 - Construction Progress Report, Portions of East Landfill Cap Constructed Prior to October 19, 2015-APE20190004 & Alternate Performance Standard, Alternate Liner Demonstration - APE20190001
3. 05-01-20 - Construction Progress Report, Clean Closure of Ash Pond - APE20190009



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**Financial Assurance**

**ACTV0001 - Financial Assurance**

The following is a history of the financial assurance for this facility:

1. 07-10-1987 - SB# B80-201654, \$83,000.00
2. 07-06-1992 - SB# B80-201654, \$539,900.00
3. 09-05-2001 - SB# B80-201654, \$564,102.00
4. 09-16-2002 - SB# B80-201654, \$577,534.00
5. 10-23-2003 - Financial Test, \$2,120,500.00
6. 10-31-2003 - SB# B80-201654 released
7. 05-15-2006 - Financial Test, \$2,259,062.00
8. 05-31-2007 - Financial Test, \$2,324,575.00
9. 07-30-2007 - Financial Test, \$2,324,575.00
10. 09-26-2011 - Financial Test, \$2,522,049.00
11. 12-16-2013 - Financial Test, \$2,598,255.00
12. 12-18-2015 - Financial Test, \$2,674,150.00
13. 05-17-1984 - SB# B-80-87915 - \$10,000.00
14. 07-14-2017 - Financial Test, \$2,700,892.00
15. 07-14-2017 - Financial Test, \$4,427,734.00
16. 11-01-2018 - East Landfill Financial Test increased to \$2,727,901.00
17. 11-01-2018 - West Landfill Financial Test increased to \$4,472,012.00
18. 11-01-2019 - East Landfill Financial Test increased to \$16,099,479.00
19. 11-01-2019 - West Landfill Financial Test increased to \$14,885,924.00
20. 11-30-2020 - West Landfill Financial Test increased to \$16,771,248.00

**Monitoring Conditions**

**GSTR0001 - Groundwater Monitoring - SW: Groundwater Monitoring Group - East Special Waste Landfill**

**Group Members:** STRC0001 - Well MW-1; STRC0002 - Well MW-3; STRC0003 - Well MW-4; STRC0004 - Well MW-5; STRC0005 - Well MW-6; STRC0006 - Well MW-6D; STRC0026 - Well P-7; STRC0028 - Well P-9; STRC0032 - Well MW-7; STRC0040 - Well MW-09; STRC0067 - Well MW-02A

**Variances, Alternate Specifications and Special Conditions:**

1. No monitoring well construction, maintenance, or abandonment may be conducted without prior approval by the Division of Waste Management. [401 KAR 45:140 Section 1(1)]
2. Reports and Submittals: The owner or operator shall submit a Construction Progress Report (CPR) within 45 days of any groundwater monitoring well abandonment activities. [401 KAR 45:140]
3. Only a Kentucky Certified Monitoring Well Driller may construct or abandon monitoring wells. [401 KAR 6:350]

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4. The owner or operator shall provide the division a minimum of ten (10) working days advance notice for all groundwater monitoring well construction and abandonment activities. [401 KAR 6:350 Section 12(2)]

**GSTR0003 - Groundwater Monitoring - SW: Assessment Well Group - East Special Waste Landfill and Ash Pond**

**Group Members:** STRC0003 - Well MW-4; STRC0023 - Well P-4; STRC0024 - Well P-5; STRC0025 - Well P-6; STRC0026 - Well P-7; STRC0027 - Well P-8; STRC0028 - Well P-9; STRC0030 - Well MW-5D (Assessment); STRC0031 - Well MW-8D (Assessment); STRC0039 - Well MW-04D; STRC0041 - Well MW-10

**Variances, Alternate Specifications and Special Conditions:**

1. The owner or operator shall comply with the four (4) permit conditions listed under the "GSTR0001 - Groundwater Monitoring - SW: Groundwater Monitoring Group - East Special Waste Landfill" section of this document. [401 KAR 45:140, 401 KAR 6:350]

**GSTR0005 - Groundwater Monitoring - SW: Groundwater Observation Well Group - West Special Waste Landfill**

**Group Members:** STRC0033 - Well OW-105; STRC0034 - Well OW-106; STRC0035 - Well OW-104; STRC0036 - Well OW-103; STRC0037 - Well OW-102; STRC0038 - Well OW-101

**Variances, Alternate Specifications and Special Conditions:**

1. The owner or operator shall comply with the four (4) permit conditions listed under the "GSTR0001 - Groundwater Monitoring - SW: Groundwater Monitoring Group - East Special Waste Landfill" section of this document. [401 KAR 45:140, 401 KAR 6:350]

**GSTR0006 - Groundwater Monitoring - SW: Groundwater Monitoring Group - West Special Waste Landfill - Wells Proposed for Construction**

**Group Members:** STRC0046 - Well MW-205 (Proposed); STRC0047 - Well MW-206 (Proposed); STRC0048 - Well MW-207 (Proposed)

**Variances, Alternate Specifications and Special Conditions:**

1. The owner or operator shall comply with the four (4) permit conditions listed under the "GSTR0001 - Groundwater Monitoring - SW: Groundwater Monitoring Group - East Special Waste Landfill" section of this document. [401 KAR 45:140, 401 KAR 6:350]

**GSTR0008 - Groundwater Monitoring - SW: Groundwater Monitoring Group - West Special Waste Landfill**

**Group Members:** STRC0051 - Well MW-201; STRC0052 - Well MW-202; STRC0053 - Well MW-204; STRC0054 - Well MW-208; STRC0055 - Well MW-203

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**Variations, Alternate Specifications and Special Conditions:**

1. The owner or operator shall comply with the four (4) permit conditions listed under the "GSTR0001 - Groundwater Monitoring - SW: Groundwater Monitoring Group - East Special Waste Landfill" section of this document. [401 KAR 45:140, 401 KAR 6:350]

**GSTR0010 - Groundwater Monitoring - SWB: Chapter 46 Group**

**Group Members:** AIOO0176 -

**Variations, Alternate Specifications and Special Conditions:**

1. Groundwater Monitoring: The owner or operator shall monitor groundwater and provide notifications in accordance with 401 KAR Chapter 46 and submit the results and analysis to the Division of Waste Management, Solid Waste Branch upon request. [401 KAR 45:030, 401 KAR 46:110 Section 10, 401 KAR 46:110 Section 8]
2. Only a Kentucky Certified Monitoring Well Driller may construct or abandon monitoring wells. [401 KAR 6:350]
3. The owner or operator shall provide the division a minimum of ten (10) working days advance notice for all groundwater monitoring well construction and abandonment activities. [401 KAR 6:350 Section 12(2)]

**GSTR0011 - Groundwater Monitoring - SW: Groundwater Monitoring Well Installation Development and Abandonment**

**Group Members:** AIOO0176 -

**Variations, Alternate Specifications and Special Conditions:**

1. Groundwater Well Construction: The Division of Waste Management (DWM) accepts that Monitoring Wells MW-9A and MW-19A were properly installed and developed pursuant to 401 KAR 6:350 as documented in the Monitoring Well Construction Progress Report (CPR) associated with tracking number APE20190006; DWM accepts that Monitoring Wells MW-9R and MW-19 were properly abandoned pursuant to 401 KAR 6:350 as documented in the CPR. [401 KAR 6:350]
2. Groundwater Well Construction: As documented in the Monitoring Well Construction Progress Report associated with tracking number APE20190006, the Division of Waste Management accepts that the following work on the following wells was conducted in accordance with 401 KAR 6:350.

- MW-1: One bollard installed
- MW-2A: Two bollards and two weep holes installed
- MW-3: One bollard installed
- MW-5: One bollard installed
- MW-5D: Two bollards and two weep holes installed
- MW-6: One bollard installed
- MW-6D: One bollard installed
- MW-7: Two bollards and two weep holes installed

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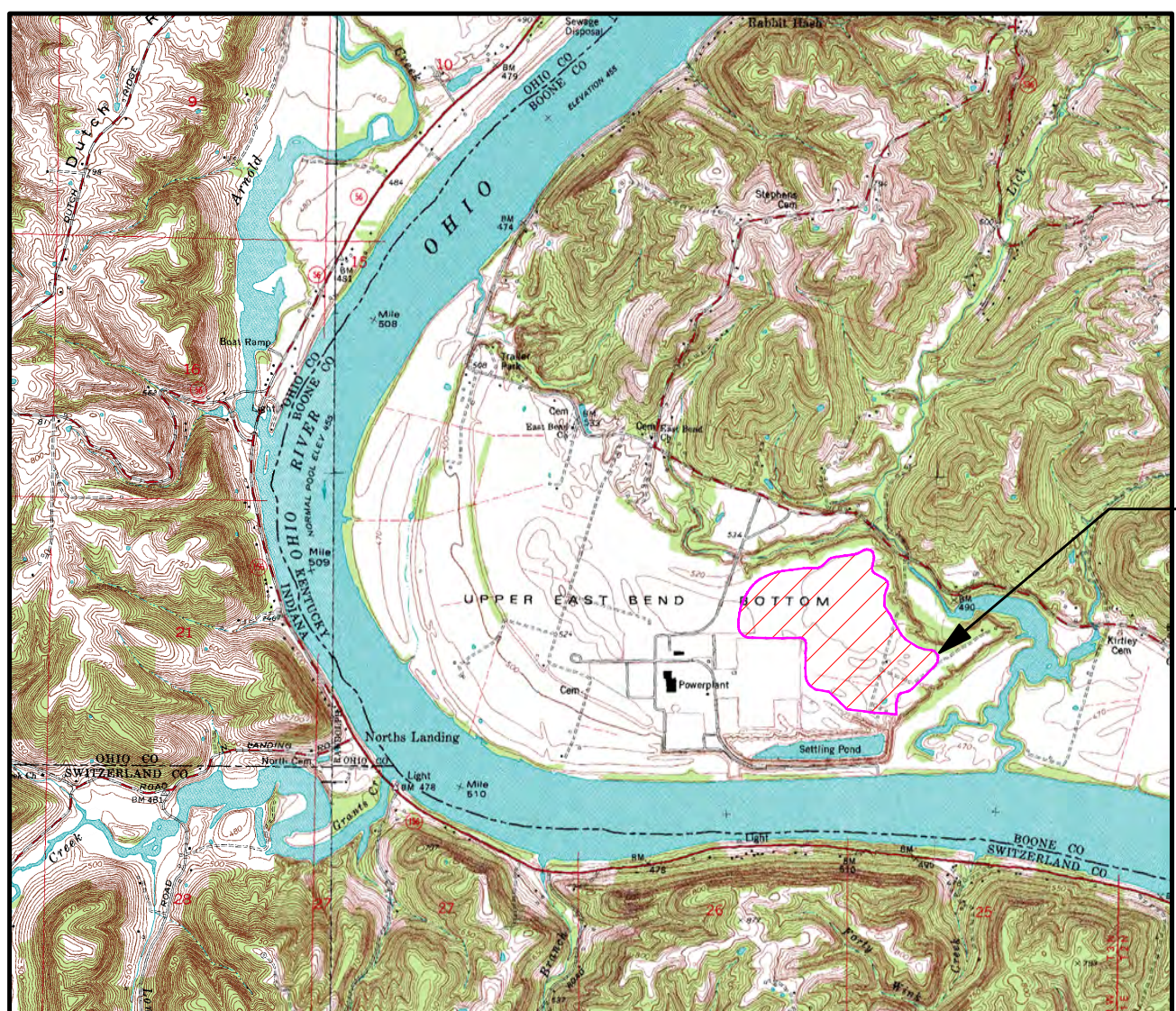
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MW-8D: One bollard and two weep holes installed  
MW-9: Two weep holes installed  
MW-10: Two bollards installed  
MW-11: Two weep holes installed  
MW-12: One bollard and two weep holes installed  
MW-13: One bollard and two weep holes installed  
MW-14: Two weep holes installed  
MW-18: One bollard installed between MW-18 & 18D, One weep hole installed  
MW-18D: One bollard installed between MW-18 & 18D, One weep hole installed  
MW-201: Two weep holes installed  
MW-202: One bollard and two weep holes installed  
MW-203: Two weep holes installed  
MW-204: Two weep holes installed  
MW-208: Two weep holes installed  
MW-209: One bollard and two weep holes installed  
MW-210: One bollard and two weep holes installed  
MW-211: One bollard and two weep holes installed  
MW-P4: Two bollards and two weep holes installed  
MW-P5: Two weep holes installed  
MW-P7: One weep hole installed  
P-6: Two bollards and two weep holes installed  
P-8: Two weep holes installed  
P-9: One bollard and one weep hole installed  
P-10: Two bollards and one weep hole installed  
P-11: Two bollards and one weep hole installed  
P-14: One weep hole installed  
P-15: Two bollards and one weep hole installed  
OW-101: Two weep holes installed  
OW-102: Two weep holes installed  
OW-103: Two weep holes installed. [401 KAR 6:350]

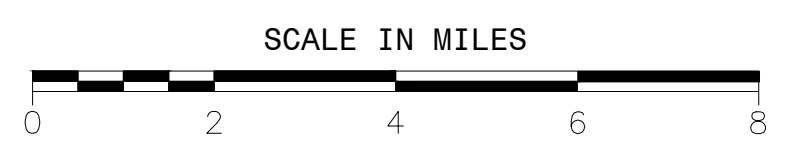
3. Groundwater Well Construction: The approval of the Monitoring Well Construction Progress Report (CPR) associated with tracking number APE20190006 is limited to the construction activities specifically listed herein. This approval in no way constitutes the acceptance of any monitoring well construction, modification, or abandonment activities conducted previously and not specified in this permit. Approval of the CPR does not constitute DWM acceptance of any well or well network as being appropriate for monitoring groundwater in any particular aquifer or aquifer zone at any CCR Unit pursuant to the provision(s) of 401 KAR Chapter 46. [401 KAR 6:350]

# CLOSURE CONSTRUCTION EAST CCR LANDFILL EAST BEND GENERATING STATION BOONE COUNTY, KY



EAST LANDFILL

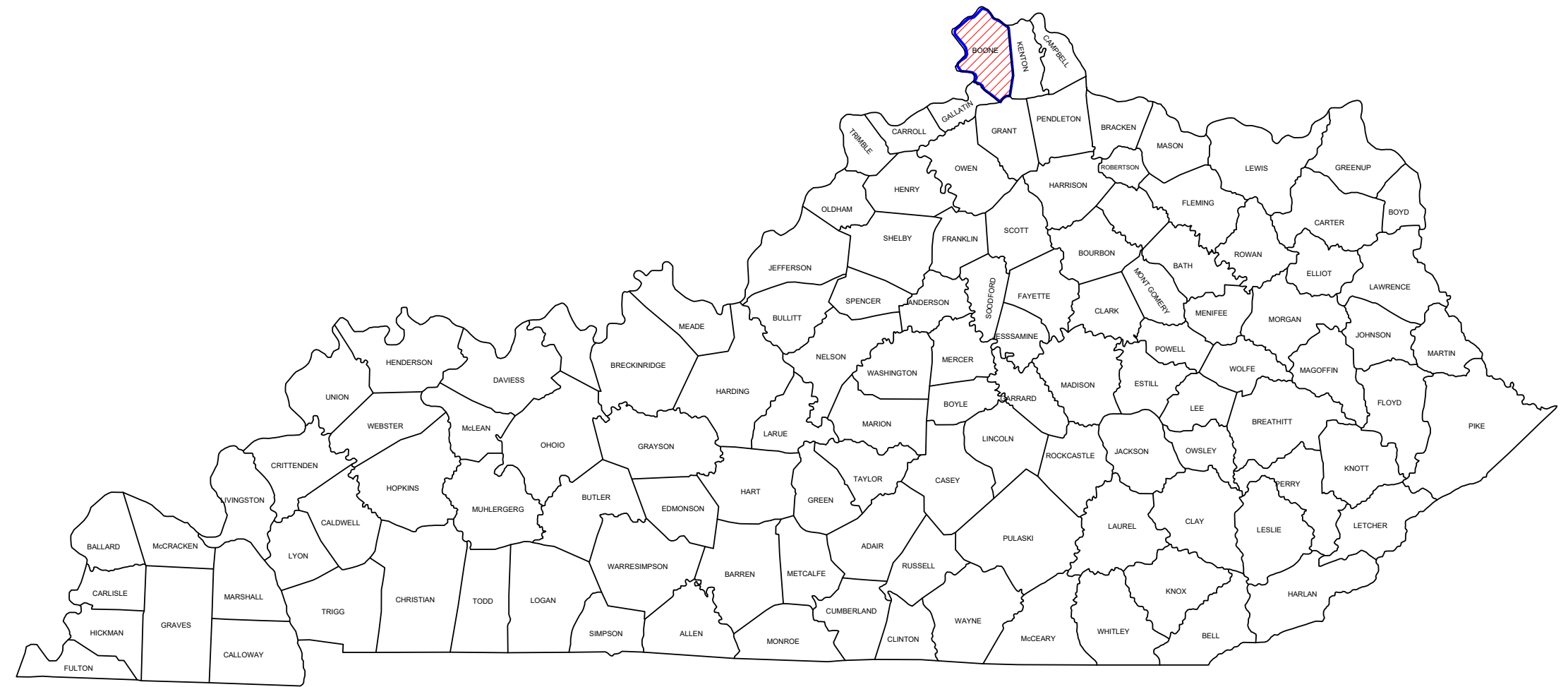
VICINITY MAP



OPERATED BY:  
**DUKE ENERGY KENTUCKY, INC.**  
6293 BEAVER RD, UNION, KENTUCKY 41091

OWNED BY:  
**DUKE ENERGY, INC.**  
526 SOUTH CHURCH STREET, CHARLOTTE, NORTH CAROLINA 28202

PREPARED BY:  
**S&ME, INC.**  
6190 ENTERPRISE COURT, DUBLIN, OHIO 43016



LOCATION MAP  
NOT TO SCALE

**DRAWING INDEX**

NUMBER	TITLE
EBS_C907.007.001	COVER SHEET
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EBS_C907.007.004	DEMOLITION PLAN
EBS_C907.007.005	COVER SYSTEM SITE PREPARATION GRADES
EBS_C907.007.006	COVER SYSTEM PIPE NETWORK
EBS_C907.007.007	COVER SYSTEM FINAL GRADES
EBS_C907.007.008	DOWNDRAIN REPLACEMENT (1 OF 2)
EBS_C907.007.009	DOWNDRAIN REPLACEMENT (2 OF 2)
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EBS_C907.007.013	PERIMETER DITCH REPAIR (2 OF 2)
EBS_C907.007.014	DETAILS, COVER SYSTEM
EBS_C907.007.015	DETAILS, SURFACE WATER CONTROLS
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EBS_C907.007.017	DETAILS, PERIMETER DITCH REPAIR
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EBS_C907.007.019	EROSION AND SEDIMENT CONTROL PLAN (2 OF 2)
EBS_C907.007.020	DETAILS, EROSION AND SEDIMENT CONTROLS (1)
EBS_C907.007.021	DETAILS, EROSION AND SEDIMENT CONTROLS (2)
EBS_C907.007.022	DOWNDRAIN CONTROL POINT TABLE



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REV	DATE	JOB NO.	PROJECT TYPE	DES	DFTR	CHKD	ENGR	APPD
0	5/7/2021	7217-17-004K	CLOSURE CONSTRUCTION	DCV	DCV	CKH	JDR	MGR

DESC: ISSUED FOR BID

TITLE  
**COVER SHEET**

FOR  
EAST BEND STATION - EAST CCR LANDFILL

SCALE: AS SHOWN	DES: DCV
DWG TYPE: CIVIL	DFTR: DCV
JOB NO: 7217-17-004K	CHKD: CKH
DATE: 5/7/2021	ENGR: JDR
FILENAME: EBS_C907.007.001.DWG	APPD: MGR

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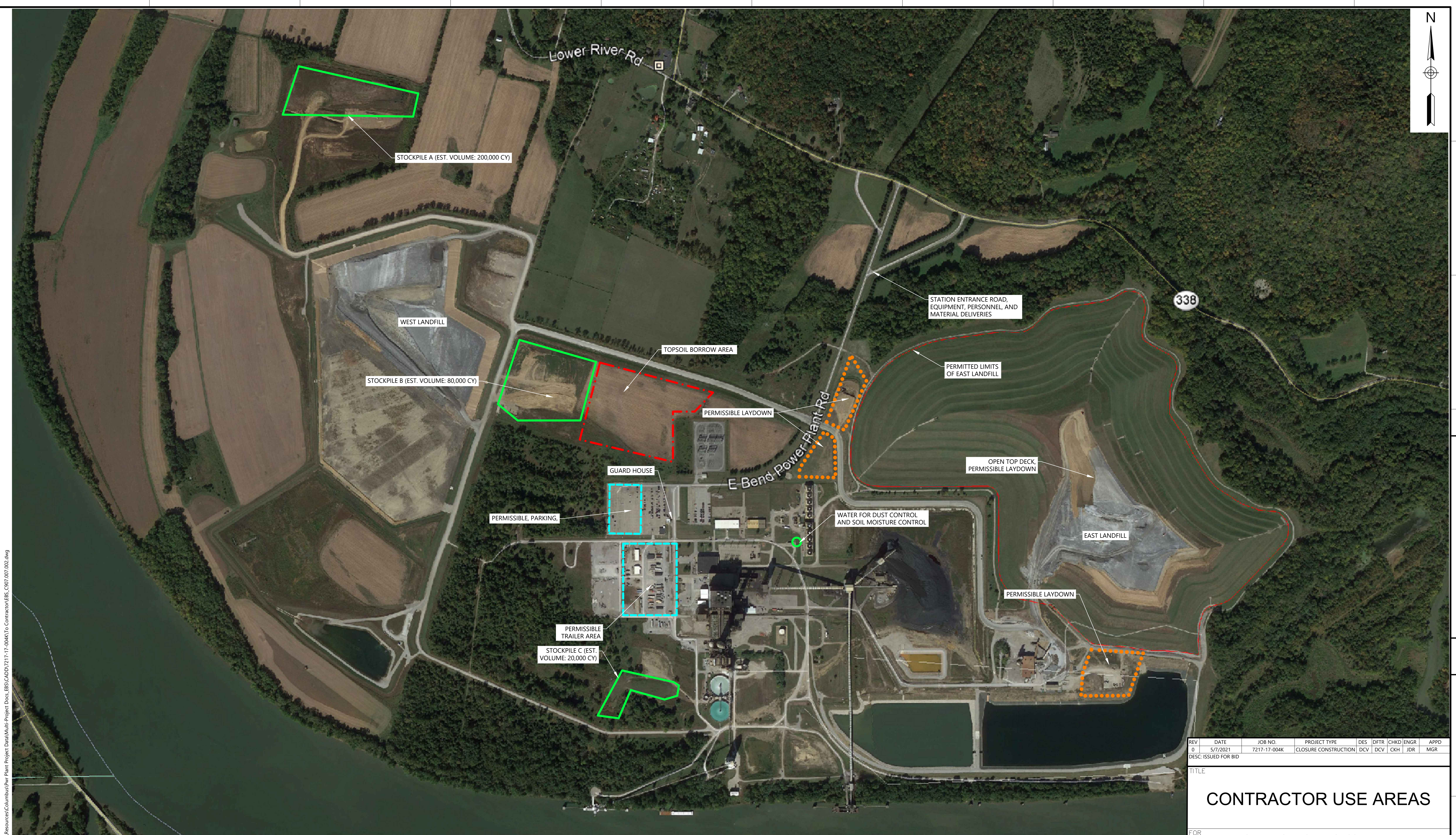
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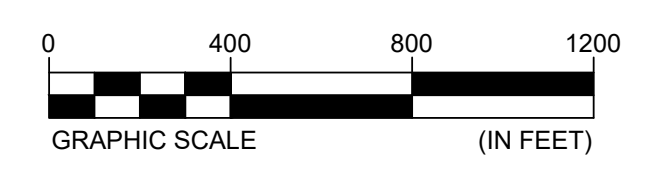




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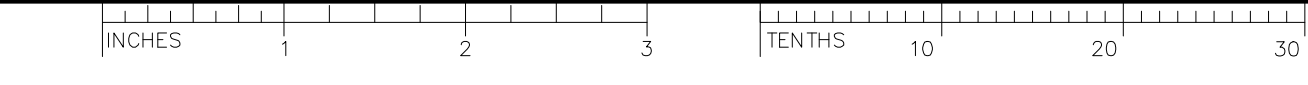
	EXISTING STOCKPILES		PERMISSIBLE LAYDOWN
	TOPSOIL BORROW AREA		PERMISSIBLE TRAILER AREA AND PARKING

NOTE:  
1. AERIAL IMAGE OBTAINED FROM 10/7/2020 GOOGLE MAPS CAPTURE, ©2021 GOOGLE



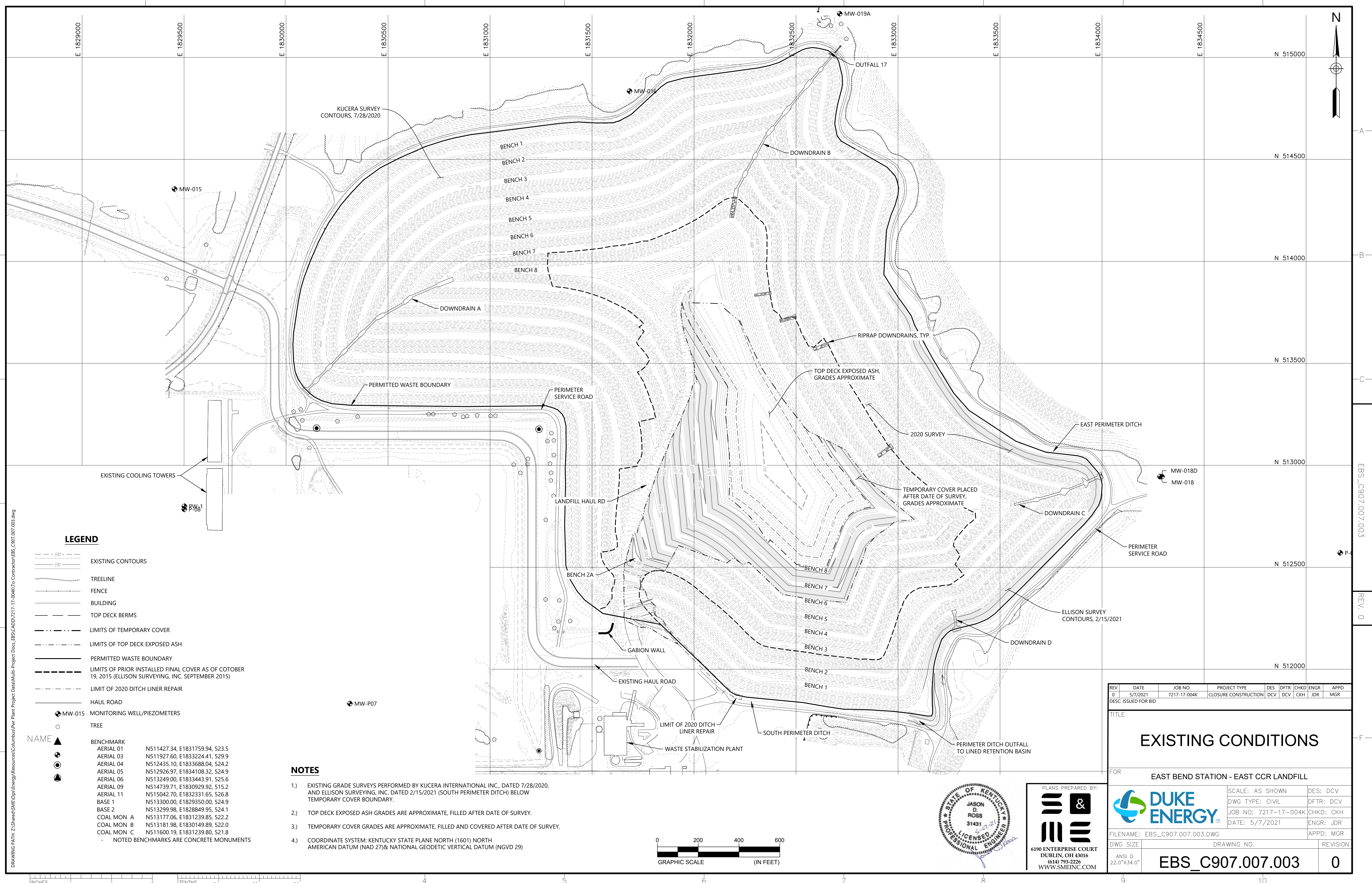
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REV	DATE	JOB NO.	PROJECT TYPE	DES	DFTR	CHKD	ENGR	APPD
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DESC: ISSUED FOR BID								
TITLE								
<b>CONTRACTOR USE AREAS</b>								
FOR								
EAST BEND STATION - EAST CCR LANDFILL								
SCALE: AS SHOWN			DES: DCV			DFTR: DCV		
DWG TYPE: CIVIL			JOB NO: 7217-17-004K			CHKD: CKH		
DATE: 5/7/2021			ENGR: JDR			APPD: MGR		
FILENAME: EBS_C907.007.002.DWG			DRAWING NO.			REVISION		
ANSI D 22.0"X34.0"			<b>EBS_C907.007.002</b>			<b>0</b>		



EBS\_C907.007.002

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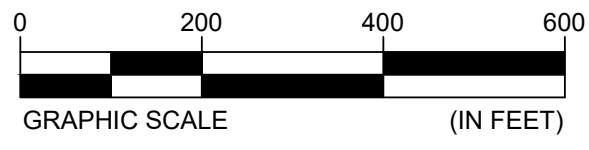


**LEGEND**

- EXISTING CONTOURS
- TREELINE
- FENCE
- BUILDING
- TOP DECK BERMS
- LIMITS OF TEMPORARY COVER
- LIMITS OF TOP DECK EXPOSED ASH
- PERMITTED WASTE BOUNDARY
- LIMITS OF PRIOR INSTALLED FINAL COVER AS OF COTOBER 19, 2015 (ELLISON SURVEYING, INC. SEPTEMBER 2015)
- LIMIT OF 2020 DITCH LINER REPAIR
- HAUL ROAD
- MW-015 MONITORING WELL/PIEZOMETERS
- TREE
- NAME**
- BENCHMARK
- AERIAL 01 N511427.34, E1831759.94, 523.5
- AERIAL 03 N511927.60, E1833224.41, 529.9
- AERIAL 04 N512435.10, E1833688.04, 524.2
- AERIAL 05 N512926.97, E1834108.32, 524.9
- AERIAL 06 N513249.00, E1833443.91, 525.6
- AERIAL 09 N514739.71, E1830929.92, 515.2
- AERIAL 11 N515042.70, E1832331.65, 526.8
- BASE 1 N513300.00, E1829350.00, 524.9
- BASE 2 N513299.98, E1828849.95, 524.1
- COAL MON A N513177.06, E1831239.85, 522.2
- COAL MON B N513181.98, E1830149.89, 522.0
- COAL MON C N511600.19, E1831239.80, 521.8
- NOTED BENCHMARKS ARE CONCRETE MONUMENTS

**NOTES**

- 1.) EXISTING GRADE SURVEYS PERFORMED BY KUCERA INTERNATIONAL INC., DATED 7/28/2020, AND ELLISON SURVEYING, INC. DATED 2/15/2021 (SOUTH PERIMETER DITCH) BELOW TEMPORARY COVER BOUNDARY.
- 2.) TOP DECK EXPOSED ASH GRADES ARE APPROXIMATE, FILLED AFTER DATE OF SURVEY.
- 3.) TEMPORARY COVER GRADES ARE APPROXIMATE, FILLED AND COVERED AFTER DATE OF SURVEY.
- 4.) COORDINATE SYSTEM: KENTUCKY STATE PLANE NORTH (1601) NORTH AMERICAN DATUM (NAD 27)& NATIONAL GEODETIC VERTICAL DATUM (NGVD 29)



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0	5/7/2021	7217-17-004K	CLOSURE CONSTRUCTION	DCV	DCV	CKH	JDR	MGR

DESC: ISSUED FOR BID

TITLE  
**EXISTING CONDITIONS**

FOR  
**EAST BEND STATION - EAST CCR LANDFILL**

SCALE: AS SHOWN	DES: DCV
DWG TYPE: CIVIL	DFTR: DCV
JOB NO: 7217-17-004K	CHKD: CKH
DATE: 5/7/2021	ENGR: JDR
APPD: MGR	

FILENAME: EBS\_C907.007.003.DWG

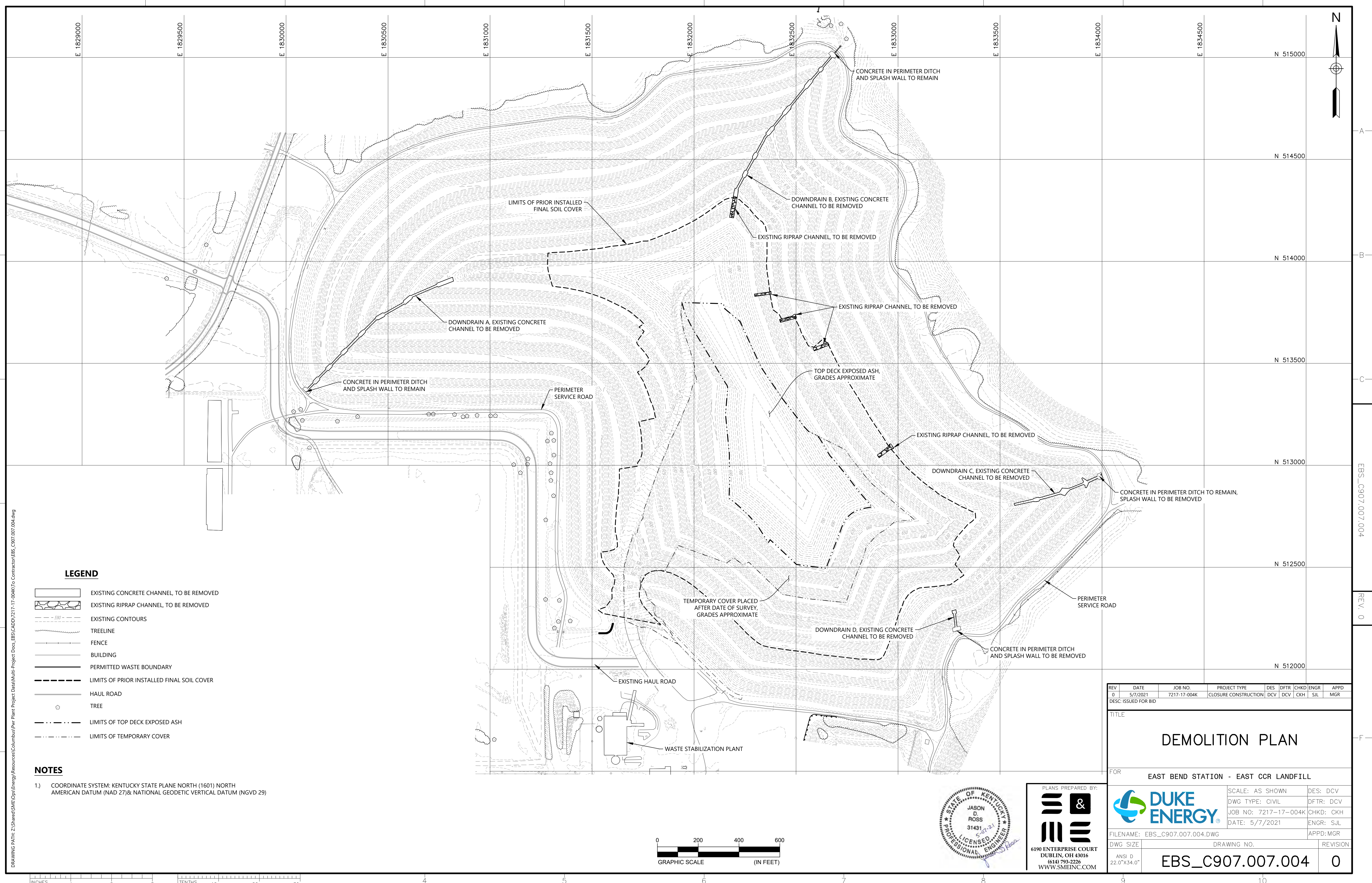
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**LEGEND**

- EXISTING CONCRETE CHANNEL, TO BE REMOVED
- EXISTING RIPRAP CHANNEL, TO BE REMOVED
- EXISTING CONTOURS
- TREELINE
- FENCE
- BUILDING
- PERMITTED WASTE BOUNDARY
- LIMITS OF PRIOR INSTALLED FINAL SOIL COVER
- HAUL ROAD
- TREE
- LIMITS OF TOP DECK EXPOSED ASH
- LIMITS OF TEMPORARY COVER

**NOTES**

- 1) COORDINATE SYSTEM: KENTUCKY STATE PLANE NORTH (1601) NORTH AMERICAN DATUM (NAD 27)& NATIONAL GEODETIC VERTICAL DATUM (NGVD 29)



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0	5/7/2021	7217-17-004K	CLOSURE CONSTRUCTION	DCV	DCV	CKH	SJL	MGR
DESC: ISSUED FOR BID								
TITLE								
<b>DEMOLITION PLAN</b>								
FOR								
EAST BEND STATION - EAST CCR LANDFILL								
SCALE: AS SHOWN			DES: DCV					
DWG TYPE: CIVIL			DFTR: DCV					
JOB NO: 7217-17-004K			CHKD: CKH					
DATE: 5/7/2021			ENGR: SJL					
FILENAME: EBS_C907.007.004.DWG			APPD: MGR					
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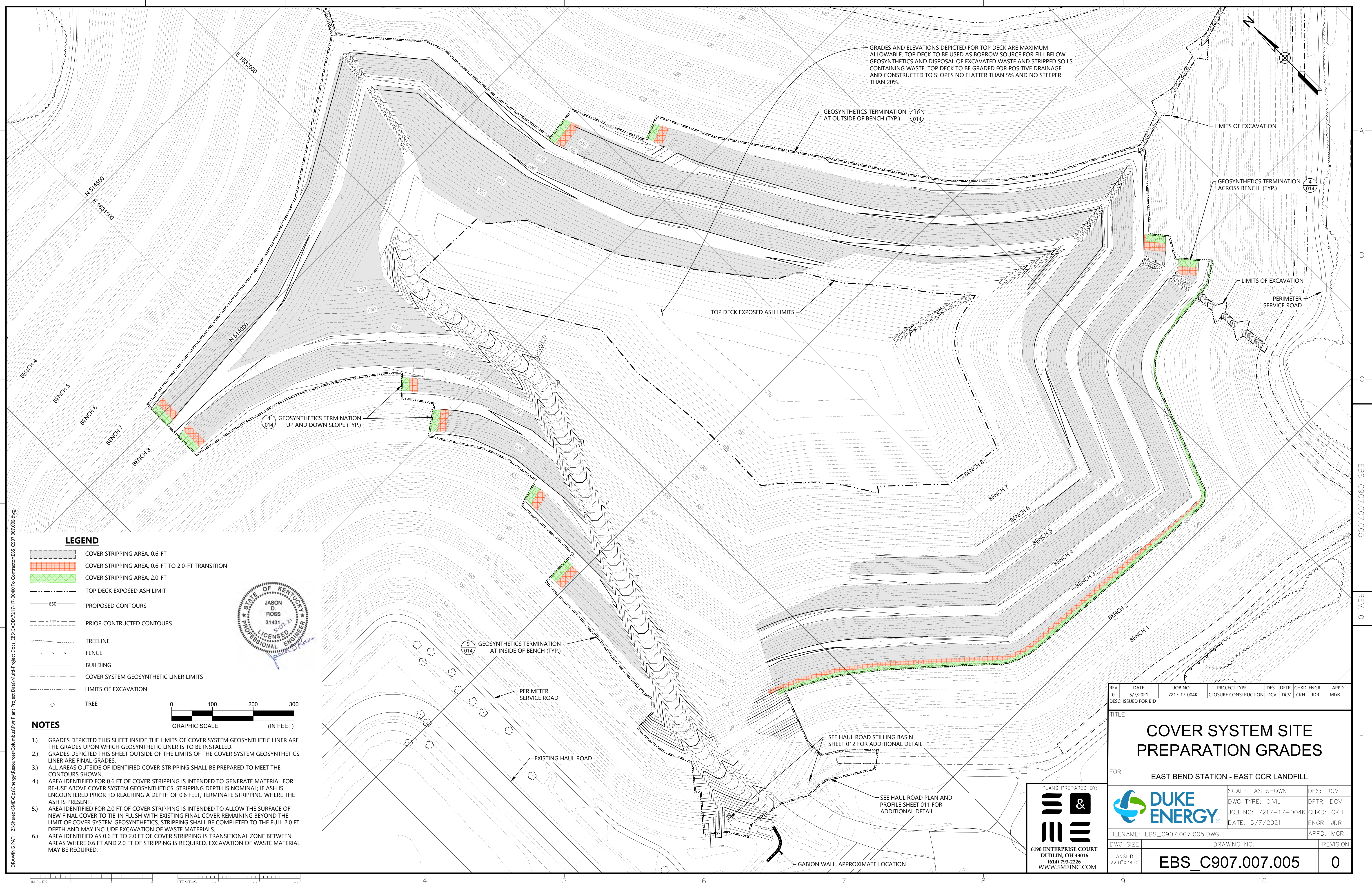
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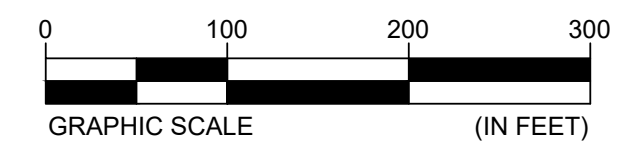
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**LEGEND**

- COVER STRIPPING AREA, 0.6-FT
- COVER STRIPPING AREA, 0.6-FT TO 2.0-FT TRANSITION
- COVER STRIPPING AREA, 2.0-FT
- TOP DECK EXPOSED ASH LIMIT
- PROPOSED CONTOURS
- PRIOR CONSTRUCTED CONTOURS
- TREELINE
- FENCE
- BUILDING
- COVER SYSTEM GEOSYNTHETIC LINER LIMITS
- LIMITS OF EXCAVATION
- TREE



**NOTES**

- 1.) GRADES DEPICTED THIS SHEET INSIDE THE LIMITS OF COVER SYSTEM GEOSYNTHETIC LINER ARE THE GRADES UPON WHICH GEOSYNTHETIC LINER IS TO BE INSTALLED.
- 2.) GRADES DEPICTED THIS SHEET OUTSIDE OF THE LIMITS OF THE COVER SYSTEM GEOSYNTHETIC LINER ARE FINAL GRADES.
- 3.) ALL AREAS OUTSIDE OF IDENTIFIED COVER STRIPPING SHALL BE PREPARED TO MEET THE CONTOURS SHOWN.
- 4.) AREA IDENTIFIED FOR 0.6 FT OF COVER STRIPPING IS INTENDED TO GENERATE MATERIAL FOR RE-USE ABOVE COVER SYSTEM GEOSYNTHETICS. STRIPPING DEPTH IS NOMINAL; IF ASH IS ENCOUNTERED PRIOR TO REACHING A DEPTH OF 0.6 FEET, TERMINATE STRIPPING WHERE THE ASH IS PRESENT.
- 5.) AREA IDENTIFIED FOR 2.0 FT OF COVER STRIPPING IS INTENDED TO ALLOW THE SURFACE OF NEW FINAL COVER TO TIE-IN FLUSH WITH EXISTING FINAL COVER REMAINING BEYOND THE LIMIT OF COVER SYSTEM GEOSYNTHETICS. STRIPPING SHALL BE COMPLETED TO THE FULL 2.0 FT DEPTH AND MAY INCLUDE EXCAVATION OF WASTE MATERIALS.
- 6.) AREA IDENTIFIED AS 0.6 FT TO 2.0 FT OF COVER STRIPPING IS TRANSITIONAL ZONE BETWEEN AREAS WHERE 0.6 FT AND 2.0 FT OF STRIPPING IS REQUIRED. EXCAVATION OF WASTE MATERIAL MAY BE REQUIRED.

GRADES AND ELEVATIONS DEPICTED FOR TOP DECK ARE MAXIMUM ALLOWABLE. TOP DECK TO BE USED AS BORROW SOURCE FOR FILL BELOW GEOSYNTHETICS AND DISPOSAL OF EXCAVATED WASTE AND STRIPPED SOILS CONTAINING WASTE. TOP DECK TO BE GRADED FOR POSITIVE DRAINAGE AND CONSTRUCTED TO SLOPES NO FLATTER THAN 5% AND NO STEEPER THAN 20%.

GEOSYNTHETICS TERMINATION AT OUTSIDE OF BENCH (TYP.)

LIMITS OF EXCAVATION

GEOSYNTHETICS TERMINATION ACROSS BENCH (TYP.)

LIMITS OF EXCAVATION

PERIMETER SERVICE ROAD

TOP DECK EXPOSED ASH LIMITS

GEOSYNTHETICS TERMINATION UP AND DOWN SLOPE (TYP.)

GEOSYNTHETICS TERMINATION AT INSIDE OF BENCH (TYP.)

PERIMETER SERVICE ROAD

EXISTING HAUL ROAD

SEE HAUL ROAD STILLING BASIN SHEET 012 FOR ADDITIONAL DETAIL

SEE HAUL ROAD PLAN AND PROFILE SHEET 011 FOR ADDITIONAL DETAIL

GABION WALL, APPROXIMATE LOCATION

REV	DATE	JOB NO.	PROJECT TYPE	DES	DFTR	CHKD	ENGR	APPD
0	5/7/2021	7217-17-004K	CLOSURE CONSTRUCTION	DCV	DCV	CKH	JDR	MGR

TITLE  
**COVER SYSTEM SITE PREPARATION GRADES**

FOR  
EAST BEND STATION - EAST CCR LANDFILL

SCALE: AS SHOWN	DES: DCV
DWG TYPE: CIVIL	DFTR: DCV
JOB NO: 7217-17-004K	CHKD: CKH
DATE: 5/7/2021	ENGR: JDR
FILENAME: EBS_C907.007.005.DWG	APPD: MGR

DWG SIZE ANSI D 22.0"X34.0"	DRAWING NO.	REVISION
	<b>EBS_C907.007.005</b>	<b>0</b>

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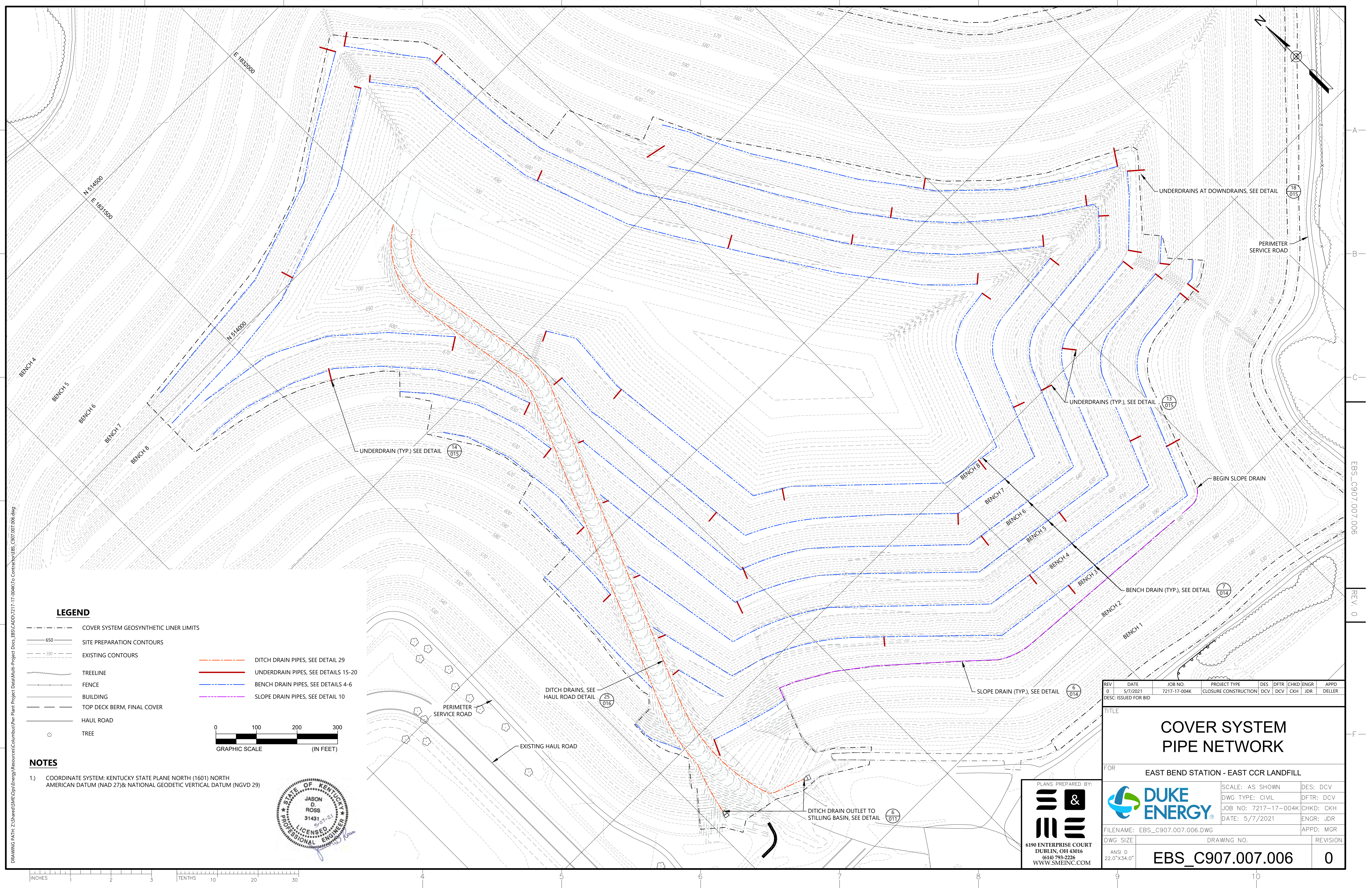
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**LEGEND**

- - - COVER SYSTEM GEOSYNTHETIC LINER LIMITS
- 650 SITE PREPARATION CONTOURS
- 590 EXISTING CONTOURS
- ~~~~~ TREELINE
- ===== FENCE
- ===== BUILDING
- ===== TOP DECK BERM, FINAL COVER
- ===== HAUL ROAD
- TREE
- DITCH DRAIN PIPES, SEE DETAIL 29
- UNDERDRAIN PIPES, SEE DETAILS 15-20
- BENCH DRAIN PIPES, SEE DETAILS 4-6
- SLOPE DRAIN PIPES, SEE DETAIL 10

**NOTES**

- 1) COORDINATE SYSTEM: KENTUCKY STATE PLANE NORTH (1601) NORTH AMERICAN DATUM (NAD 27) & NATIONAL GEODETIC VERTICAL DATUM (NGVD 29)



REV	DATE	JOB NO.	PROJECT TYPE	DES	DFTR	CHKD	ENGR	APPD
0	5/7/2021	7217-17-004K	CLOSURE CONSTRUCTION	DCV	DCV	CKH	JDR	DELLER

TITLE

## COVER SYSTEM PIPE NETWORK

FOR EAST BEND STATION - EAST CCR LANDFILL

SCALE: AS SHOWN	DES: DCV
DWG TYPE: CIVIL	DFTR: DCV
JOB NO: 7217-17-004K	CHKD: CKH
DATE: 5/7/2021	ENGR: JDR
APPD: MGR	

FILENAME: EBS\_C907.007.006.DWG

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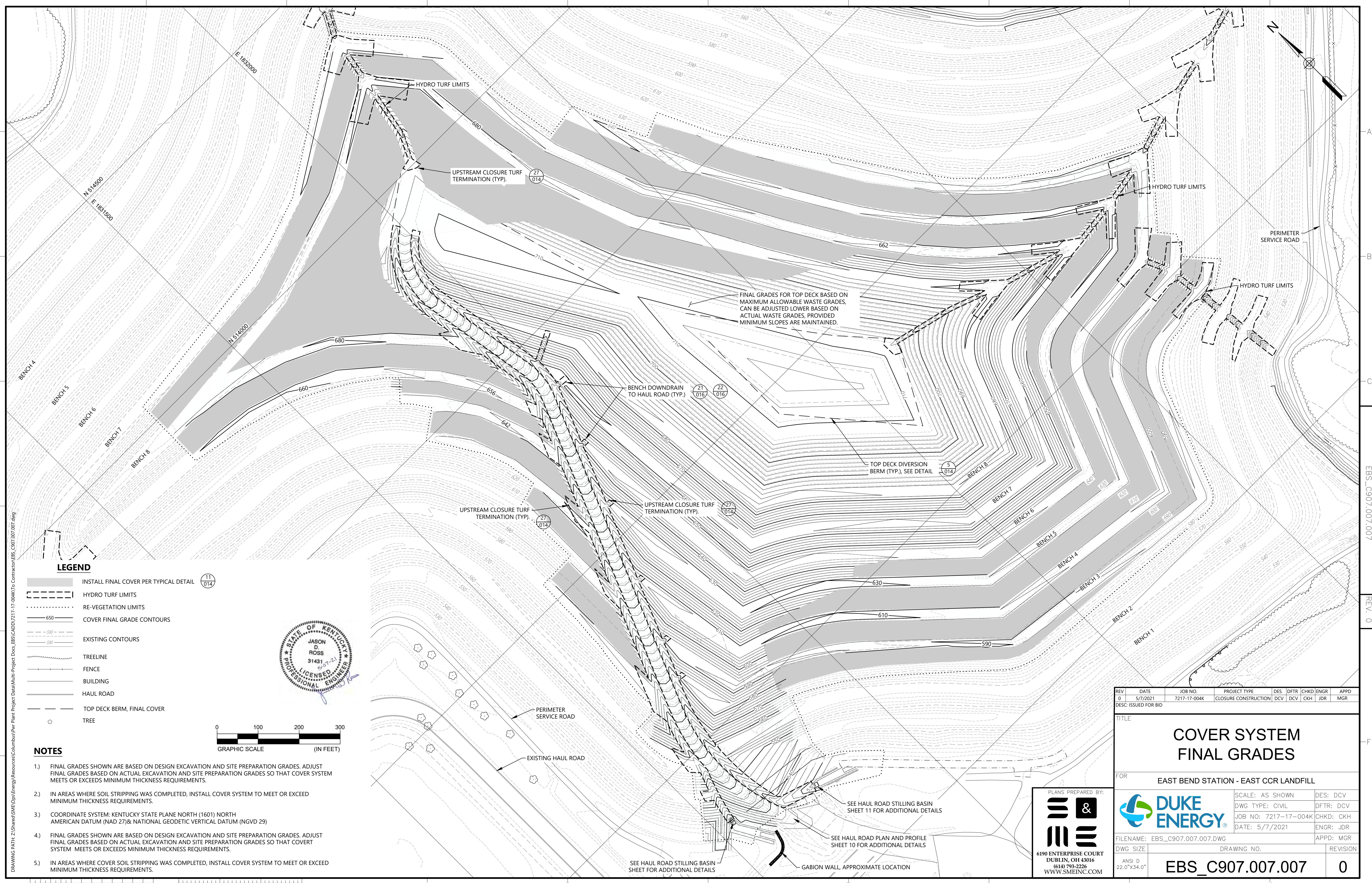
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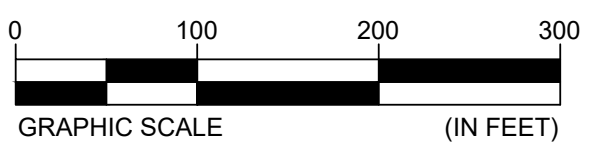
REV. 0





**LEGEND**

- INSTALL FINAL COVER PER TYPICAL DETAIL (11/014)
- HYDRO TURF LIMITS
- RE-VEGETATION LIMITS
- COVER FINAL GRADE CONTOURS
- EXISTING CONTOURS
- TREELINE
- FENCE
- BUILDING
- HAUL ROAD
- TOP DECK BERM, FINAL COVER
- TREE



**NOTES**

- 1.) FINAL GRADES SHOWN ARE BASED ON DESIGN EXCAVATION AND SITE PREPARATION GRADES. ADJUST FINAL GRADES BASED ON ACTUAL EXCAVATION AND SITE PREPARATION GRADES SO THAT COVER SYSTEM MEETS OR EXCEEDS MINIMUM THICKNESS REQUIREMENTS.
- 2.) IN AREAS WHERE SOIL STRIPPING WAS COMPLETED, INSTALL COVER SYSTEM TO MEET OR EXCEED MINIMUM THICKNESS REQUIREMENTS.
- 3.) COORDINATE SYSTEM: KENTUCKY STATE PLANE NORTH (1601) NORTH AMERICAN DATUM (NAD 27) & NATIONAL GEODETIC VERTICAL DATUM (NGVD 29)
- 4.) FINAL GRADES SHOWN ARE BASED ON DESIGN EXCAVATION AND SITE PREPARATION GRADES. ADJUST FINAL GRADES BASED ON ACTUAL EXCAVATION AND SITE PREPARATION GRADES SO THAT COVER SYSTEM MEETS OR EXCEEDS MINIMUM THICKNESS REQUIREMENTS.
- 5.) IN AREAS WHERE COVER SOIL STRIPPING WAS COMPLETED, INSTALL COVER SYSTEM TO MEET OR EXCEED MINIMUM THICKNESS REQUIREMENTS.

FINAL GRADES FOR TOP DECK BASED ON MAXIMUM ALLOWABLE WASTE GRADES, CAN BE ADJUSTED LOWER BASED ON ACTUAL WASTE GRADES, PROVIDED MINIMUM SLOPES ARE MAINTAINED.

REV	DATE	JOB NO.	PROJECT TYPE	DES	DFTR	CHKD	ENGR	APPD
0	5/7/2021	7217-17-004K	CLOSURE CONSTRUCTION	DCV	DCV	CKH	JDR	MGR

TITLE  
**COVER SYSTEM  
FINAL GRADES**

FOR  
**EAST BEND STATION - EAST CCR LANDFILL**

SCALE: AS SHOWN	DES: DCV
DWG TYPE: CIVIL	DFTR: DCV
JOB NO: 7217-17-004K	CHKD: CKH
DATE: 5/7/2021	ENGR: JDR
APPD: MGR	
FILENAME: EBS_C907.007.007.DWG	
DWG SIZE: 22.0"X34.0"	DRAWING NO.:
<b>EBS_C907.007.007</b>	
REVISION <b>0</b>	

PLANS PREPARED BY:  
  
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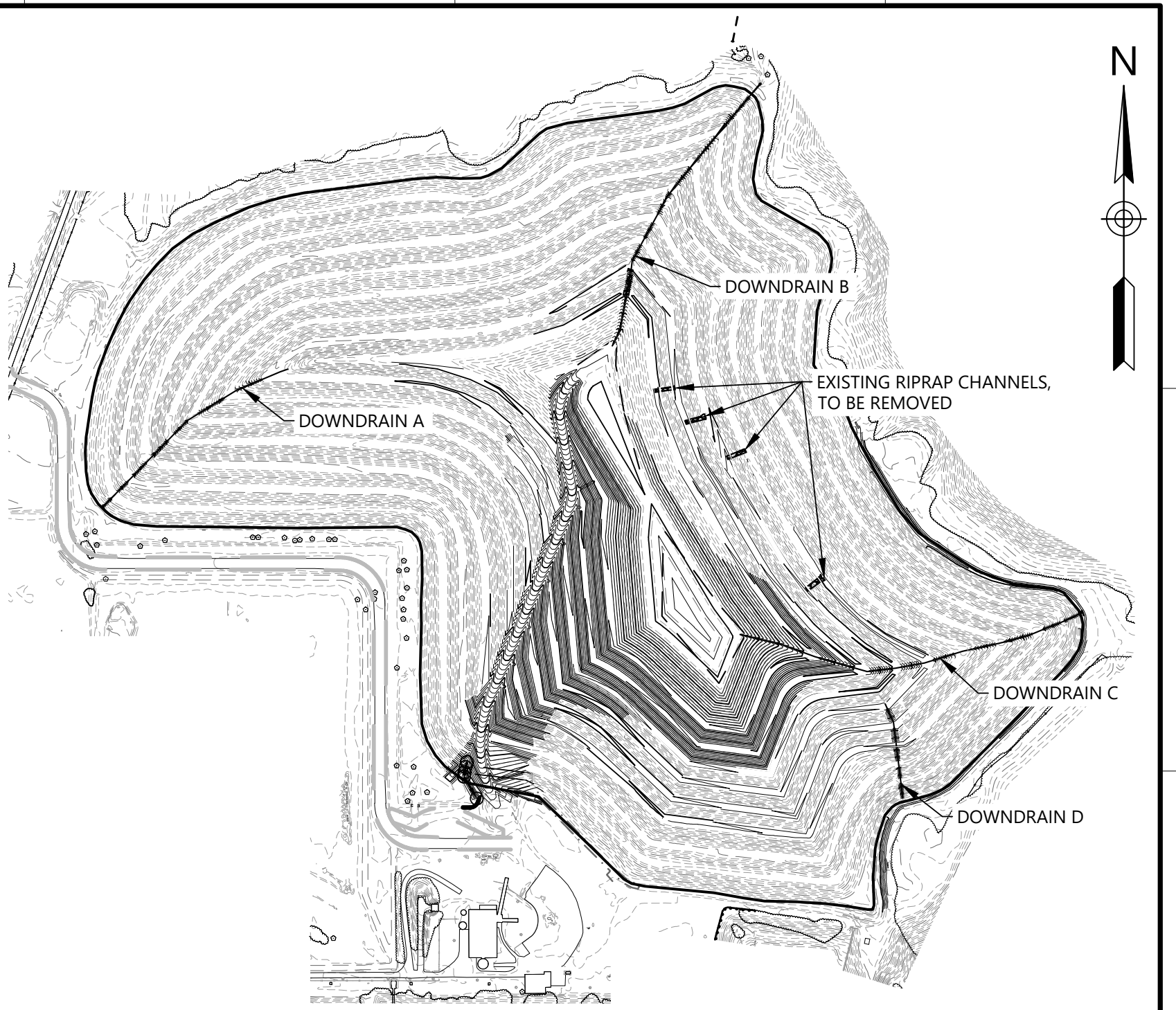
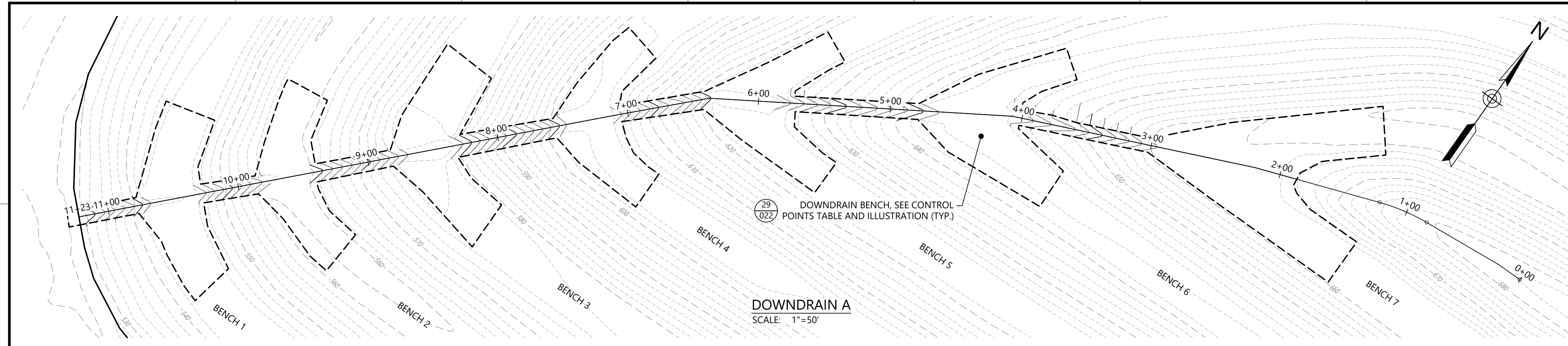


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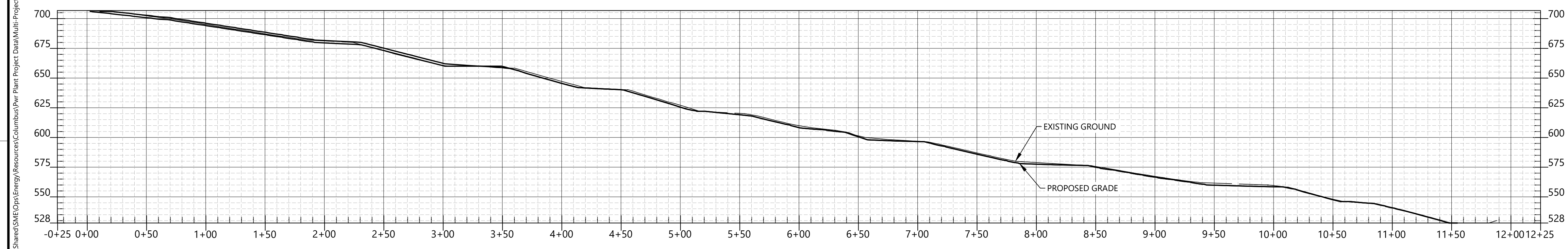
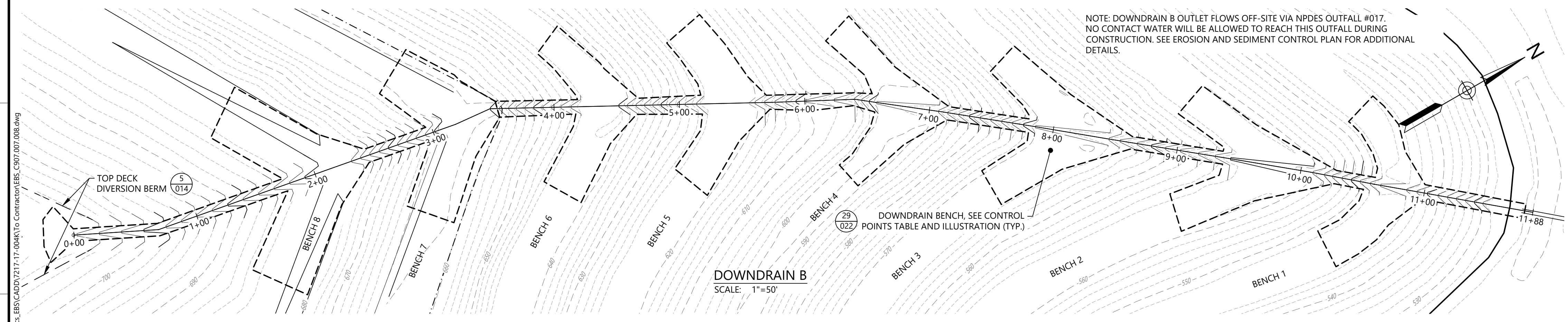
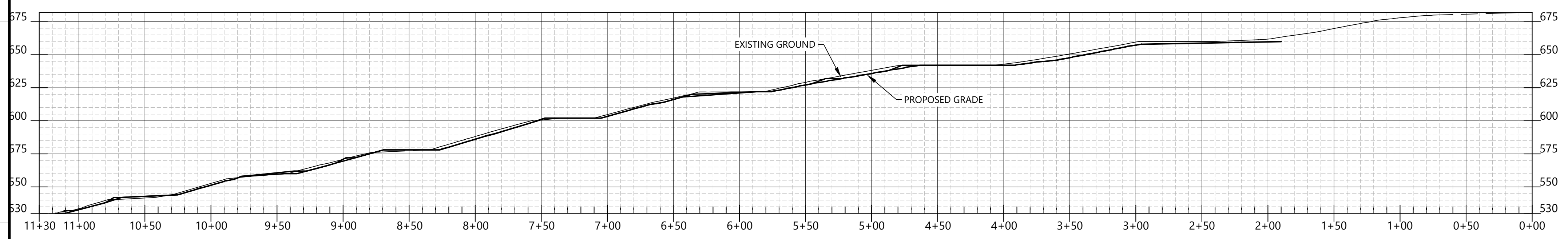
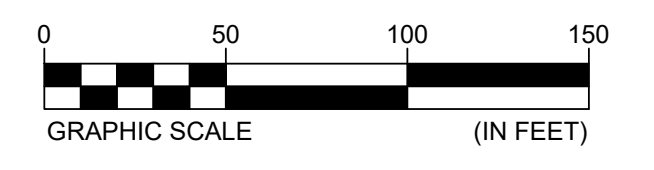
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- LEGEND**
- HYDRO TURF LIMITS
  - COVER FINAL GRADE CONTOURS
  - EXISTING CONTOURS
  - TREELINE
  - FENCE
  - LIMITS OF PRIOR INSTALLED FINAL COVER AS OF COTOBER 19, 2015 (ELLISON SURVEYING, INC. SEPTEMBER 2015)
  - COVER SYSTEM GEOSYNTHETIC LINER LIMITS
  - TREE
- NOTES**
- 1) EXISTING GROUND SURFACE CONTOURS SHOWN ON THIS PLAN WERE OBTAINED FROM A FLYOVER SURVEY PERFORMED BY KUCERA INTERNATIONAL, DATED 08-08-2016.
  - 2) COORDINATE SYSTEM: KENTUCKY STATE PLANE NORTH (1601) NORTH AMERICAN DATUM (NAD 27) & NATIONAL GEODETIC VERTICAL DATUM (NGVD 29)
  - 3) PERMITTED WASTE BOUNDARY LIMITS OBTAINED FROM PERMIT DRAWING EBS\_EASTLF\_1 PREPARED BY ELLISON SURVEYING, INC., 03/03/16.
  - 4) DOWNDRAIN B OUTLET FLOWS OFF-SITE VIA NPDES OUTFALL #017. NO CONTACT WATER WILL BE ALLOWED TO REACH THIS OUTFALL DURING CONSTRUCTION. SEE EROSION AND SEDIMENT CONTROL PLAN FOR ADDITIONAL DETAILS.



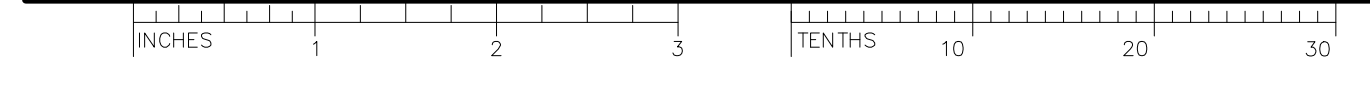
PLANS PREPARED BY:

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REV	DATE	JOB NO.	PROJECT TYPE	DES	DFTR	CHKD	ENGR	APPD
0	5/7/2021	7217-17-004K	CLOSURE CONSTRUCTION	DCV	DCV	CKH	JDR	MGR

DESC: ISSUED FOR BID

TITLE		
<b>DOWNDRAIN REPLACEMENT (1 OF 2)</b>		
FOR		
EAST BEND STATION - EAST CCR LANDFILL		
		SCALE: AS SHOWN DWG TYPE: CIVIL JOB NO: 7217-17-004K DATE: 5/7/2021
FILENAME: EBS_C907.007.008.DWG DWG SIZE: 22.0"x34.0"		DES: DCV DFTR: DCV CHKD: CKH ENGR: JDR APPD: MGR
ANSI D		REVISION
<b>EBS_C907.007.008</b>		<b>0</b>

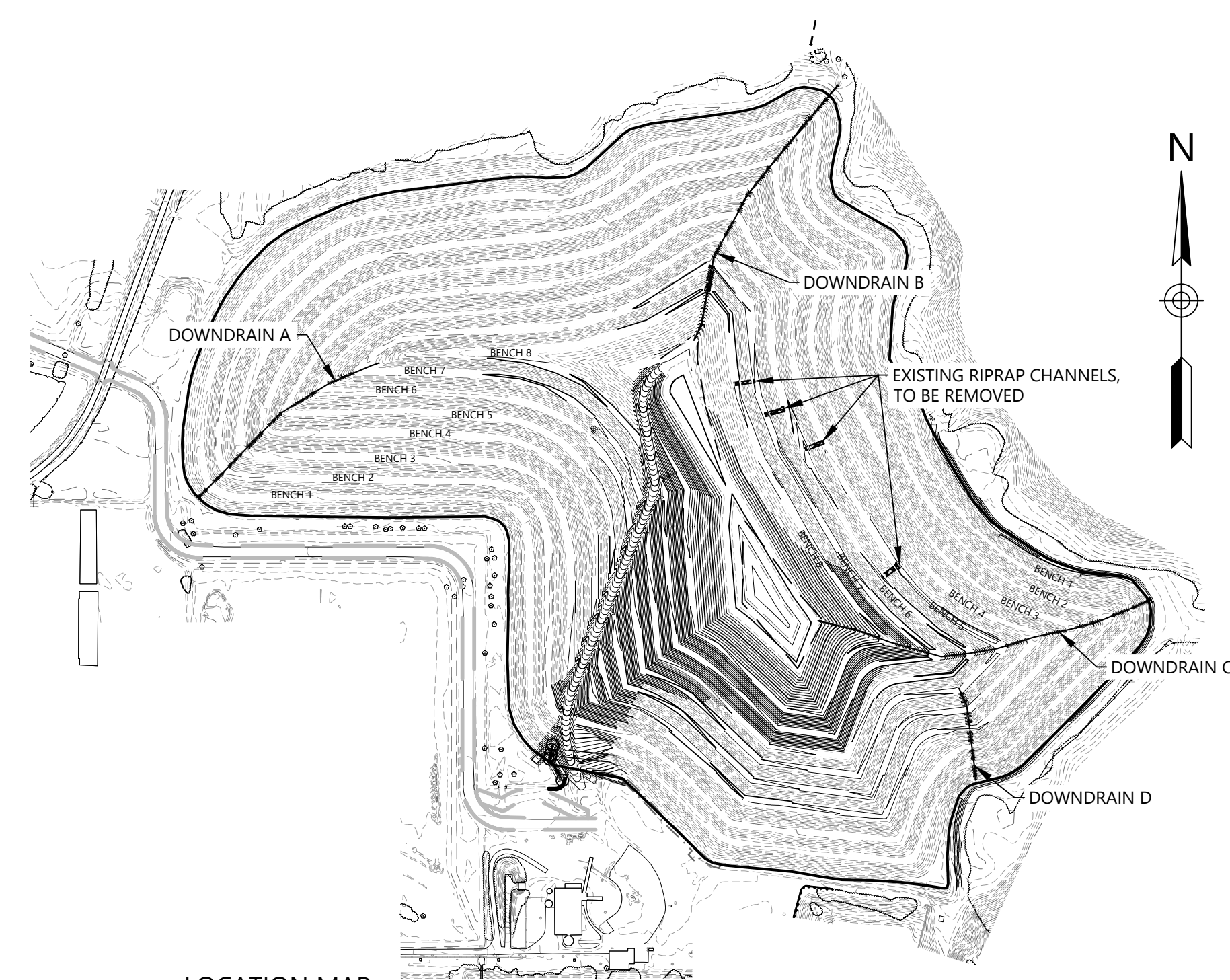
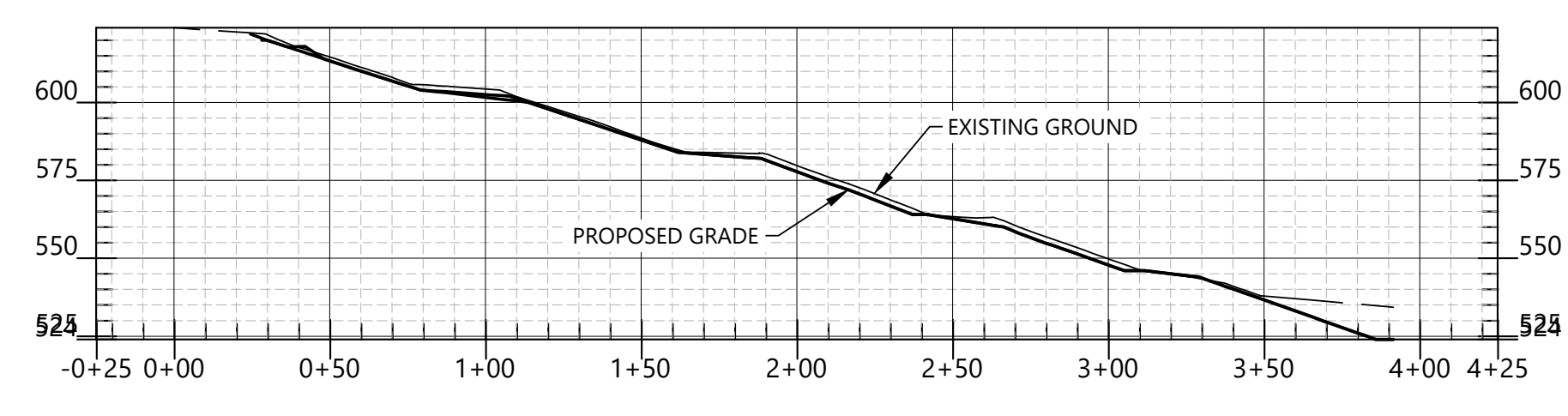
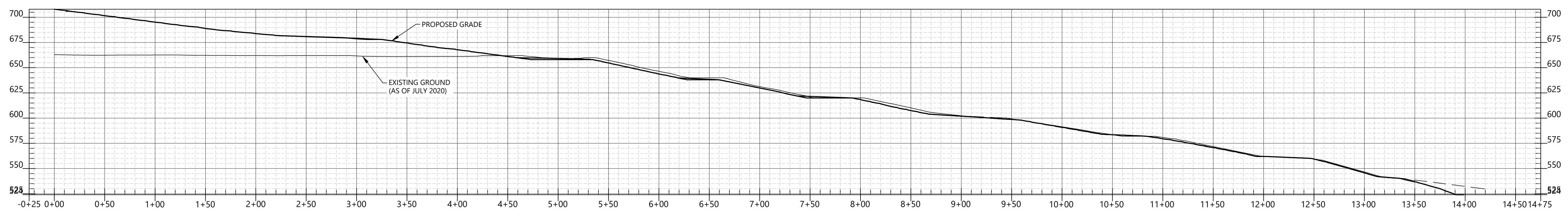
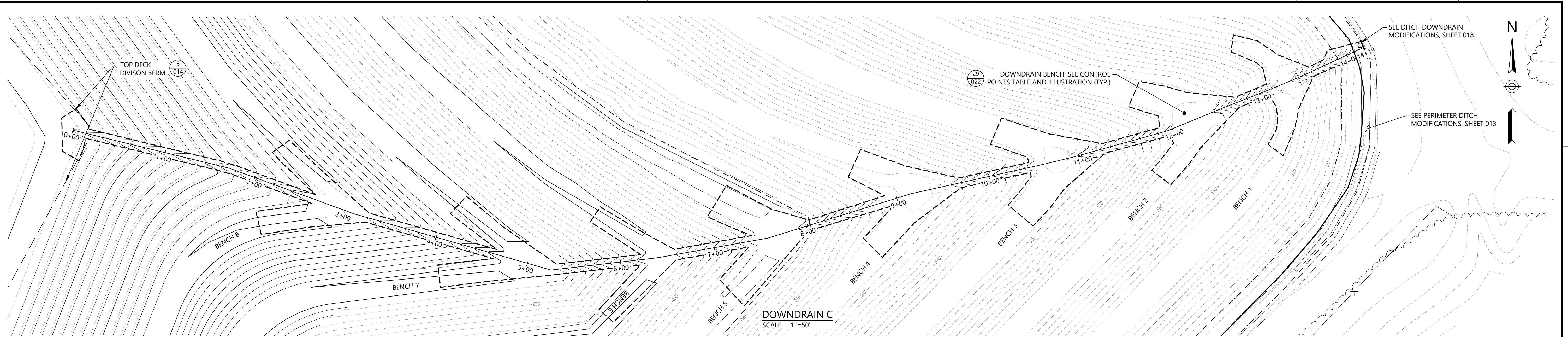


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EBS\_C907.007.008

REV. 0

F



**LEGEND**

- HYDRO TURF LIMITS
- COVER FINAL GRADE CONTOURS
- EXISTING CONTOURS
- LIMITS OF PRIOR INSTALLED FINAL COVER AS OF COTOBER 19, 2015 (ELLISON SURVEYING, INC. SEPTEMBER 2015)
- COVER SYSTEM GEOSYNTHETIC LINER LIMITS
- TREELINE
- FENCE
- TREE

**NOTES**

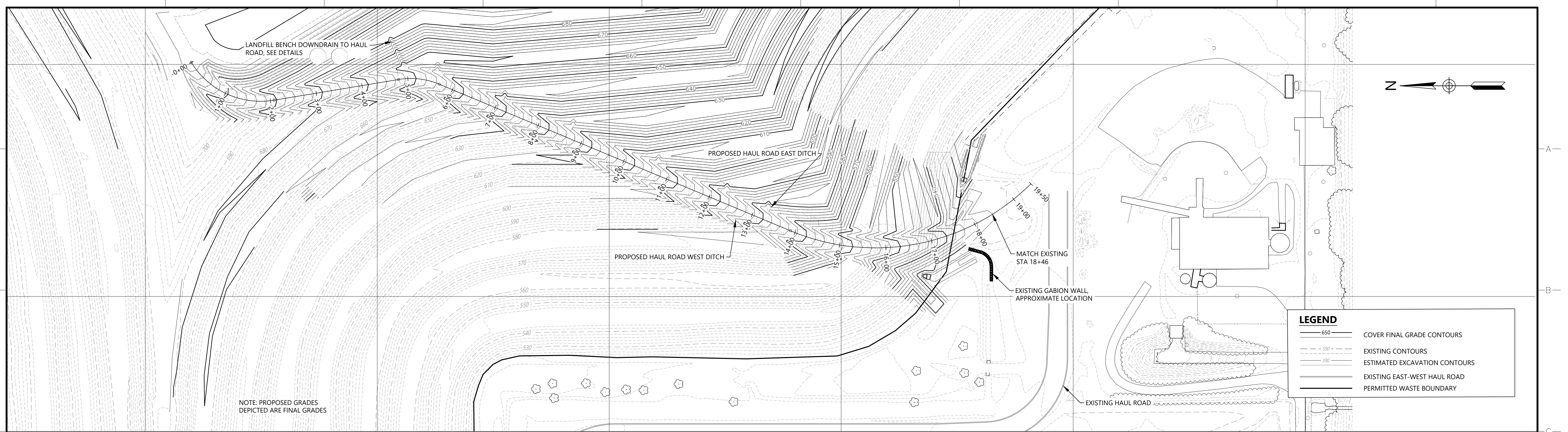
- EXISTING GRADE SURVEYS PERFORMED BY KUCERA INTERNATIONAL INC., DATED 7/28/2020, AND ELLISON SURVEYING, INC. DATED 2/15/2021 (SOUTH PERIMETER DITCH) BELOW TEMPORARY COVER BOUNDARY.
- COORDINATE SYSTEM: KENTUCKY STATE PLANE NORTH (1601) NORTH AMERICAN DATUM (NAD 27)& NATIONAL GEODETIC VERTICAL DATUM (NGVD 29)
- PERMITTED WASTE BOUNDARY LIMITS OBTAINED FROM PERMIT DRAWING EBS\_EASTLF\_1 PREPARED BY ELLISON SURVEYING, INC., 03/03/16.

GRAPHIC SCALE (IN FEET): 0, 50, 100, 150



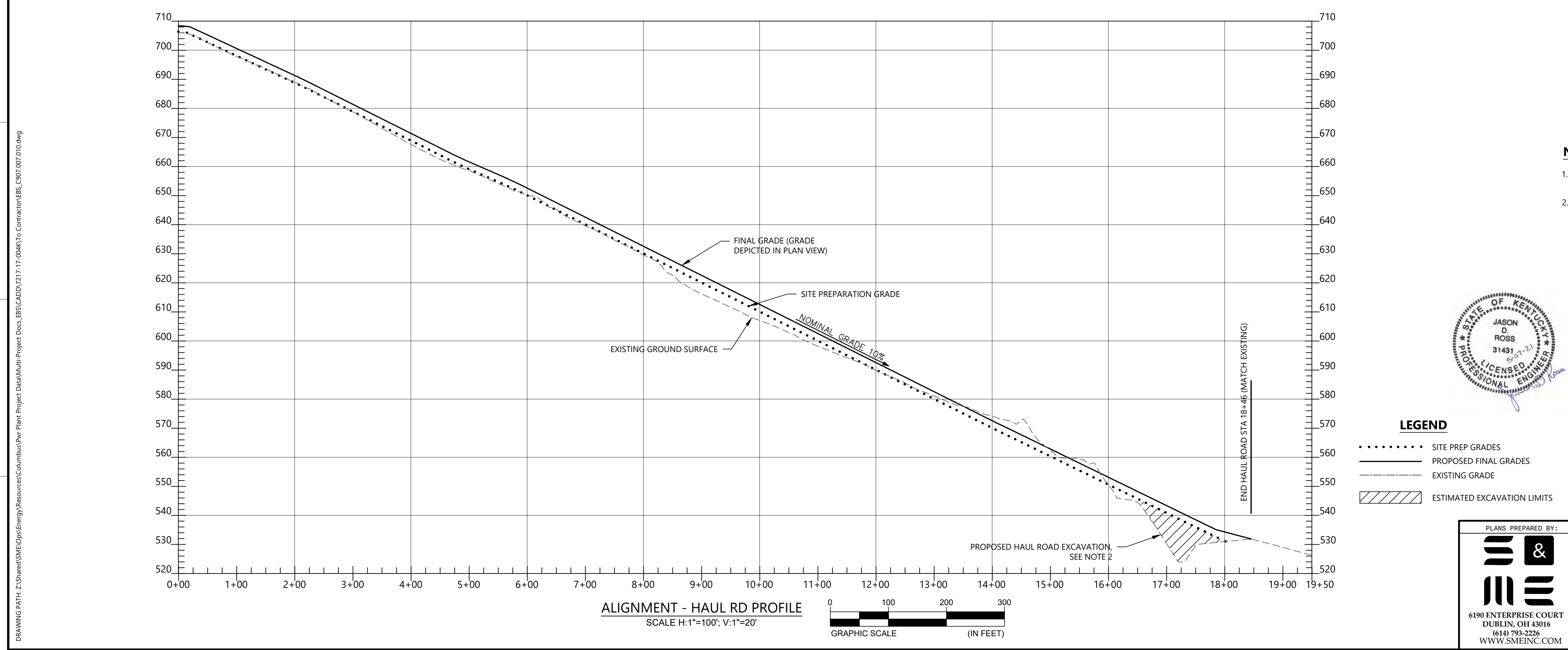
PLANS PREPARED BY:  
  
 6190 ENTERPRISE COURT  
 DUBLIN, OH 43016  
 (614) 793-2226  
 WWW.SMEINC.COM

REV	DATE	JOB NO.	PROJECT TYPE	DES	DFTR	CHKD	ENGR	APPD
0	5/7/2021	7217-17-004K	CLOSURE CONSTRUCTION	DCV	DCV	CKH	JDR	MGR
DESC: ISSUED FOR BID								
TITLE <b>DOWNDRAIN REPLACEMENT (2 OF 2)</b>								
FOR EAST BEND STATION - EAST CCR LANDFILL								
SCALE: AS SHOWN			DES: DCV			DWG TYPE: CIVIL		
JOB NO: 7217-17-004K			CHKD: CKH			DATE: 5/7/2021		
ENGR: JDR			APPD: MGR			FILENAME: EBS_C907.007.009.DWG		
ANSI D 22.0"x34.0"			DRAWING NO.			REVISION		
EBS_C907.007.009			0					



HAUL RD PLAN VIEW

0 100 200 300  
GRAPHIC SCALE (IN FEET)



- NOTES**
- EXISTING GRADE SURVEYS PERFORMED BY KUCERA INTERNATIONAL INC., DATED 7/28/2020,
  - EXCAVATE AS NEEDED AT BASE OF LANDFILL HAUL ROAD TO EXPOSE THE ORIGINAL LANDFILL PERIMETER DITCH AND REMOVE ASH BEYOND PERMITTED LIMITS OF WASTE. BACKFILL TO PROPOSED GRADES WITH TYPE S1 FILL.



REV	DATE	JOB NO.	PROJECT TYPE	DES	DFTR	CHKD	ENGR	APPD
0	5/7/2021	7217-17-004K	CLOSURE CONSTRUCTION	DCV	DCV	CKH	JDR	MGR

DESC: ISSUED FOR BID

TITLE  
**HAUL ROAD, PLAN AND PROFILE**

FOR  
EAST BEND STATION - EAST CCR LANDFILL

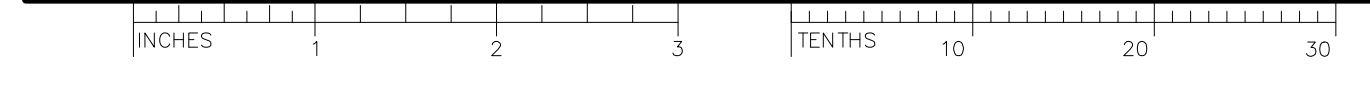
PLANS PREPARED BY:  
**S & ME**  
6190 ENTERPRISE COURT  
DUBLIN, OH 43016  
(614) 793-2226  
WWW.SMEINC.COM

SCALE: AS SHOWN  
DWG TYPE: CIVIL  
JOB NO: 7217-17-004K  
DATE: 5/7/2021

DES: DCV  
DFTR: DCV  
CHKD: CKH  
ENGR: JDR  
APPD: MGR

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DWG SIZE: 22.0"x34.0"  
DRAWING NO.  
REVISION

**EBS\_C907.007.010** 0

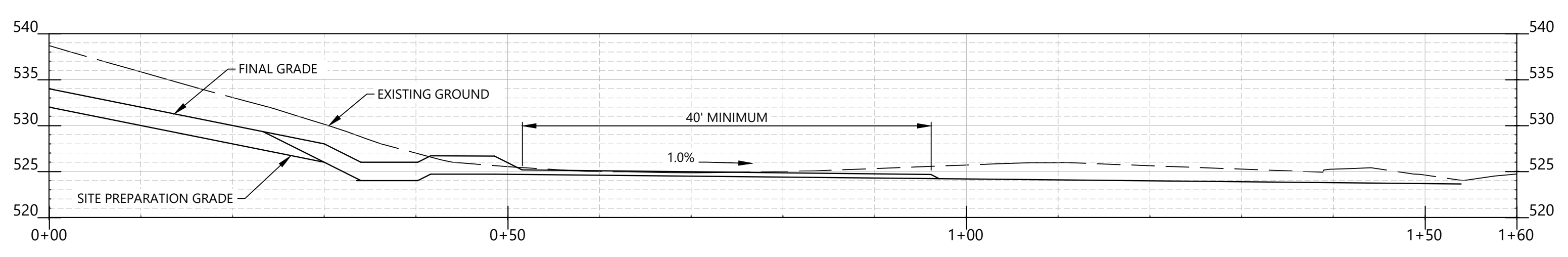


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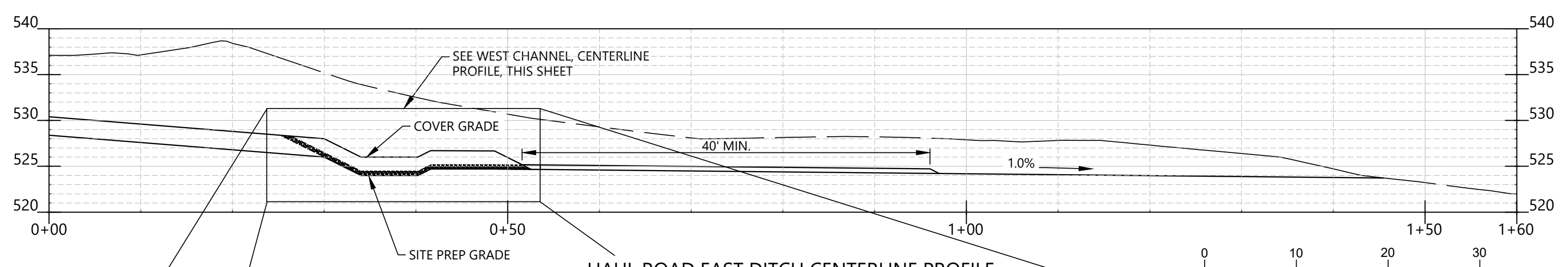
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REV. 0

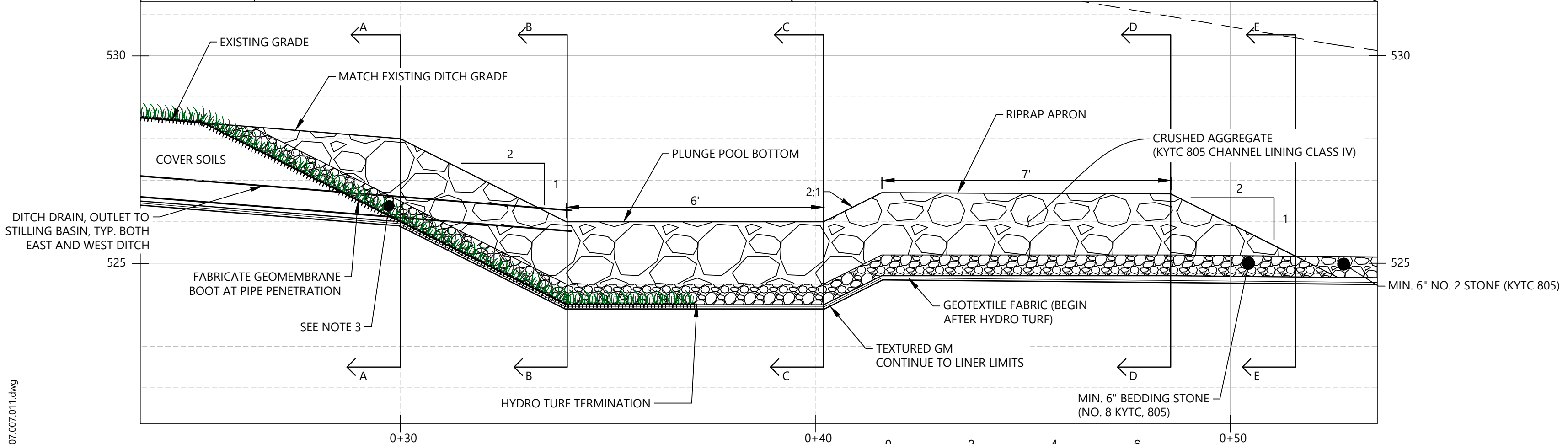
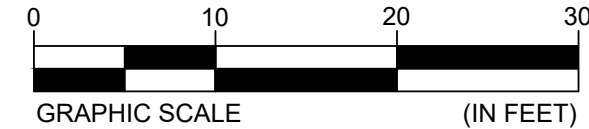
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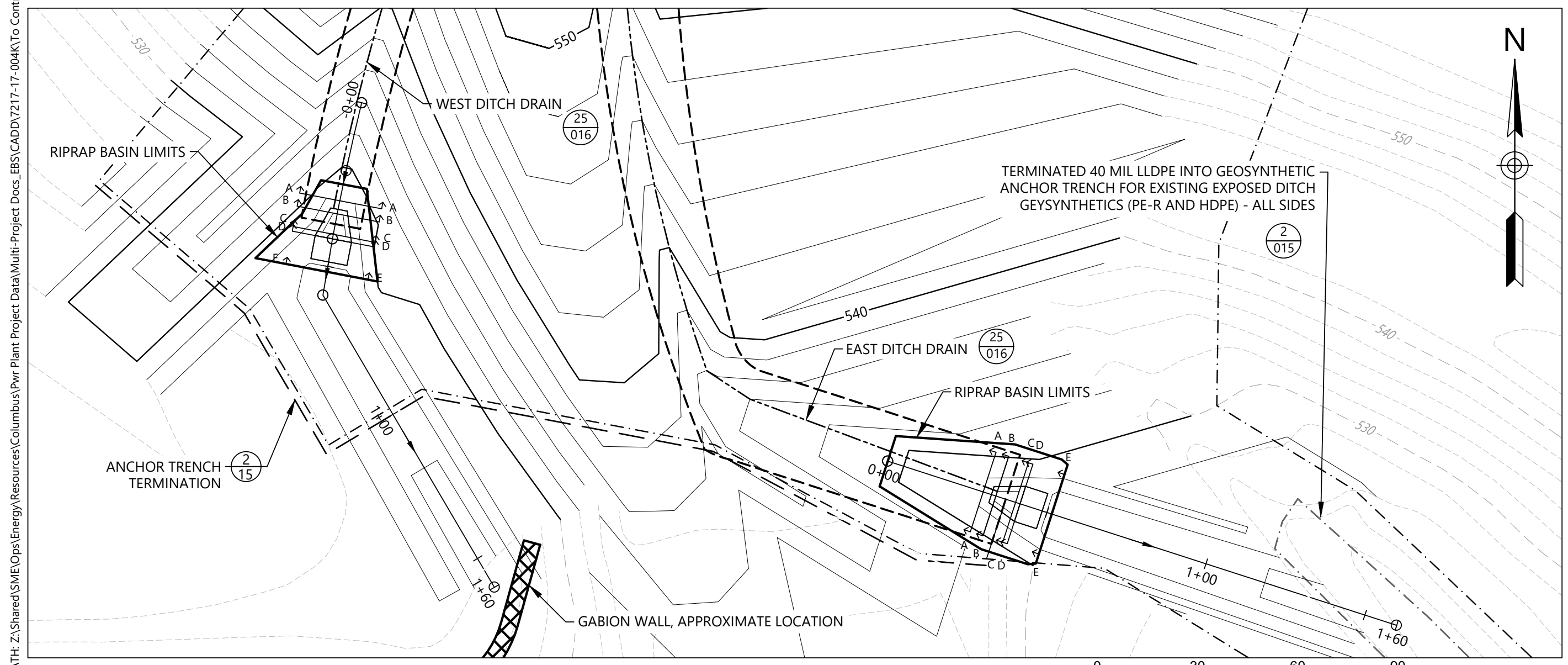
HAUL ROAD WEST DITCH CENTERLINE PROFILE  
SCALE: 1"=10'



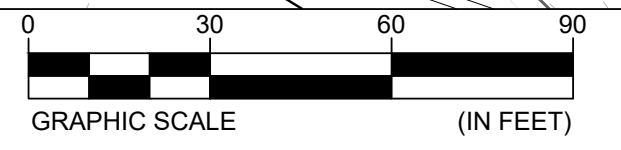
HAUL ROAD EAST DITCH CENTERLINE PROFILE  
SCALE: 1"=10'



26 EAST\* STILLING BASIN - PROFILE VIEW  
011 \*SEE NOTE 4



HAUL ROAD DITCH TERMINATION - PLAN VIEW

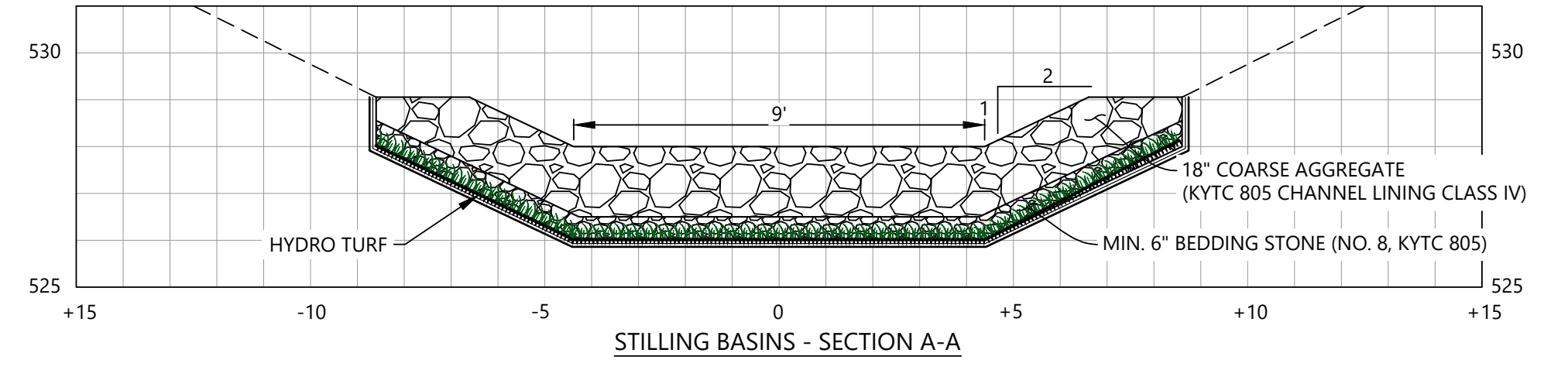


**LEGEND**

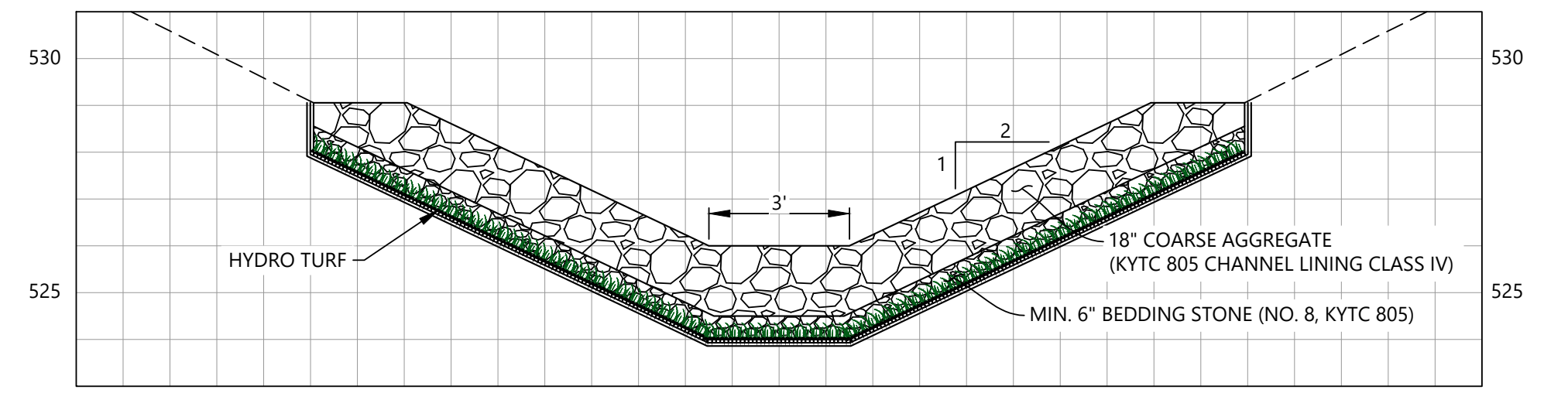
- - - - - EXISTING CONTOURS
- - - - - HYDRO TURF LIMITS
- - - - - LIMITS OF PRIOR INSTALLED FINAL COVER AS OF COTOBER 19, 2015 (ELLISON SURVEYING, INC. SEPTEMBER 2015)
- - - - - EXISTING HAUL ROAD / TRUCK WASH
- - - - - EXISTING CONTOURS
- — — — — TREELINE
- — — — — FENCE
- — — — — BUILDING
- — — — — COVER FINAL GRADE CONTOURS
- TREE

**NOTES:**

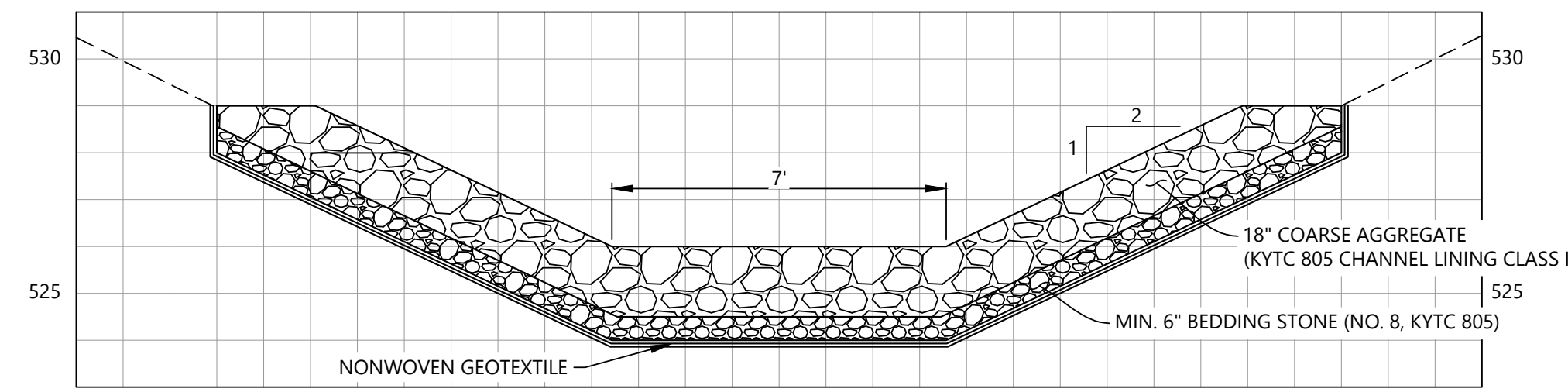
- 1) ALL AGGREGATE MUST BE OBTAINED FROM AN APPROVED KYTC SOURCE
- 2) PLACE NONWOVEN GEOTEXTILE MEETING KYTC TYPE 1 FABRIC REQUIREMENTS CUSHION LAYER ABOVE GEOMEMBRANE WHERE GEOCOMPOSITE DRAINAGE LAYER IS NOT PRESENT
- 3) 2'x2' WINDOWS SHALL BE CUT IN ENGINEERED TURF ALONG SLOPE IDENTIFIED TO ALLOW WATER ALONG DRAINAGE STUDS TO EXIT INTO AGGREGATE.
- 4) ALIGNMENT AND GEOMETRY OF EAST AND WEST PLUNGE POOLS ARE IDENTICAL, ELEVATIONS VARY.



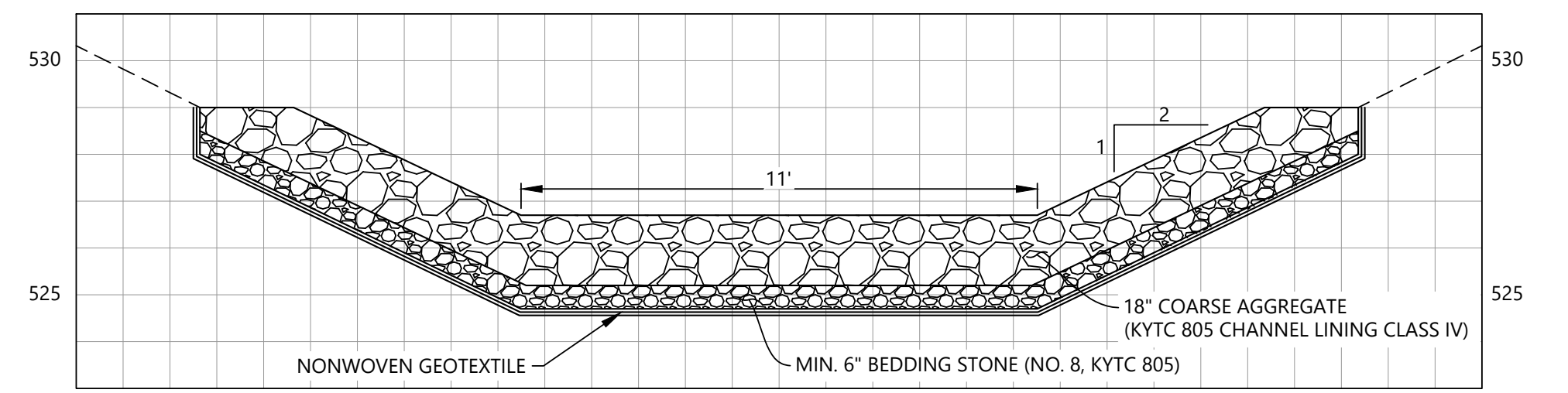
STILLING BASINS - SECTION A-A



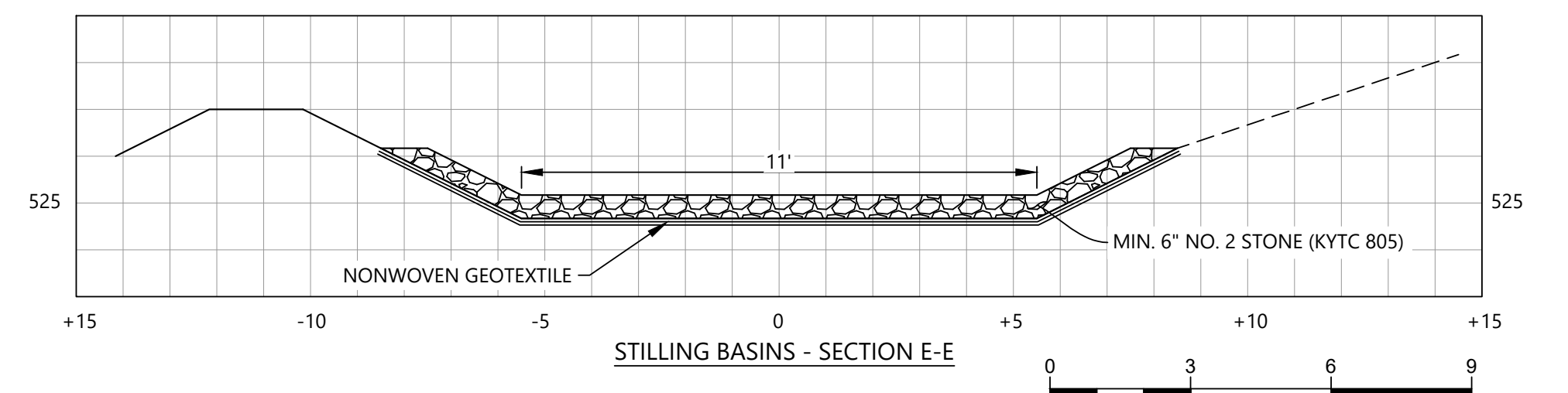
STILLING BASINS - SECTION B-B



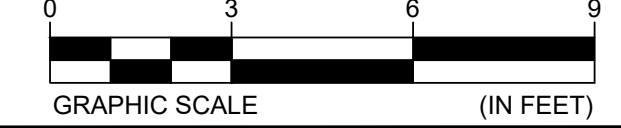
STILLING BASINS - SECTION C-C



STILLING BASINS - SECTION D-D



STILLING BASINS - SECTION E-E



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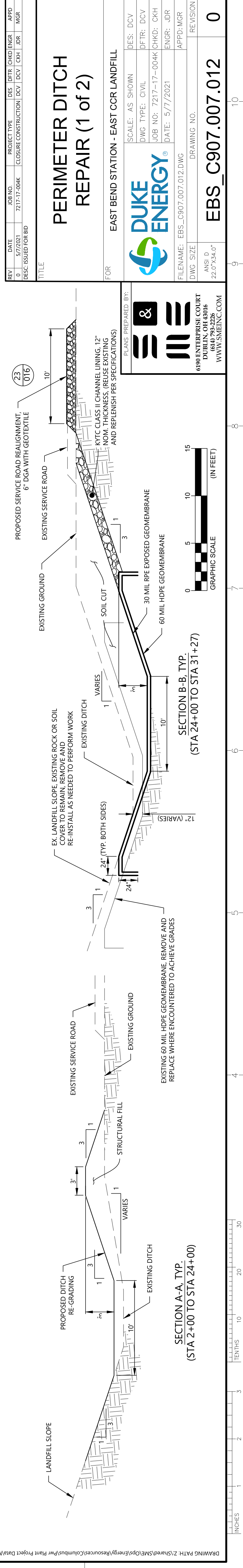
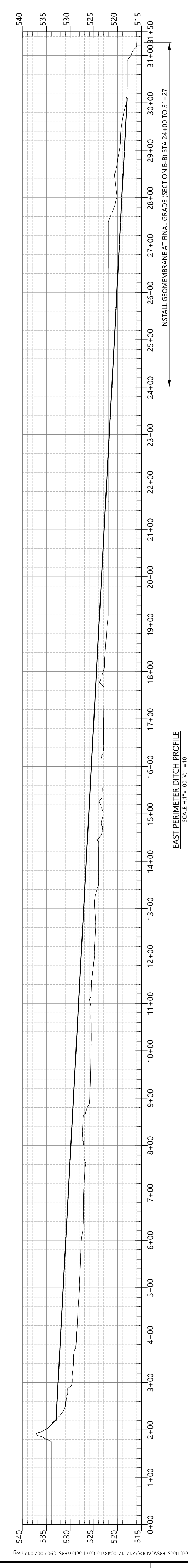
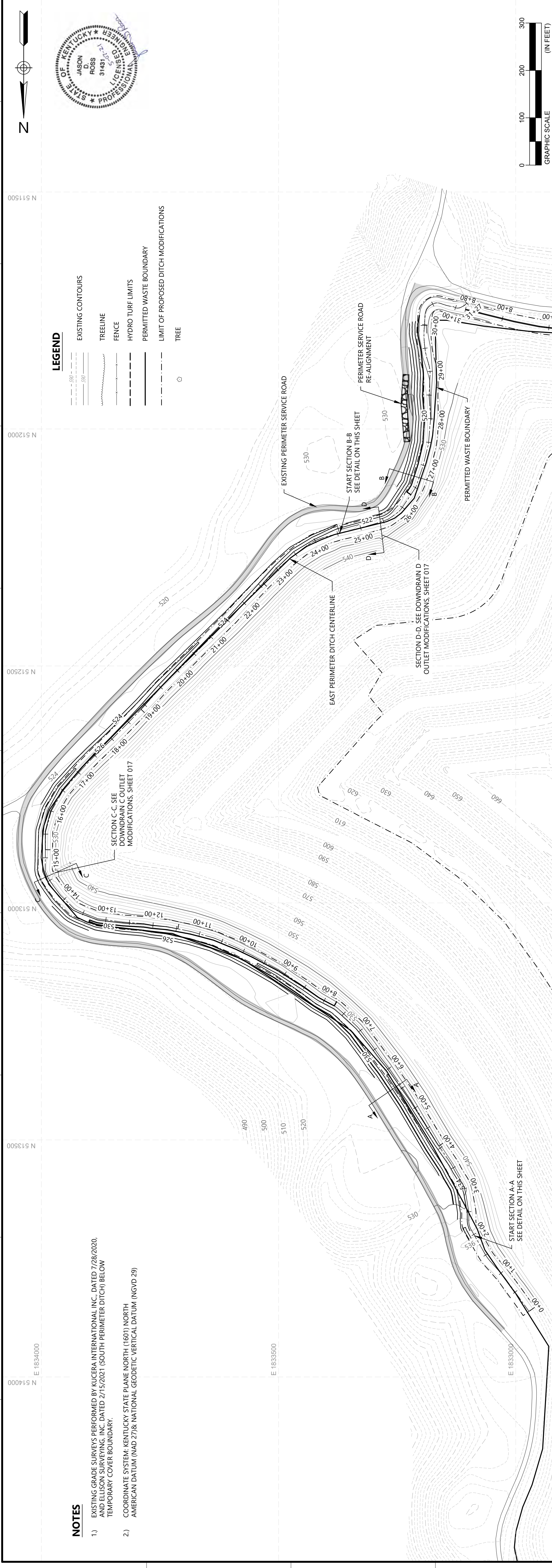
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0	5/7/2021	7217-17-004K	CLOSURE CONSTRUCTION	DCV	DCV	CKH	JDR	MGR
DESC: ISSUED FOR BID								
TITLE <b>HAUL ROAD STILLING BASINS</b>								
FOR EAST BEND STATION - EAST CCR LANDFILL								
SCALE: AS SHOWN			DES: DCV			APPD: MGR		
DWG TYPE: CIVIL			DFTR: DCV			ENGR: JDR		
JOB NO: 7217-17-004K			CHKD: CKH			DATE: 5/7/2021		
FILENAME: EBS_C907.007.011.DWG			DRAWING NO.			REVISION		
ANSI D 22.0"x34.0"			<b>EBS_C907.007.011</b>			0		

DRAWING PATH: Z:\Shared\SW\EnergyResources\Columbus\Prj Plant Project Data\Multi-Project Docs\_EBS\CADD\217-17-004K\To Contractor\EBS\_C907.007.011.dwg

EBS\_C907.007.011

REV. 0

F



**LEGEND**

- EXISTING CONTOURS
- TREELINE
- FENCE
- HYDRO TURF LIMITS
- PERMITTED WASTE BOUNDARY
- LIMIT OF PROPOSED DITCH MODIFICATIONS
- TREE

- NOTES**
- 1) EXISTING GRADE SURVEYS PERFORMED BY KUCERA INTERNATIONAL, INC. DATED 7/28/2020, AND ELLISON SURVEYING, INC. DATED 2/15/2021 (SOUTH PERIMETER DITCH) BELOW TEMPORARY COVER BOUNDARY.
  - 2) COORDINATE SYSTEM: KENTUCKY STATE PLANE NORTH (1601) NORTH AMERICAN DATUM (NAD 27)& NATIONAL GEODETIC VERTICAL DATUM (NGVD 29)



REV	DATE	JOB NO.	PROJECT TYPE	DES	DFTR	CHKD	ENGR	APPD
0	5/7/2021	7217-17-004K	CLOSURE/CONSTRUCTION	DCV	DCV	CKH	JDR	MGR
DESC: ISSUED FOR BID								
TITLE <b>PERIMETER DITCH REPAIR (1 of 2)</b>								
FOR <b>EAST BEND STATION - EAST COR LANDFILL</b>								
SCALE: AS SHOWN			DES: DCV			DFT: DCV		
DWG TYPE: CIVIL			JOB NO: 7217-17-004K			CHKD: CKH		
ENGR: JDR			DATE: 5/7/2021			APPD: MGR		
FILENAME: EBS_C907.007.012.DWG			DRAWING NO.			REVISION		
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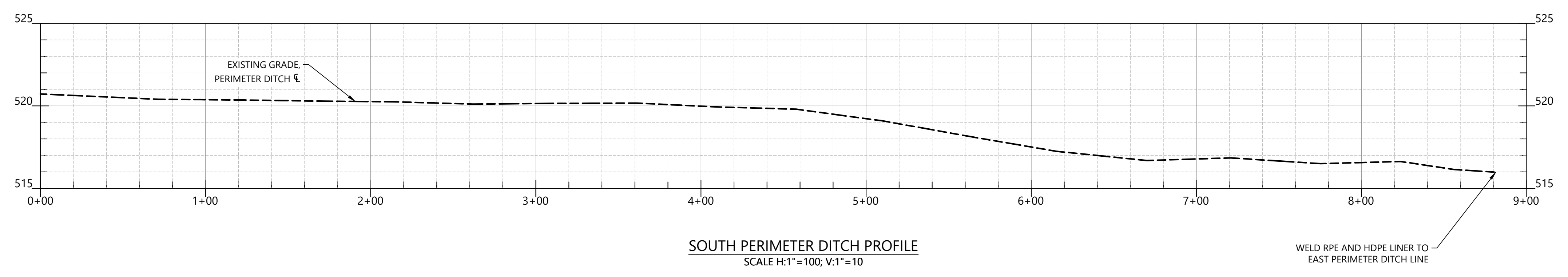
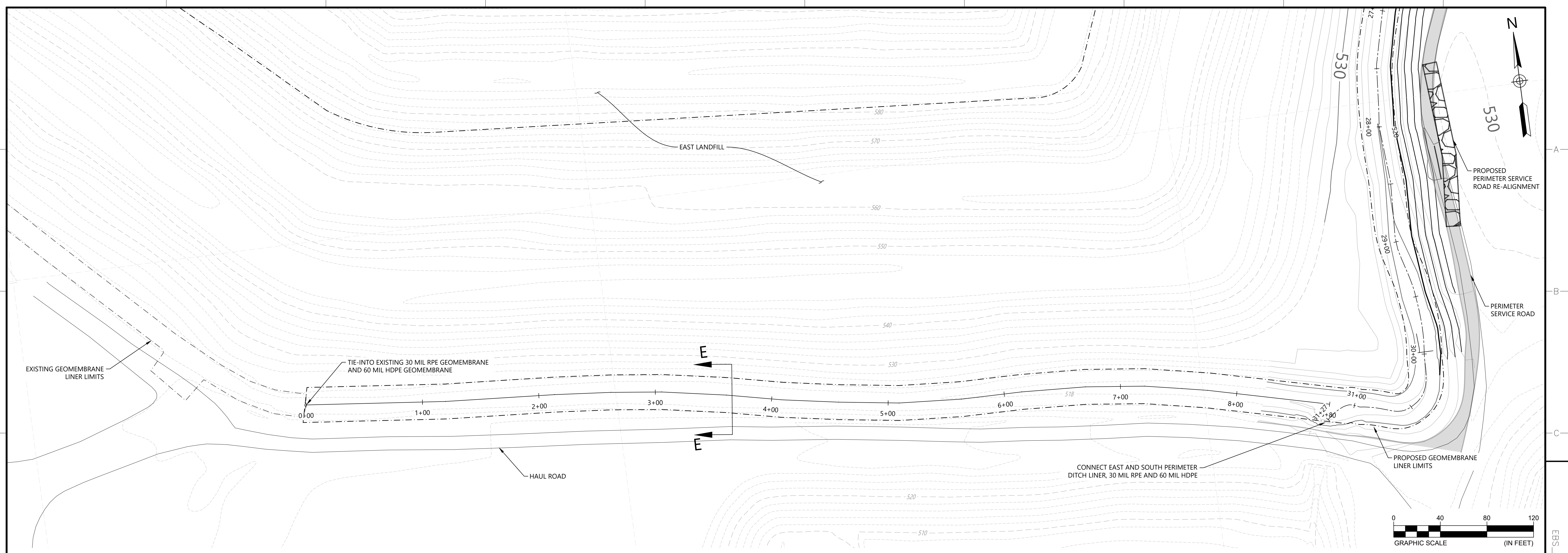


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**6150 WATERBURY COURT  
DUBLIN, OH 43016  
(614) 793-2226  
WWW.SMEINC.COM**

SECTION B-B, TYP.  
(STA 24+00 TO STA 31+27)

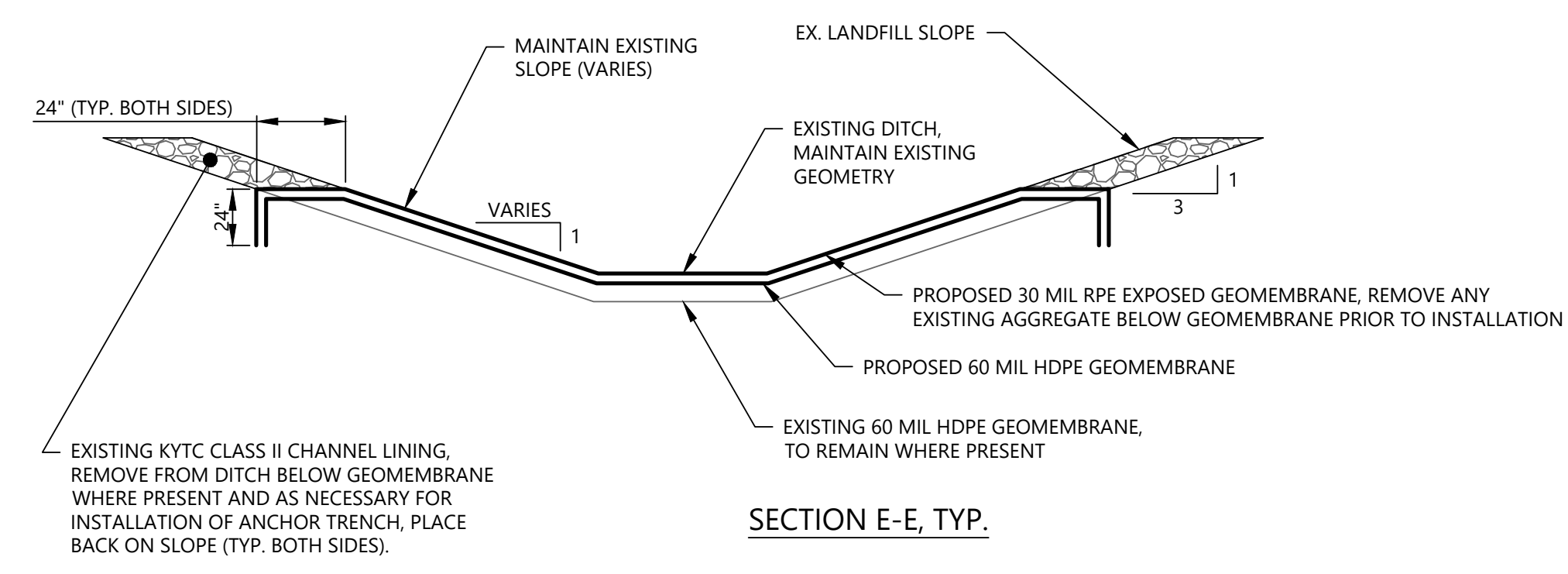
SECTION A-A, TYP.  
(STA 2+00 TO STA 24+00)





**LEGEND**

- EXISTING CONTOURS
- TREE LINE
- FENCE
- HYDRO TURF LIMITS
- BOUNDARIES BETWEEN 2020 SURVEY, INTERMEDIATE COVER, AND TOP DECK EXPOSED ASH
- PERMITTED WASTE BOUNDARY
- LIMITS OF PRIOR INSTALLED FINAL COVER AS OF COTOBER 19, 2015 (ELLISON SURVEYING, INC. SEPTEMBER 2015)
- LIMIT OF 2020 DITCH LINER REPAIR
- TREE



- NOTES**
- EXISTING GRADE SURVEYS PERFORMED BY KUCERA INTERNATIONAL INC., DATED 7/28/2020, THE PROFILE SHOWN IS BASED ON EAST LANDFILL 2016 PERIMETER DITCH SURVEY.
  - COORDINATE SYSTEM: KENTUCKY STATE PLANE NORTH (1601) NORTH AMERICAN DATUM (NAD 27)& NATIONAL GEODETIC VERTICAL DATUM (NGVD 29)
  - MATCH EXISTING DITCH GEOMETRY, INSTALL NEW LINER TO 3 FEET ABOVE FLOWLINE



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REV	DATE	JOB NO.	PROJECT TYPE	DES	DFTR	CHKD	ENGR	APPD
0	5/7/2021	7217-17-004K	CLOSURE CONSTRUCTION	DCV	DCV	CKH	JDR	MGR

DESC: ISSUED FOR BID

TITLE: **PERIMETER DITCH REPAIR (2 of 2)**

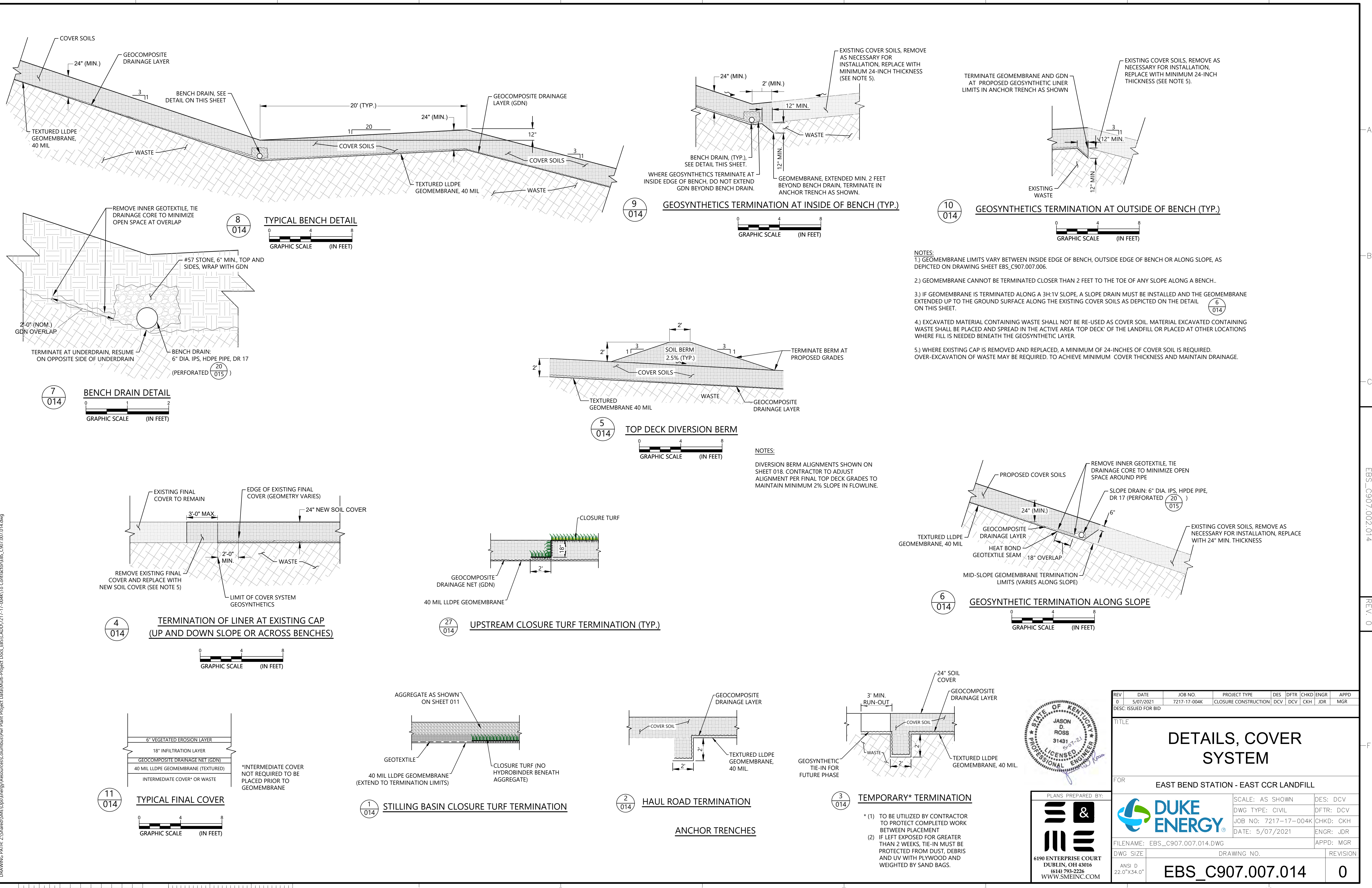
FOR: **EAST BEND STATION - EAST CCR LANDFILL**

SCALE: AS SHOWN	DES: DCV
DWG TYPE: CIVIL	DFTR: DCV
JOB NO: 7217-17-004K	CHKD: CKH
DATE: 5/7/2021	ENGR: JDR
APPD: MGR	

FILENAME: EBS\_C907.007.013.DWG

DWG SIZE	DRAWING NO.	REVISION
ANSI D 22.0"x34.0"	EBS_C907.007.013	0





- NOTES:**
- 1) GEOMEMBRANE LIMITS VARY BETWEEN INSIDE EDGE OF BENCH, OUTSIDE EDGE OF BENCH OR ALONG SLOPE, AS DEPICTED ON DRAWING SHEET EBS\_C907.007.006.
  - 2) GEOMEMBRANE CANNOT BE TERMINATED CLOSER THAN 2 FEET TO THE TOE OF ANY SLOPE ALONG A BENCH.
  - 3) IF GEOMEMBRANE IS TERMINATED ALONG A 3H:1V SLOPE, A SLOPE DRAIN MUST BE INSTALLED AND THE GEOMEMBRANE EXTENDED UP TO THE GROUND SURFACE ALONG THE EXISTING COVER SOILS AS DEPICTED ON THE DETAIL ON THIS SHEET. (6/014)
  - 4) EXCAVATED MATERIAL CONTAINING WASTE SHALL NOT BE RE-USED AS COVER SOIL. MATERIAL EXCAVATED CONTAINING WASTE SHALL BE PLACED AND SPREAD IN THE ACTIVE AREA "TOP DECK" OF THE LANDFILL OR PLACED AT OTHER LOCATIONS WHERE FILL IS NEEDED BENEATH THE GEOSYNTHETIC LAYER.
  - 5) WHERE EXISTING CAP IS REMOVED AND REPLACED, A MINIMUM OF 24-INCHES OF COVER SOIL IS REQUIRED. OVER-EXCAVATION OF WASTE MAY BE REQUIRED. TO ACHIEVE MINIMUM COVER THICKNESS AND MAINTAIN DRAINAGE.



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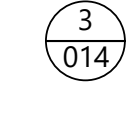
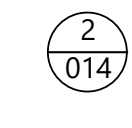
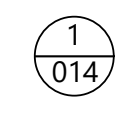
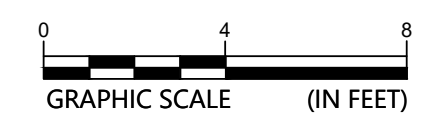
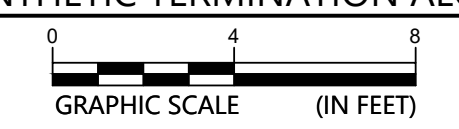
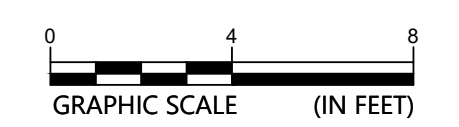
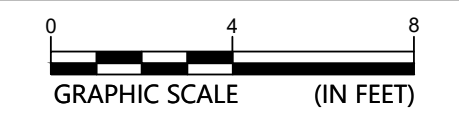
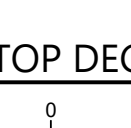
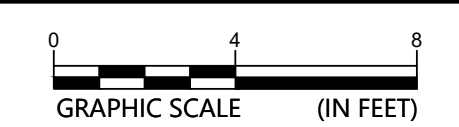
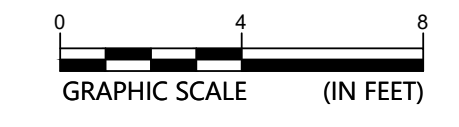
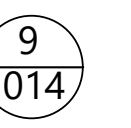
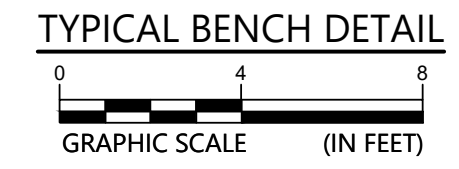
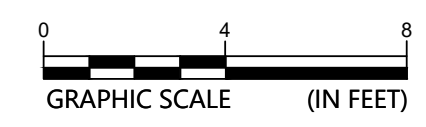
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0	5/07/2021	7217-17-004K	CLOSURE CONSTRUCTION	DCV	DCV	CKH	JDR	MGR
DESC: ISSUED FOR BID								
TITLE <b>DETAILS, COVER SYSTEM</b>								
FOR EAST BEND STATION - EAST CCR LANDFILL								
SCALE: AS SHOWN			DES: DCV			DWG TYPE: CIVIL		
JOB NO: 7217-17-004K			CHKD: CKH			DATE: 5/07/2021		
ENGR: JDR			APPD: MGR			ANSI D 22.0"x34.0"		
FILENAME: EBS_C907.007.014.DWG			DRAWING NO.			REVISION		
EBS_C907.007.014			0					

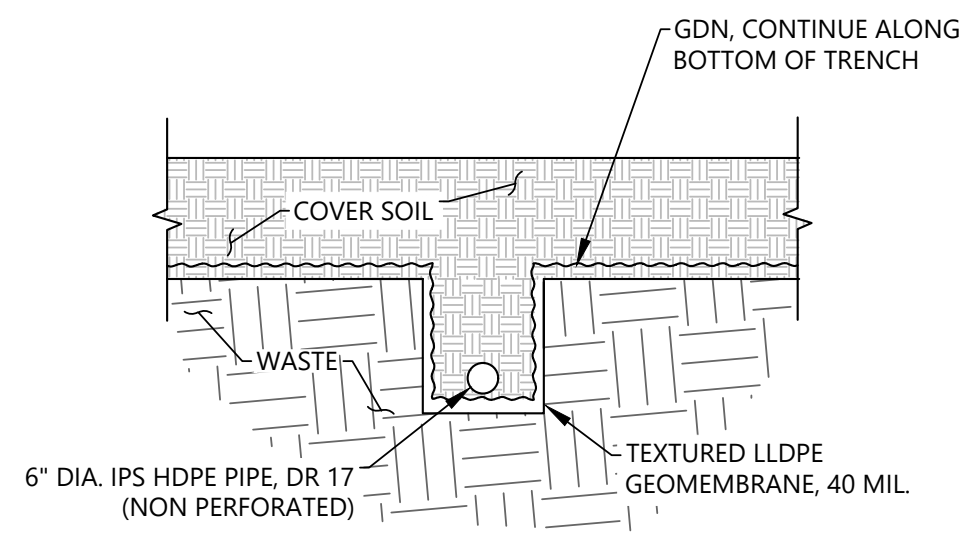
- \* (1) TO BE UTILIZED BY CONTRACTOR TO PROTECT COMPLETED WORK BETWEEN PLACEMENT**
- (2) IF LEFT EXPOSED FOR GREATER THAN 2 WEEKS, TIE-IN MUST BE PROTECTED FROM DUST, DEBRIS AND UV WITH PLYWOOD AND WEIGHTED BY SAND BAGS.**

DRAWING PATH: Z:\Shared\SW\EnergyResources\Columbus\Prj Plant Project Data\Multi-Project Docs\_EBS\CADD\217-17-004K\To contractor\EBS\_C907.007.014.dwg

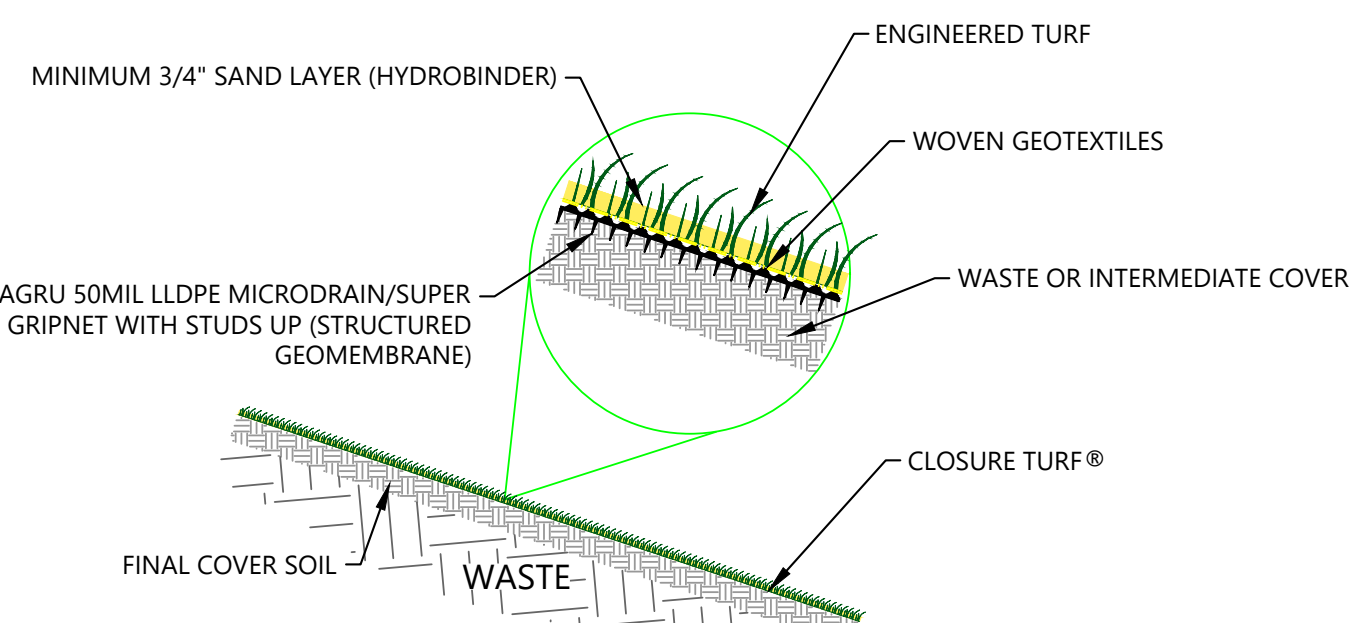
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REV. 0



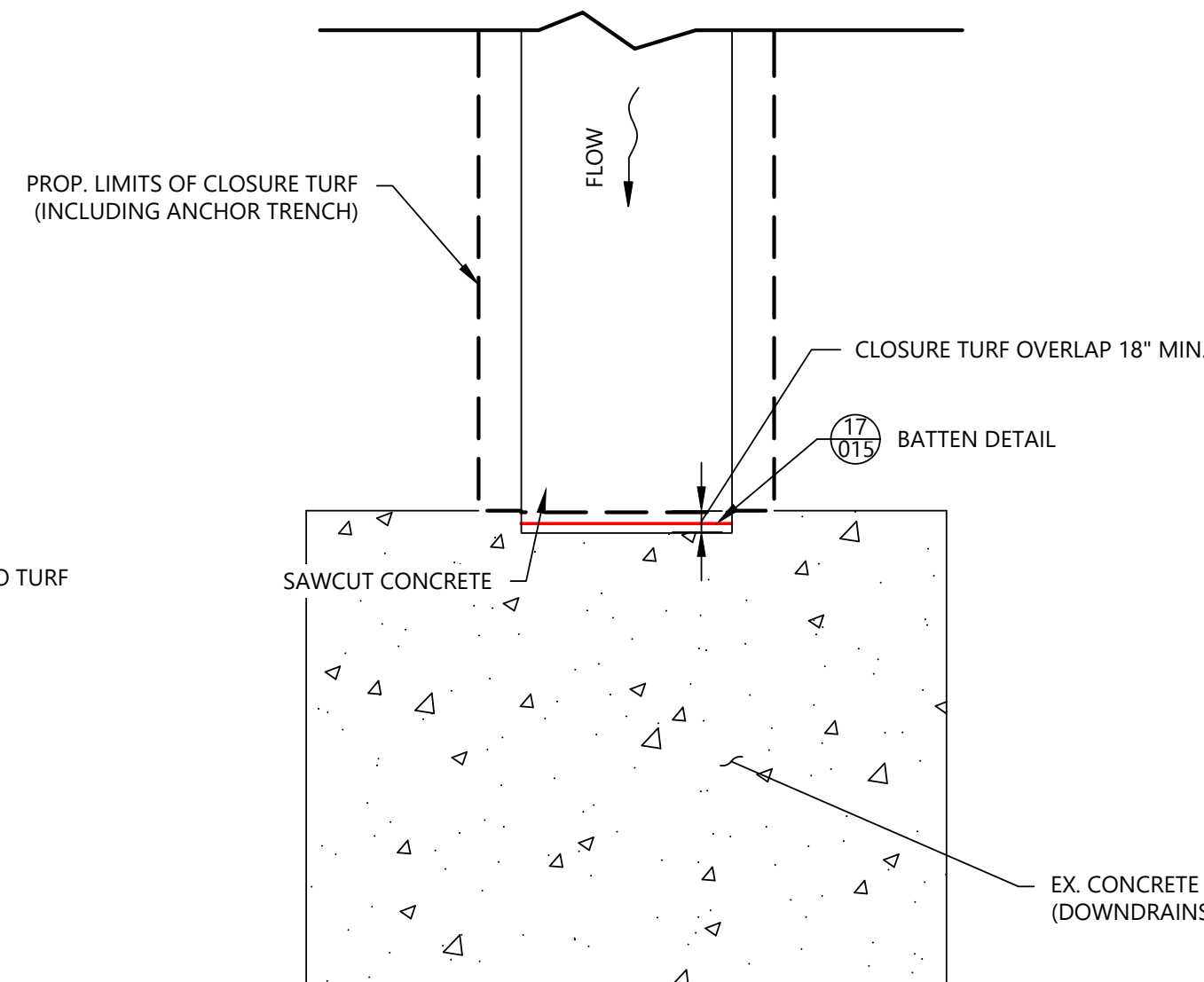


UNDERDRAIN SECTION A-A

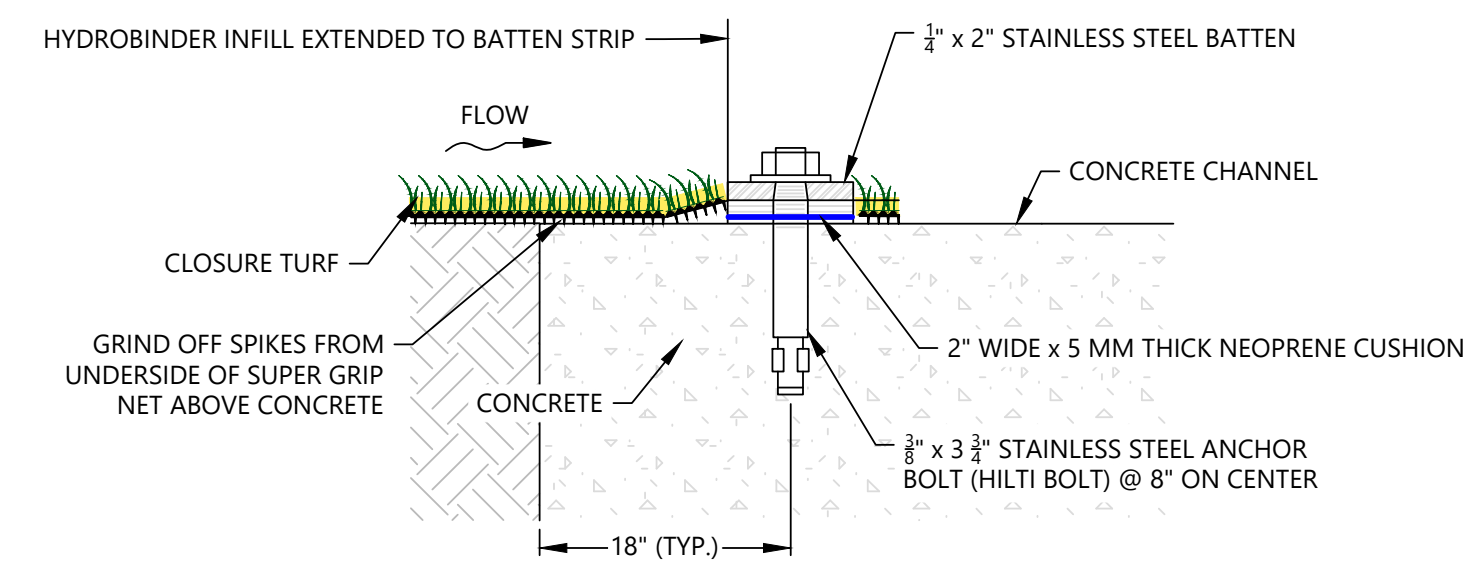


CLOSURE TURF \* DETAIL  
N.T.S.

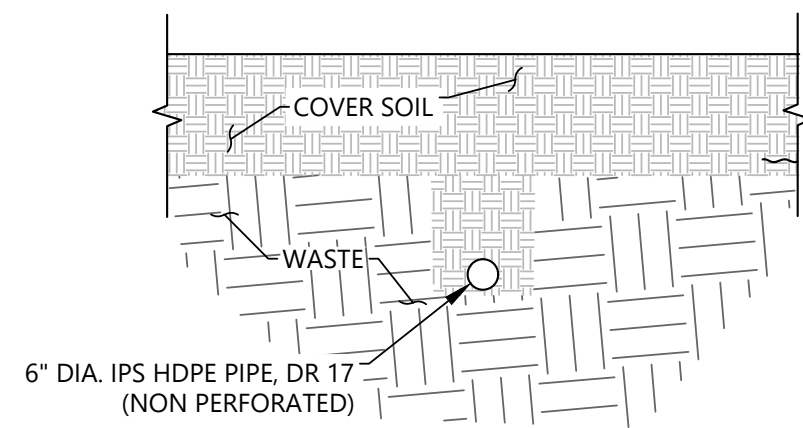
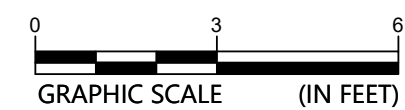
\* REFERENCES TO CLOSURE TURF AND HYDRO TURF THROUGHOUT THESE DRAWINGS ARE SYNONYMOUS.



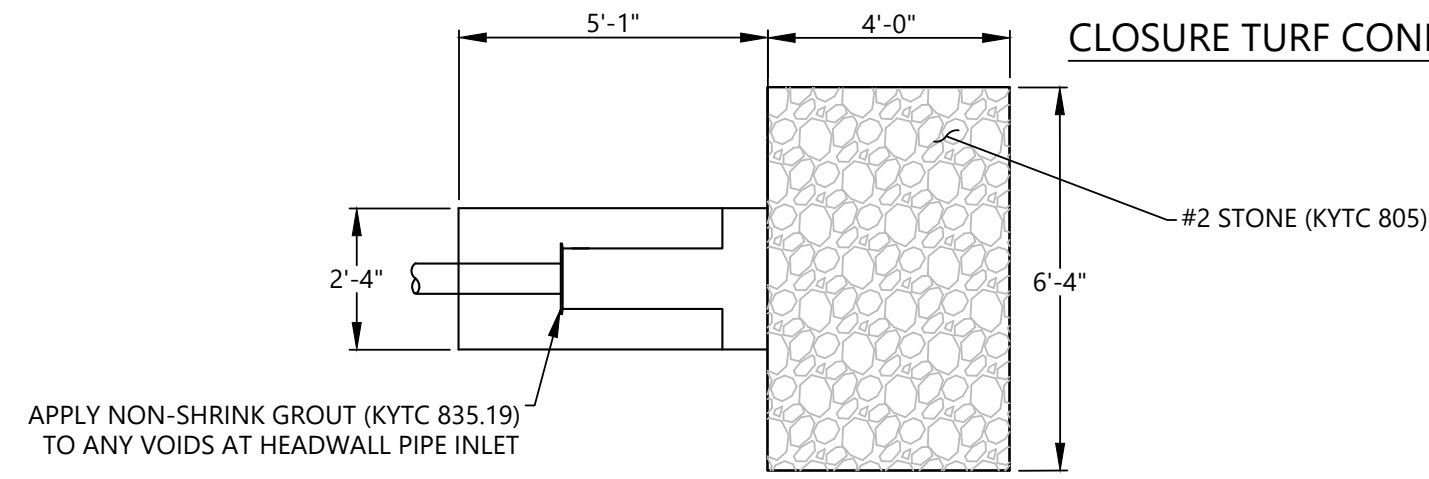
CLOSURE TURF CONNECTION TO CONCRETE DITCH  
N.T.S.



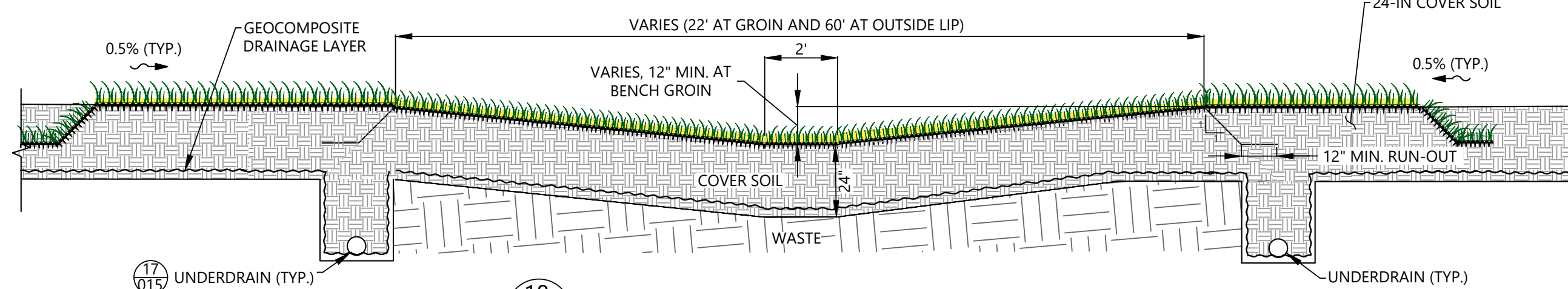
17  
015 BATTEN DETAIL - CLOSURE TURF TO EXISTING CONCRETE IN PERIMETER DITCH  
N.T.S.



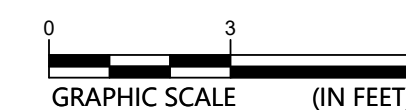
UNDERDRAIN SECTION B-B



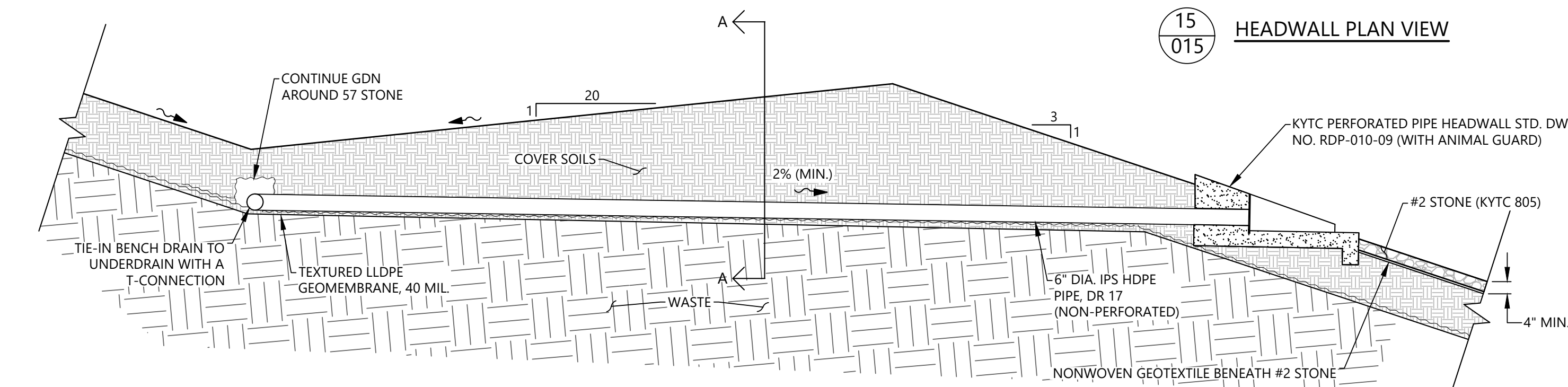
15  
015 HEADWALL PLAN VIEW



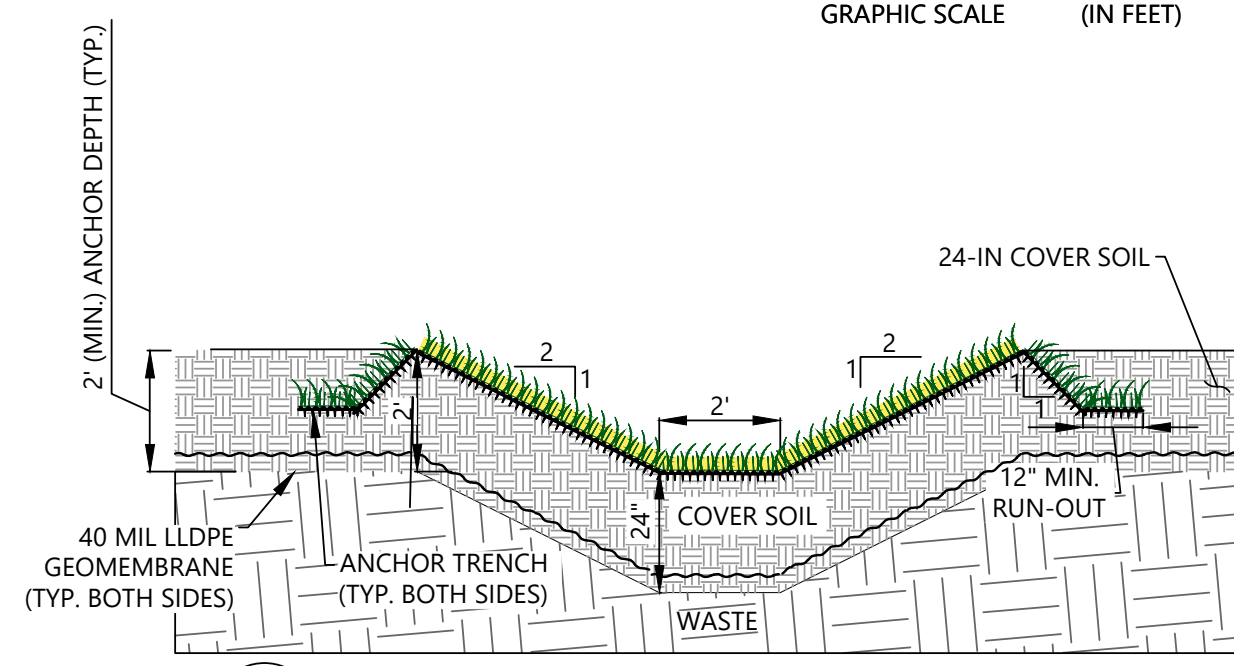
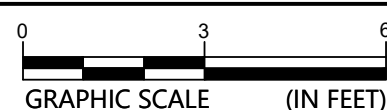
18  
015 HYDRO TURF, TYPICAL SECTION ON BENCH



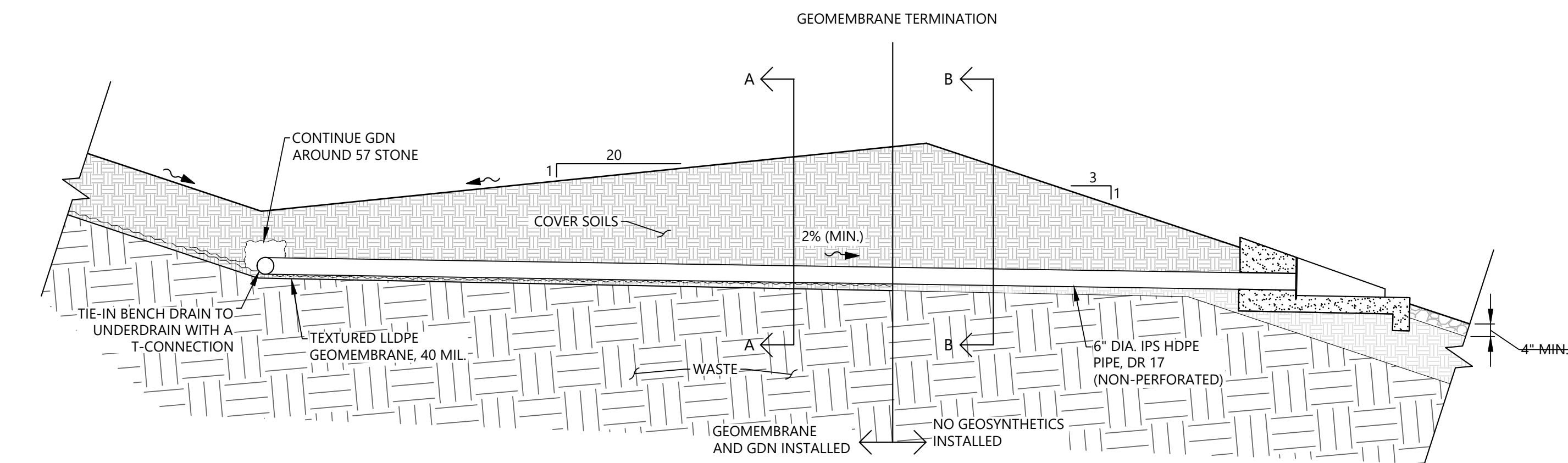
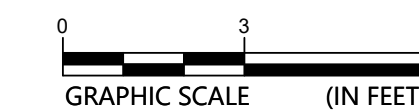
NOTES: IN NO CASE SHALL UNDERDRAINS AT DOWNDRAINS BE INSTALLED OUTSIDE OF CLOSURE TURF LIMITS.



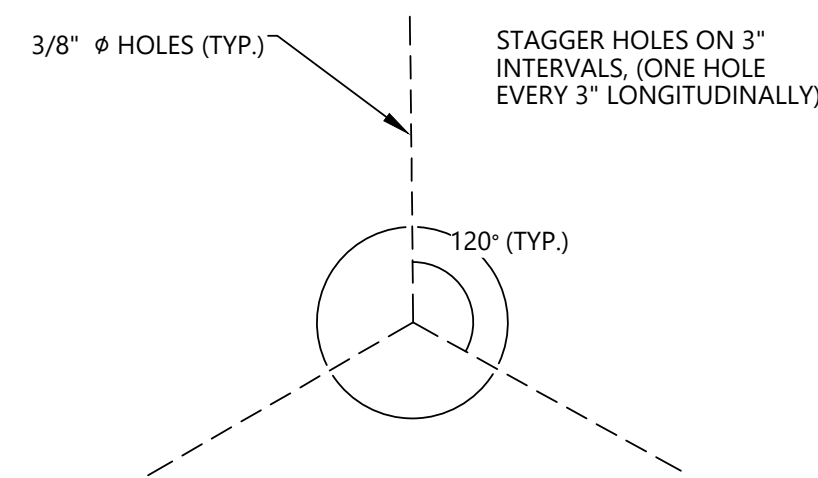
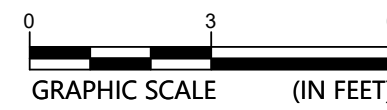
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015 UNDERDRAIN OUTLET PIPE DETAIL - CONTINUOUS GEOMEMBRANE



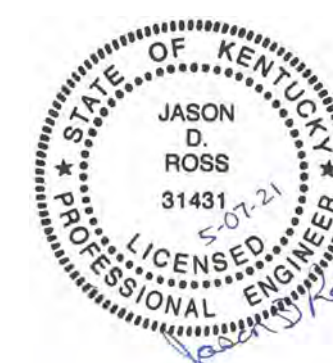
19  
015 HYDRO TURF, TYPICAL SECTION ON SLOPE



14  
015 UNDERDRAIN PIPE DETAIL - GEOMEMBRANE TERMINATION ALONG BENCH



20  
015 BENCH AND SLOPE DRAIN PERFORATED PIPE - PERFORATION PATTERN  
N.T.S.



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0	5/7/2021	7217-17-004K	CLOSURE CONSTRUCTION	DCV	DCV	CKH	JDR	MGR

DESC: ISSUED FOR BID

TITLE  
**DETAILS, SURFACE WATER CONTROLS**

FOR  
EAST BEND STATION - EAST CCR LANDFILL

SCALE: AS SHOWN	DES: DCV
DWG TYPE: CIVIL	DFTR: DCV
JOB NO: 7217-17-004K	CHKD: CKH
DATE: 5/7/2021	ENGR: JDR
FILENAME: EBS_C907.007.015.DWG	APPD: MGR

DWG SIZE: 22.0"X34.0"

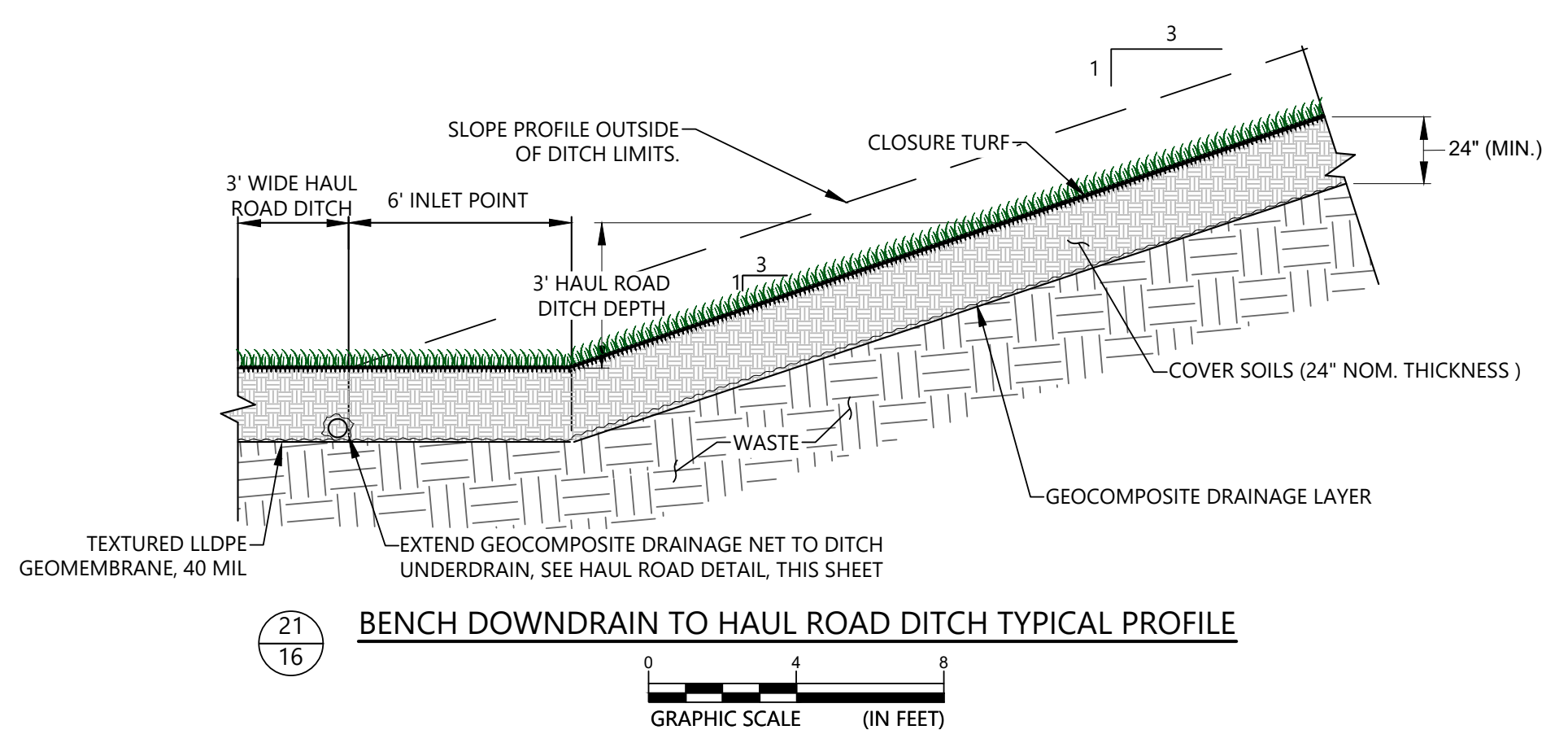
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REVISION 0

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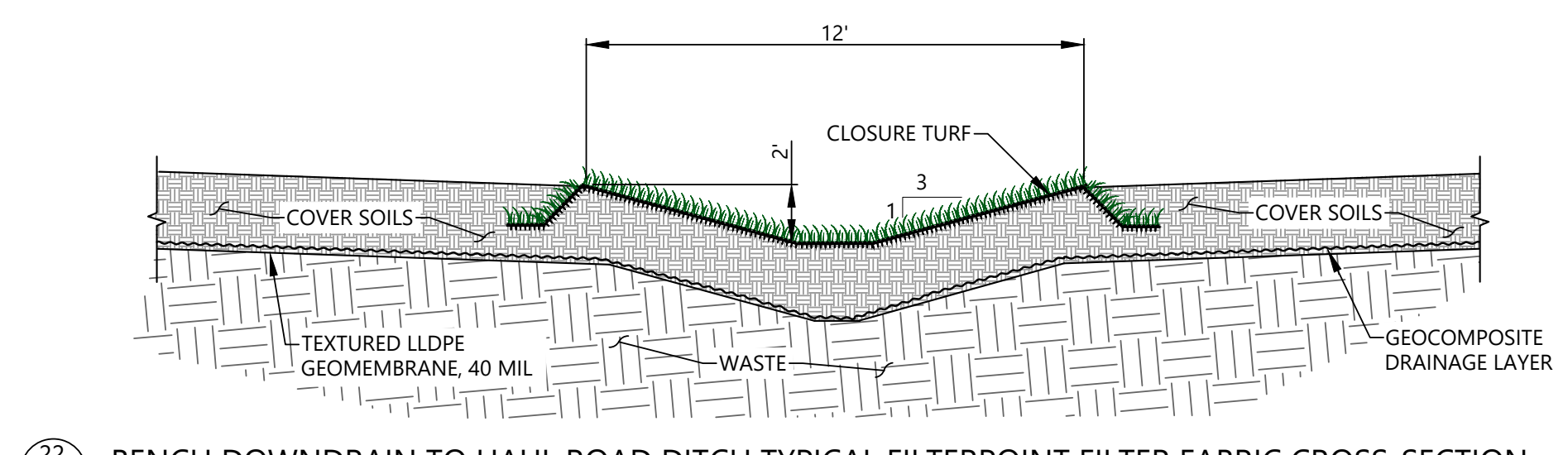
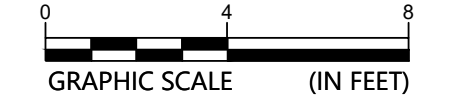
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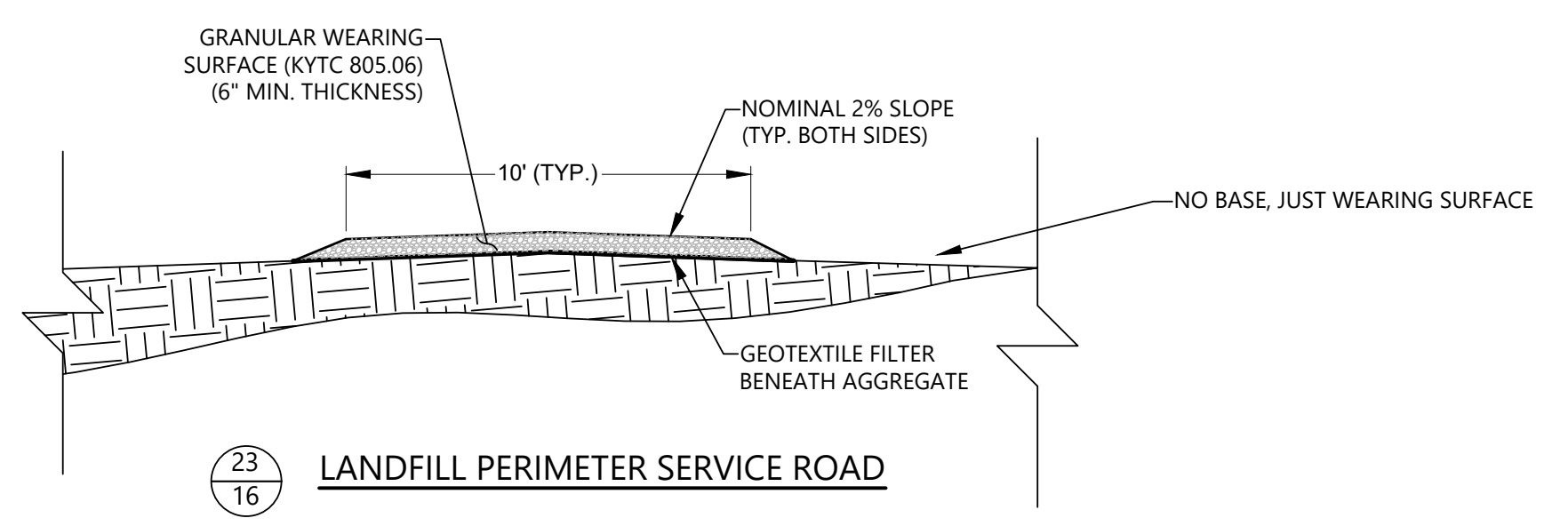
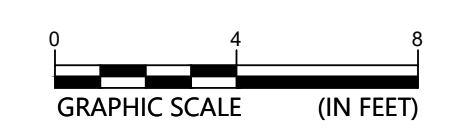




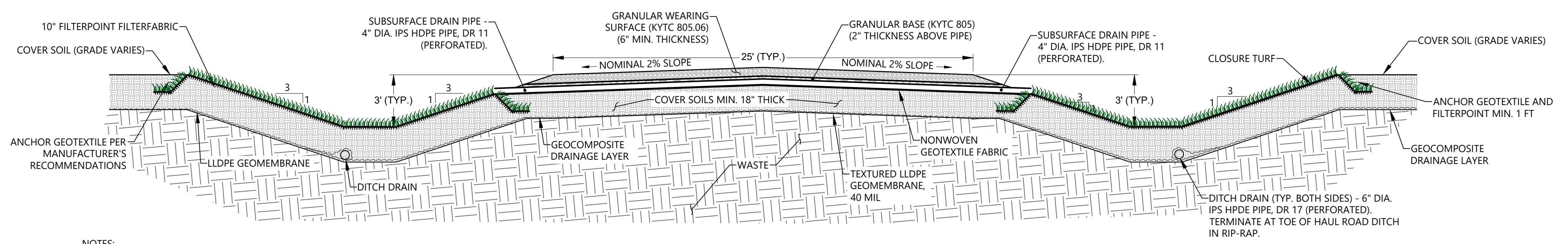
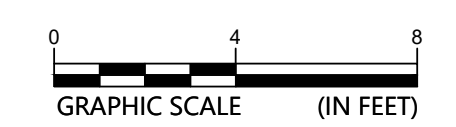
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16 BENCH DOWNDRAIN TO HAUL ROAD DITCH TYPICAL PROFILE



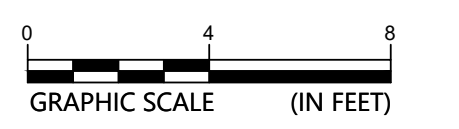
22  
16 BENCH DOWNDRAIN TO HAUL ROAD DITCH TYPICAL FILTERPOINT FILTER FABRIC CROSS-SECTION



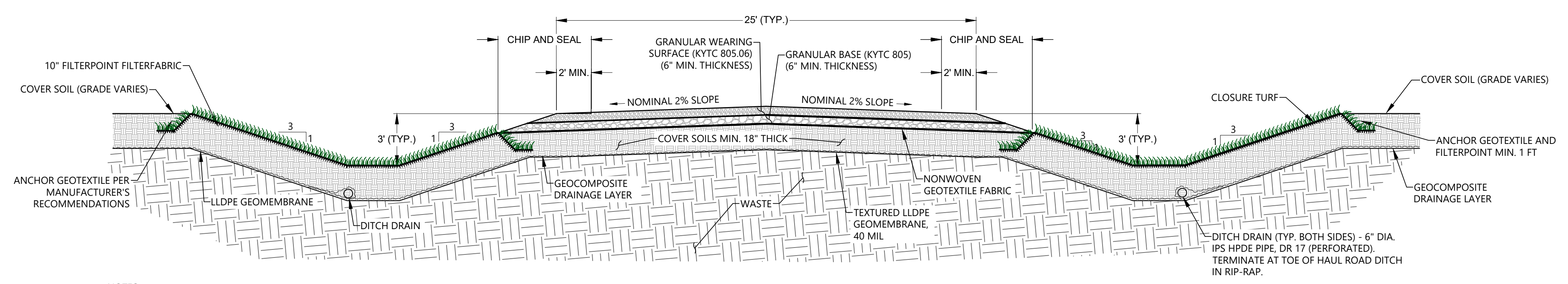
23  
16 LANDFILL PERIMETER SERVICE ROAD



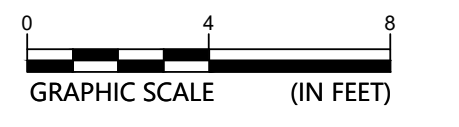
24  
16 LANDFILL HAUL ROAD AT SUBSURFACE DRAIN



**NOTES:**  
SUBSURFACE DRAINS TO BE INSTALLED AS SHOWN AT COMPLETION OF CONSTRUCTION AT OR NEAR STA 4+00, 8+00, 12+00, 15+40 and 17+60 (EAST SIDE ONLY).  
CHIP AND SEAL NOT SHOWN FOR CLARITY, BUT SHOULD CONTINUE THROUGH PIPE STATIONING.



25  
16 LANDFILL HAUL ROAD



**NOTES:**  
CHIP AND SEAL TO BE INSTALLED ON ENTIRE SHOULDER AND OUTSIDE 2 FEET OF ROADWAY SURFACE. INSTALL IN 2 LAYERS PER TECHNICAL SPECIFICATION 02060



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0	5/7/2021	7217-17-004K	CLOSURE CONSTRUCTION	DCV	DCV	CKH	JDR	MGR
DESC: ISSUED FOR BID								
TITLE								
<b>DETAILS, HAUL ROAD</b>								
FOR								
EAST BEND STATION - EAST CCR LANDFILL								
SCALE: AS SHOWN			DES: DCV					
DWG TYPE: CIVIL			DFTR: DCV					
JOB NO: 7217-17-004K			CHKD: CKH					
DATE: 5/7/2021			ENGR: JDR					
FILENAME: EBS_C907.007.016.DWG			APPD: MGR					
DWG SIZE	DRAWING NO.		REVISION					
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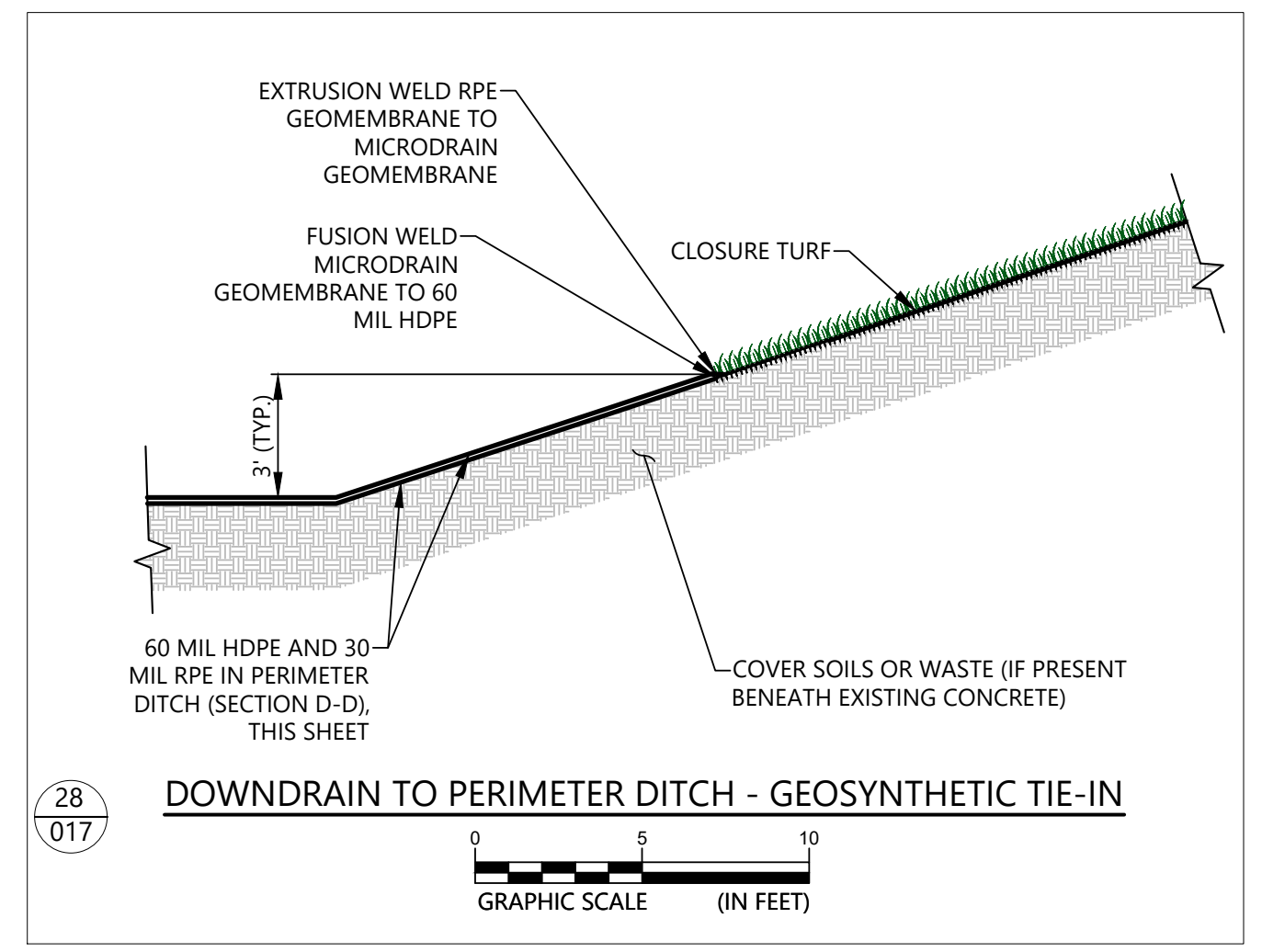
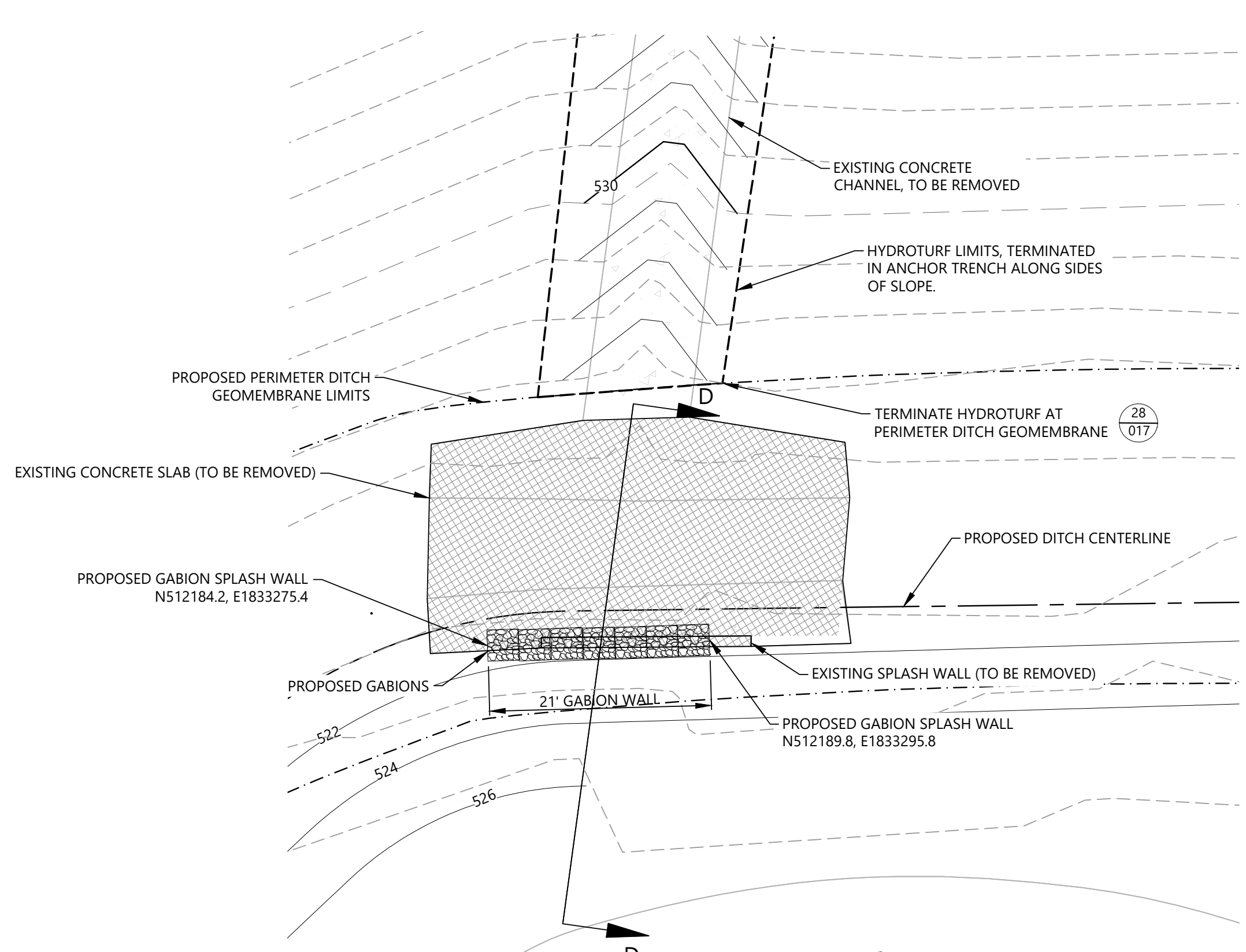
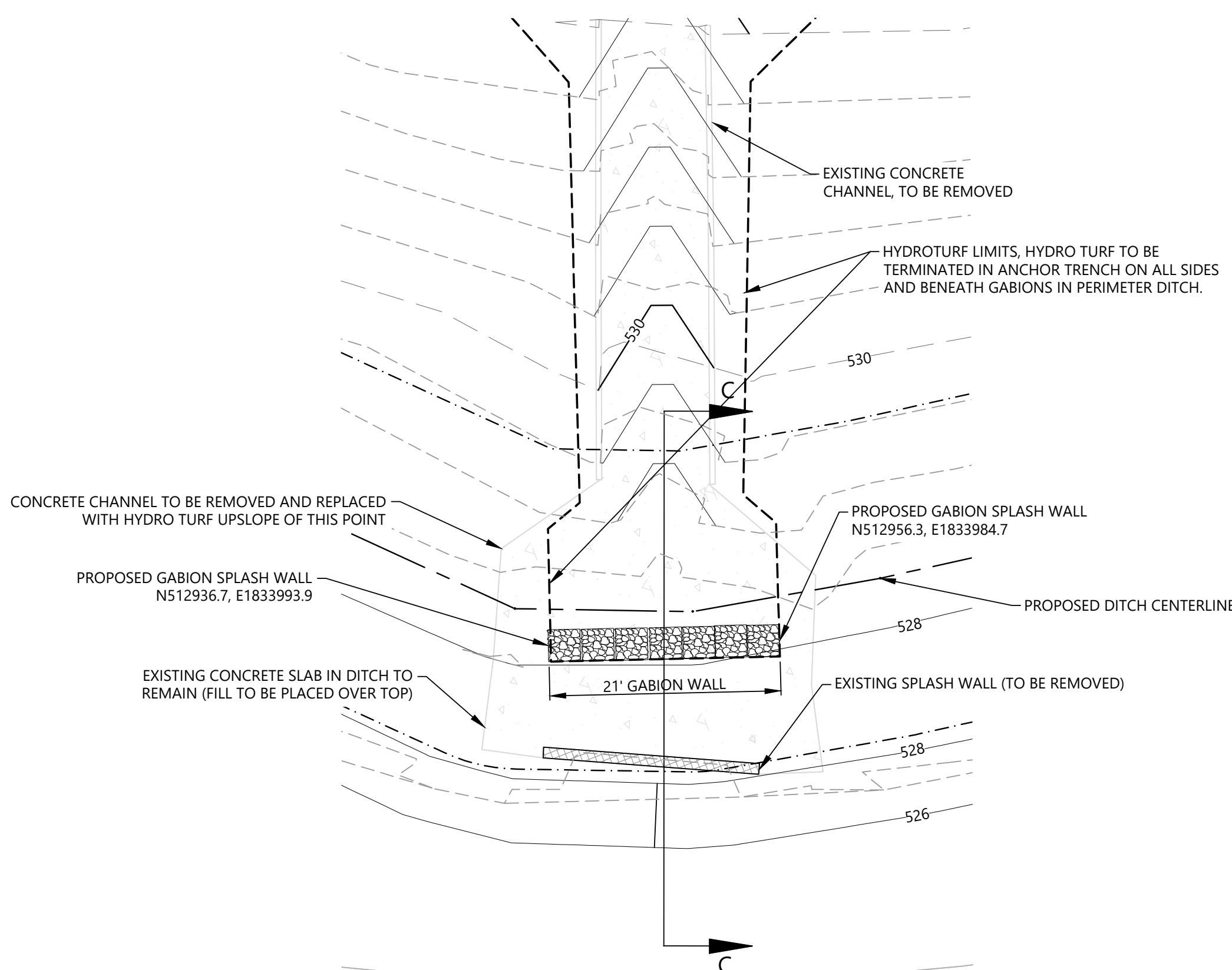
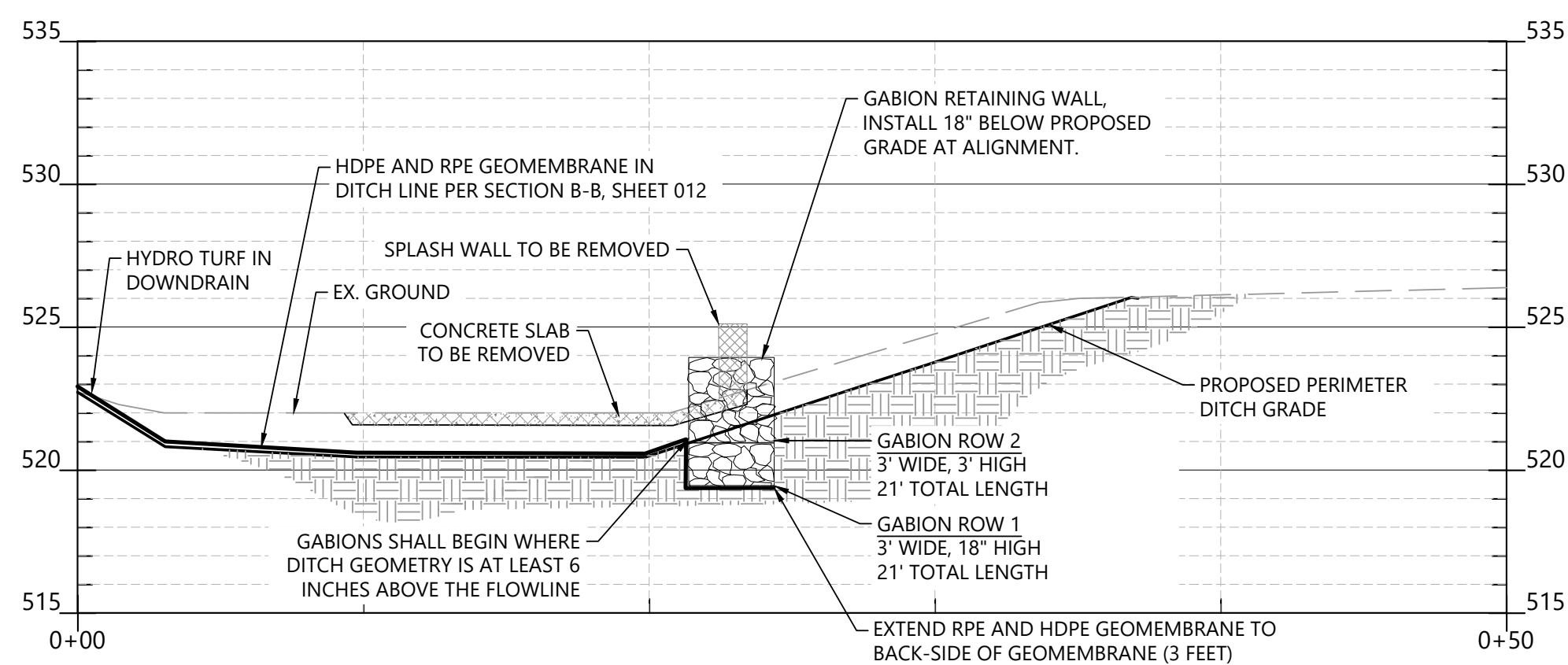
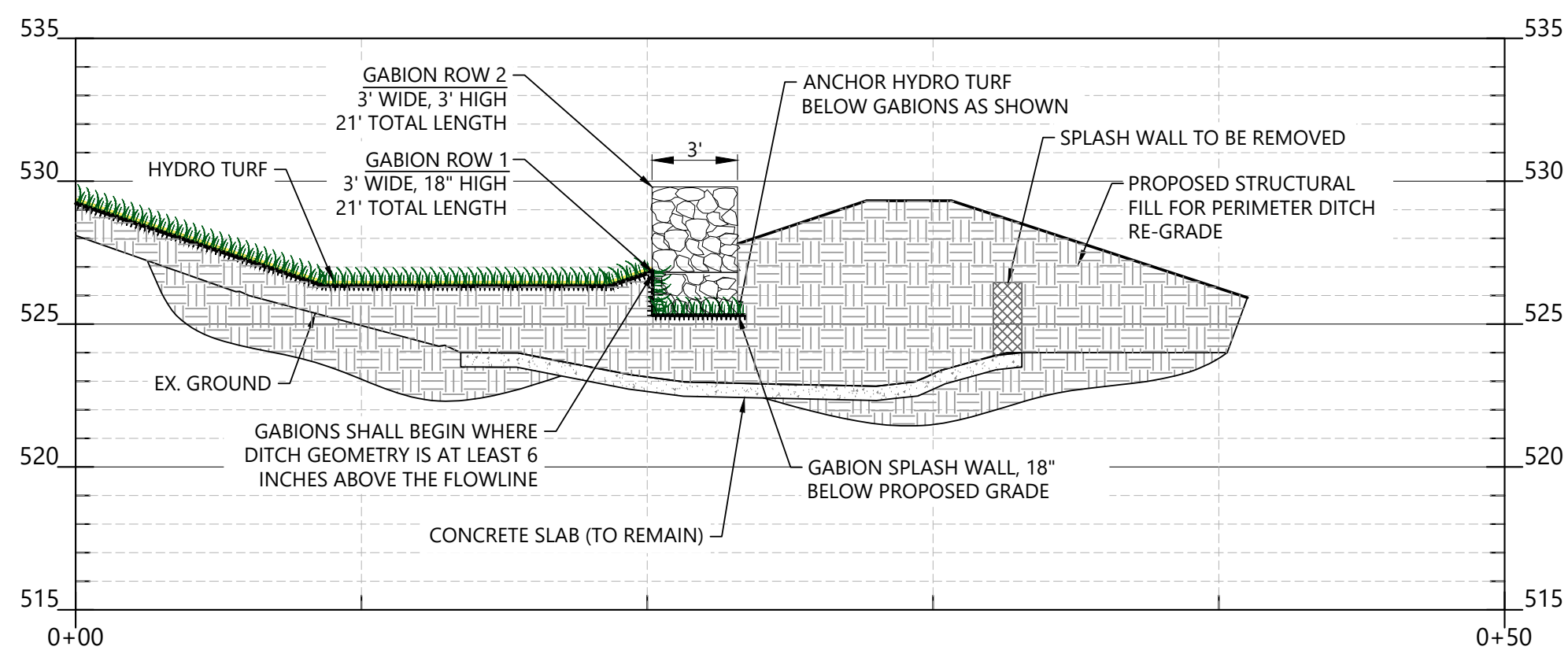
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F





- LEGEND**
- GABION BASKET WALL
  - EXISTING CONCRETE SLAB, TO REMAIN
  - EXISTING CONCRETE SLAB, TO BE REMOVED
  - HYDRO TURF LIMITS
  - RE-VEGETATION LIMITS
  - COVER FINAL GRADE CONTOURS
  - PRIOR CONSTRUCTED CONTOURS
  - GEOSYNTHETIC LINER PROPOSED LIMITS



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0	5/07/2021	7217-17-004K	CLOSURE CONSTRUCTION	DCV	DCV	CKH	JDR	MGR

DESC: ISSUED FOR BID

TITLE: **DETAILS, PERIMETER DITCH REPAIR**

FOR: **EAST BEND STATION - EAST CCR LANDFILL**

SCALE: AS SHOWN  
DWG TYPE: CIVIL  
JOB NO: 7217-17-004K  
DATE: 3/26/2021

DES: DCV  
DFTR: DCV  
CHKD: CKH  
ENGR: JDR  
APPD: MGR

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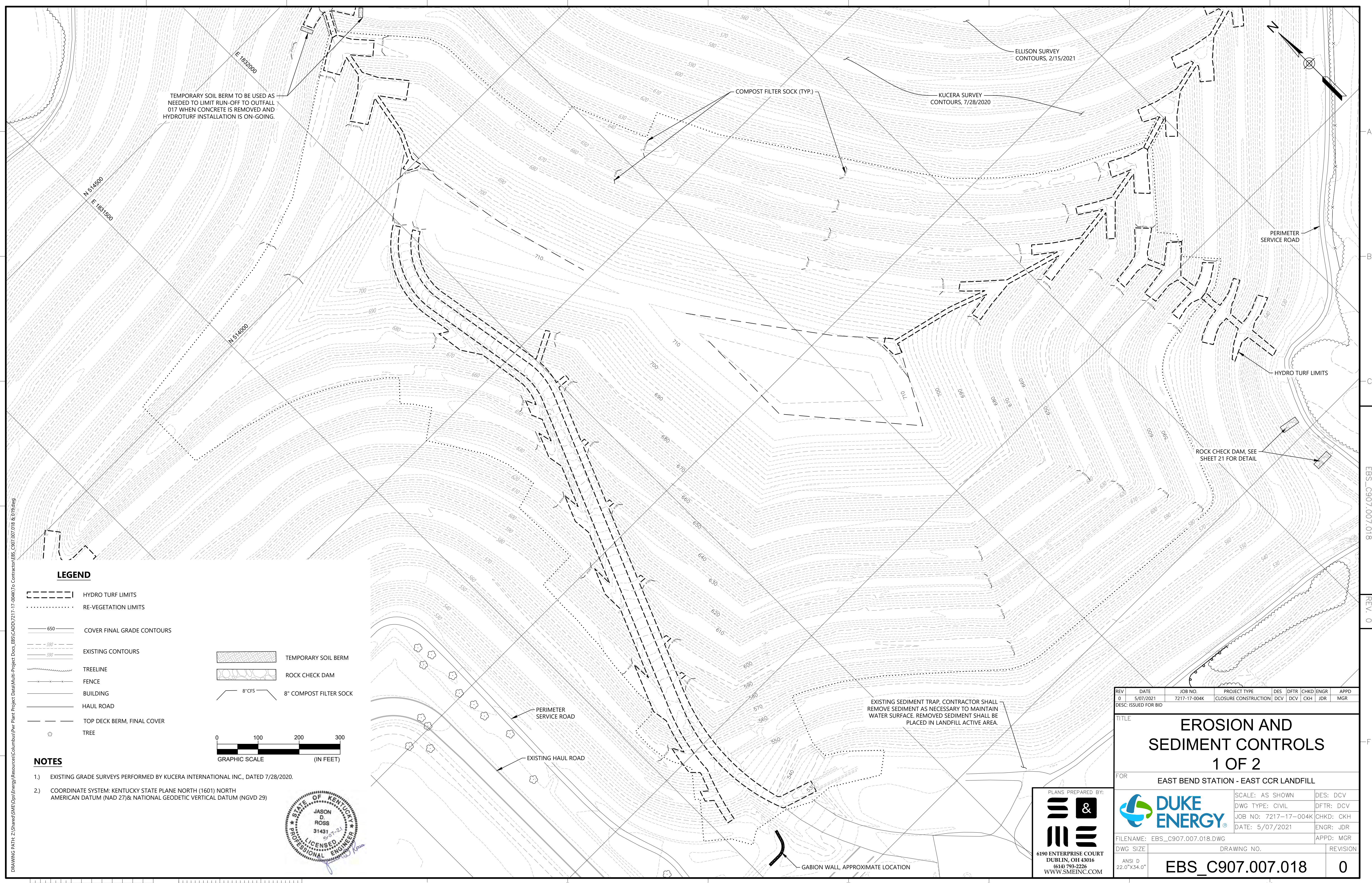
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TEMPORARY SOIL BERM TO BE USED AS NEEDED TO LIMIT RUN-OFF TO OUTFALL 017 WHEN CONCRETE IS REMOVED AND HYDROTURF INSTALLATION IS ON-GOING.

COMPOST FILTER SOCK (TYP.)

KUCERA SURVEY CONTOURS, 7/28/2020

ELLISON SURVEY CONTOURS, 2/15/2021

PERIMETER SERVICE ROAD

HYDRO TURF LIMITS

ROCK CHECK DAM, SEE SHEET 21 FOR DETAIL

EXISTING SEDIMENT TRAP. CONTRACTOR SHALL REMOVE SEDIMENT AS NECESSARY TO MAINTAIN WATER SURFACE. REMOVED SEDIMENT SHALL BE PLACED IN LANDFILL ACTIVE AREA.

GABION WALL, APPROXIMATE LOCATION

**LEGEND**

- HYDRO TURF LIMITS
- RE-VEGETATION LIMITS
- COVER FINAL GRADE CONTOURS
- EXISTING CONTOURS
- TREELINE
- FENCE
- BUILDING
- HAUL ROAD
- TOP DECK BERM, FINAL COVER
- TREE
- TEMPORARY SOIL BERM
- ROCK CHECK DAM
- 8" COMPOST FILTER SOCK



**NOTES**

- 1.) EXISTING GRADE SURVEYS PERFORMED BY KUCERA INTERNATIONAL INC., DATED 7/28/2020.
- 2.) COORDINATE SYSTEM: KENTUCKY STATE PLANE NORTH (1601) NORTH AMERICAN DATUM (NAD 27)& NATIONAL GEODETIC VERTICAL DATUM (NGVD 29)



REV	DATE	JOB NO.	PROJECT TYPE	DES	DFTR	CHKD	ENGR	APPD
0	5/07/2021	7217-17-004K	CLOSURE CONSTRUCTION	DCV	DCV	CKH	JDR	MGR

TITLE  
**EROSION AND SEDIMENT CONTROLS**  
1 OF 2

FOR  
EAST BEND STATION - EAST CCR LANDFILL

PLANS PREPARED BY: 	SCALE: AS SHOWN	DES: DCV
	DWG TYPE: CIVIL	DFTR: DCV
	JOB NO: 7217-17-004K	CHKD: CKH
	DATE: 5/07/2021	ENGR: JDR
		APPD: MGR

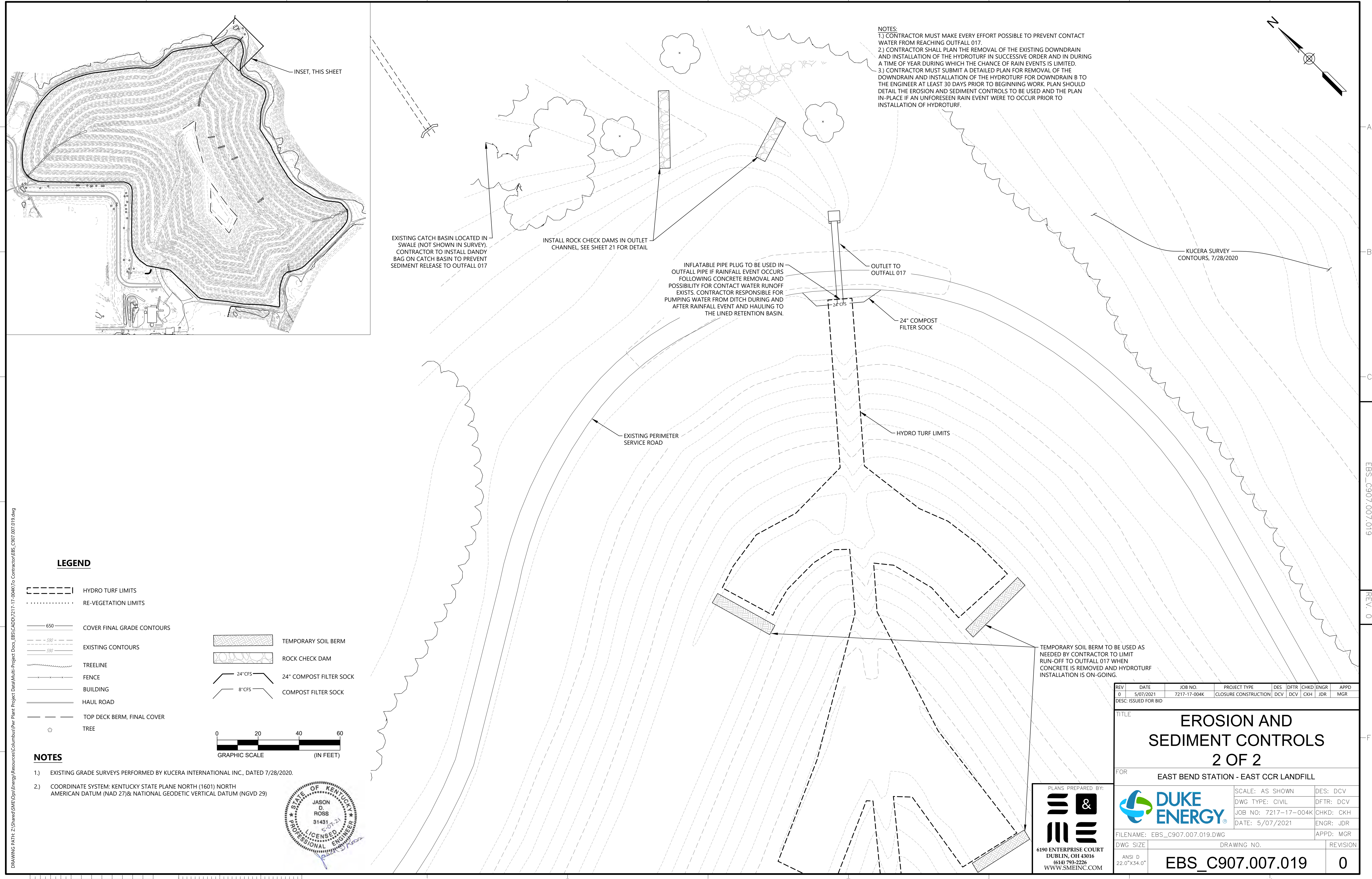
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NOTES:  
 1.) CONTRACTOR MUST MAKE EVERY EFFORT POSSIBLE TO PREVENT CONTACT WATER FROM REACHING OUTFALL 017.  
 2.) CONTRACTOR SHALL PLAN THE REMOVAL OF THE EXISTING DOWNDRAIN AND INSTALLATION OF THE HYDROTURF IN SUCCESSIVE ORDER AND IN DURING A TIME OF YEAR DURING WHICH THE CHANCE OF RAIN EVENTS IS LIMITED.  
 3.) CONTRACTOR MUST SUBMIT A DETAILED PLAN FOR REMOVAL OF THE DOWNDRAIN AND INSTALLATION OF THE HYDROTURF FOR DOWNDRAIN B TO THE ENGINEER AT LEAST 30 DAYS PRIOR TO BEGINNING WORK. PLAN SHOULD DETAIL THE EROSION AND SEDIMENT CONTROLS TO BE USED AND THE PLAN IN-PLACE IF AN UNFORESEEN RAIN EVENT WERE TO OCCUR PRIOR TO INSTALLATION OF HYDROTURF.

EXISTING CATCH BASIN LOCATED IN SWALE (NOT SHOWN IN SURVEY). CONTRACTOR TO INSTALL DANDY BAG ON CATCH BASIN TO PREVENT SEDIMENT RELEASE TO OUTFALL 017

INSTALL ROCK CHECK DAMS IN OUTLET CHANNEL. SEE SHEET 21 FOR DETAIL

INFLATABLE PIPE PLUG TO BE USED IN OUTFALL PIPE IF RAINFALL EVENT OCCURS FOLLOWING CONCRETE REMOVAL AND POSSIBILITY FOR CONTACT WATER RUNOFF EXISTS. CONTRACTOR RESPONSIBLE FOR PUMPING WATER FROM DITCH DURING AND AFTER RAINFALL EVENT AND HAULING TO THE LINED RETENTION BASIN.

OUTLET TO OUTFALL 017

24" COMPOST FILTER SOCK

KUCERA SURVEY CONTOURS, 7/28/2020

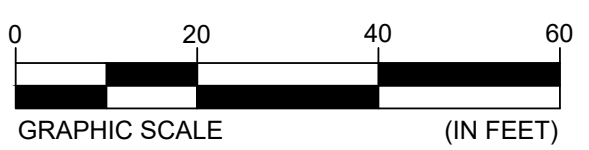
EXISTING PERIMETER SERVICE ROAD

HYDRO TURF LIMITS

TEMPORARY SOIL BERM TO BE USED AS NEEDED BY CONTRACTOR TO LIMIT RUN-OFF TO OUTFALL 017 WHEN CONCRETE IS REMOVED AND HYDROTURF INSTALLATION IS ON-GOING.

**LEGEND**

- HYDRO TURF LIMITS
- ..... RE-VEGETATION LIMITS
- 650 COVER FINAL GRADE CONTOURS
- 500 EXISTING CONTOURS
- TREELINE
- FENCE
- BUILDING
- HAUL ROAD
- TOP DECK BERM, FINAL COVER
- TREE
- TEMPORARY SOIL BERM
- ROCK CHECK DAM
- 24" CFS 24" COMPOST FILTER SOCK
- 8" CFS COMPOST FILTER SOCK



**NOTES**

- 1.) EXISTING GRADE SURVEYS PERFORMED BY KUCERA INTERNATIONAL INC., DATED 7/28/2020.
- 2.) COORDINATE SYSTEM: KENTUCKY STATE PLANE NORTH (1601) NORTH AMERICAN DATUM (NAD 27)& NATIONAL GEODETIC VERTICAL DATUM (NGVD 29)



REV	DATE	JOB NO.	PROJECT TYPE	DES	DFTR	CHKD	ENGR	APPD
0	5/07/2021	7217-17-004K	CLOSURE CONSTRUCTION	DCV	DCV	CKH	JDR	MGR

TITLE  
**EROSION AND SEDIMENT CONTROLS**  
**2 OF 2**

FOR  
 EAST BEND STATION - EAST CCR LANDFILL

PLANS PREPARED BY:  
  
 6190 ENTERPRISE COURT  
 DUBLIN, OH 43016  
 (614) 793-2226  
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SCALE: AS SHOWN	DES: DCV
DWG TYPE: CIVIL	DFTR: DCV
JOB NO: 7217-17-004K	CHKD: CKH
DATE: 5/07/2021	ENGR: JDR
APPD: MGR	

FILENAME: EBS_C907.007.019.DWG	DRAWING NO.	REVISION
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## TEMPORARY SEEDING EROSION & SEDIMENT CONTROL

### DESCRIPTION

ESTABLISH TEMPORARY COVER ON DISTURBED AREAS BY PLANTING APPROPRIATE RAPIDLY GROWING ANNUAL GRASSES OR SMALL GRAINS. STRUCTURAL EROSION AND SEDIMENT CONTROL PRACTICES SUCH AS DIVERSIONS AND SEDIMENT TRAPS SHALL BE INSTALLED AND STABILIZED WITH TEMPORARY SEEDING PRIOR TO GRADING THE REST OF THE CONSTRUCTION SITE. APPLICATIONS OF TEMPORARY SEEDING SHALL INCLUDE MULCH, WHICH SHALL BE APPLIED DURING OR IMMEDIATELY AFTER SEEDING.

### CONDITIONS WHERE PRACTICE APPLIES

TEMPORARY SEEDING SHALL BE APPLIED ON EXPOSED SOIL WHERE ADDITIONAL WORK (GRADING, ETC.) IS NOT SCHEDULED FOR MORE THAN 21 DAYS. IDLE AREAS SHALL BE SEEDING WITHIN 7 DAYS AFTER GRADING.

### SEEDING

**PLANT SELECTION:** SELECT THE PLANTS APPROPRIATE FROM TABLE 1 FOR TEMPORARY SEEDING. CHOOSE VARIETIES OF TALL FESCUE THAT ARE ENDOPHYTE FREE OR HAVE NONTOXIC ENDOPHYTES. SEEDING RATES FOR DORMANT SEEDINGS ARE INCREASED BY 50 PERCENT.

THE LENGTH OF TIME THE AREA WILL BE IDLE AND THE SEASON IN WHICH SEEDING OCCURS SHOULD INFLUENCE THE SELECTION OF SEEDING SPECIES. FOR AREAS REMAINING IDLE FOR OVER A YEAR, A MIXTURE CONTAINING PERENNIAL RYEGRASS SHALL BE USED.

**SITE PREPARATION:** TEMPORARY SEEDING IS BEST DONE ON A PREPARED SOIL SEEDBED OF LOOSE PULVERIZED SOIL. HOWEVER, SEEDINGS SHALL NOT BE DELAYED, IF ADDITIONAL SEEDBED PREPARATION IS NOT POSSIBLE. AT A MINIMUM, REMOVE LARGE ROCK OR DEBRIS THAT WILL INTERFERE WITH SEEDING OPERATIONS. IF THE GROUND HAS BECOME CRUSTED, A DISK OR A HARROW TO LOOSEN THE SOIL.

**SOIL AMENDMENTS:** A SOIL TEST IS NECESSARY TO ADEQUATELY PREDICT THE NEED FOR LIME AND FERTILIZER. SEEDINGS THAT ARE EXPECTED TO BE LONG LASTING (OVER 1-3 MONTHS), SHALL HAVE LIME AND FERTILIZER APPLIED AS RECOMMENDED BY A SOIL TEST. IN LIEU OF A SOIL TEST, FERTILIZER CAN BE BROADCAST AND WORKED INTO THE TOP INCH OF SOIL AT THE RATE OF 6 POUNDS/1000 FT<sup>2</sup> OR 250 POUNDS PER ACRE OF 10-10-10 OR 12-12-12.

**SEEDING METHODS:** SEED SHALL BE APPLIED UNIFORMLY WITH A CYCLONE SPREADER, DRILL, CULTI-PACKER SEEDER, OR HYDROSEEDER. SEED THAT HAS BEEN BROADCAST SHALL BE COVERED BY RAKING OR DRAGGING AND THEN LIGHTLY TAMPED INTO PLACE USING A ROLLER OR CULTIPACKER. IF HYDROSEEDING IS USED, THE SEED AND FERTILIZER SHALL BE MIXED ON-SITE AND THE SEEDING SHALL BE DONE IMMEDIATELY AND WITHOUT INTERRUPTION.

### TEMPORARY SEEDING SPECIFICATIONS

Table 1 Temporary Seeding Species Selection

Seeding Dates	Species	Lb./1000 ft <sup>2</sup>	Lb./Acre
March 1 to August 15	Oats	3	128 (4 Bushel)
	Tall Fescue	1	40
	Annual Ryegrass	1	40
	Perennial Ryegrass	1	40
	Tall Fescue	1	40
	Annual Ryegrass	1	40
	Annual Ryegrass	1.25	55
	Perennial Ryegrass	3.25	142
	Creeping Red Fescue	0.4	17
	Kentucky Bluegrass	0.4	17
August 16th to November	Oats	3	128 (3 bushel)
	Tall Fescue	1	40
	Annual Ryegrass	1	40
	Rye	3	112 (2 bushel)
	Tall Fescue	1	40
	Annual Ryegrass	1	40
	Wheat	3	120 (2 bushel)
	Tall Fescue	1	40
	Annual Ryegrass	1	40
	Perennial Rye	1	40
November 1 to Feb. 29	Tall Fescue	1	40
	Annual Ryegrass	1	40
	Annual Ryegrass	1.25	40
	Perennial Ryegrass	3.25	40
	Creeping Red Fescue	0.4	40
	Kentucky Bluegrass	0.4	40
	Use mulch only or dormant seeding		

Note: Other approved species may be substituted.

### MULCHING

MULCH SHALL CONSIST OF ONE OF THE FOLLOWING:

- STRAW - STRAW SHALL BE UNROTTED SMALL GRAIN STRAW APPLIED AT THE RATE OF 2 TONS/AC. OR 90 LB./1,000 SQ. FT. (TWO TO THREE BALES). THE STRAW MULCH SHALL BE SPREAD UNIFORMLY BY HAND OR MECHANICALLY SO THE SOIL SURFACE IS COVERED.
- HYDROSEEDERS - WOOD CELLULOSE FIBER SHOULD BE USED AT 2,000 LB./AC. OR 46 LB./1,000 SQ. FT.
- OTHER - ACCEPTABLE MULCHES INCLUDE MULCH MATTINGS AND ROLLED EROSION CONTROL PRODUCTS APPLIED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS OR WOOD MULCH/CHIPS APPLIED AT 10-20 TONS/AC.

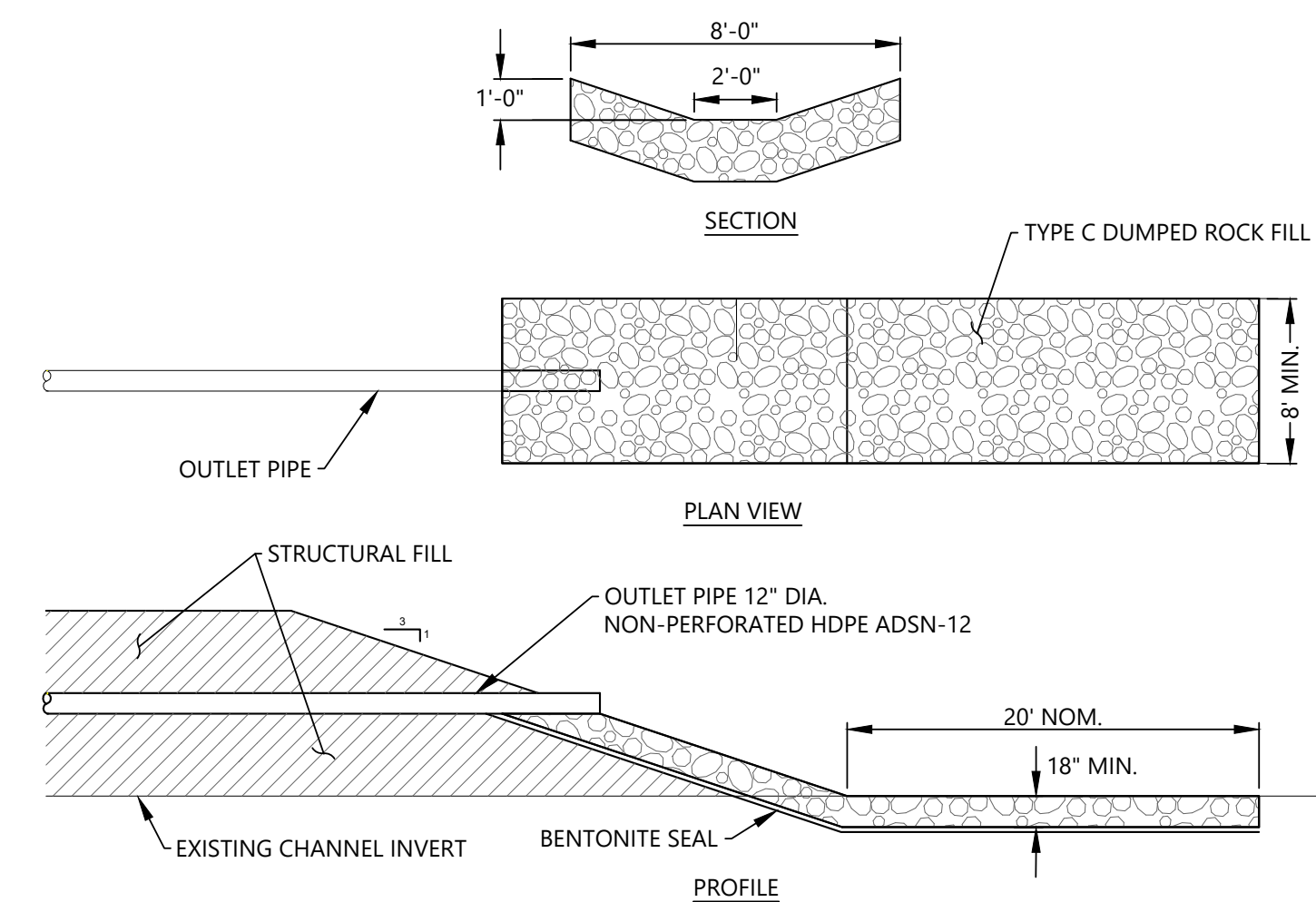
MULCH ANCHORING - MULCH SHALL BE ANCHORED IMMEDIATELY TO MINIMIZE LOSS BY WIND OR RUNOFF. THE FOLLOWING ARE ACCEPTABLE METHODS FOR ANCHORING MULCH.

- MECHANICAL - USE A DISK, CRIMPER, OR SIMILAR TYPE TOOL SET STRAIGHT TO PUNCH OR ANCHOR THE MULCH MATERIAL INTO THE SOIL. STRAW MECHANICALLY ANCHORED SHALL NOT BE FINELY CHOPPED BUT BE LEFT GENERALLY LONGER THAN 6 INCHES.
- MULCH NETTINGS - USE ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS, FOLLOWING ALL PLACEMENT AND ANCHORING REQUIREMENTS. USE IN AREAS OF WATER CONCENTRATION AND STEEP SLOPES TO HOLD MULCH IN PLACE.
- SYNTHETIC BINDERS - FOR STRAW MULCH, SYNTHETIC BINDERS SUCH AS ACRYLIC DLR (AGRI-TAC), DCA-70, PETROSET, TERRA TACK OR EQUAL MAY BE USED AT RATES RECOMMENDED BY THE MANUFACTURER. ALL APPLICATIONS OF SYNTHETIC BINDERS MUST BE CONDUCTED IN SUCH A MANNER WHERE THERE IS NO CONTACT WITH WATERS OF THE STATE.
- WOOD CELLULOSE FIBER - WOOD CELLULOSE FIBER MAY BE USED FOR ANCHORING STRAW. THE FIBER BINDER SHALL BE APPLIED AT A NET DRY WEIGHT OF 750 LB./ACRE. THE WOOD CELLULOSE FIBER SHALL BE MIXED WITH WATER AND THE MIXTURE SHALL CONTAIN A MAXIMUM OF 50 LB./100 GAL. OF WOOD CELLULOSE FIBER.

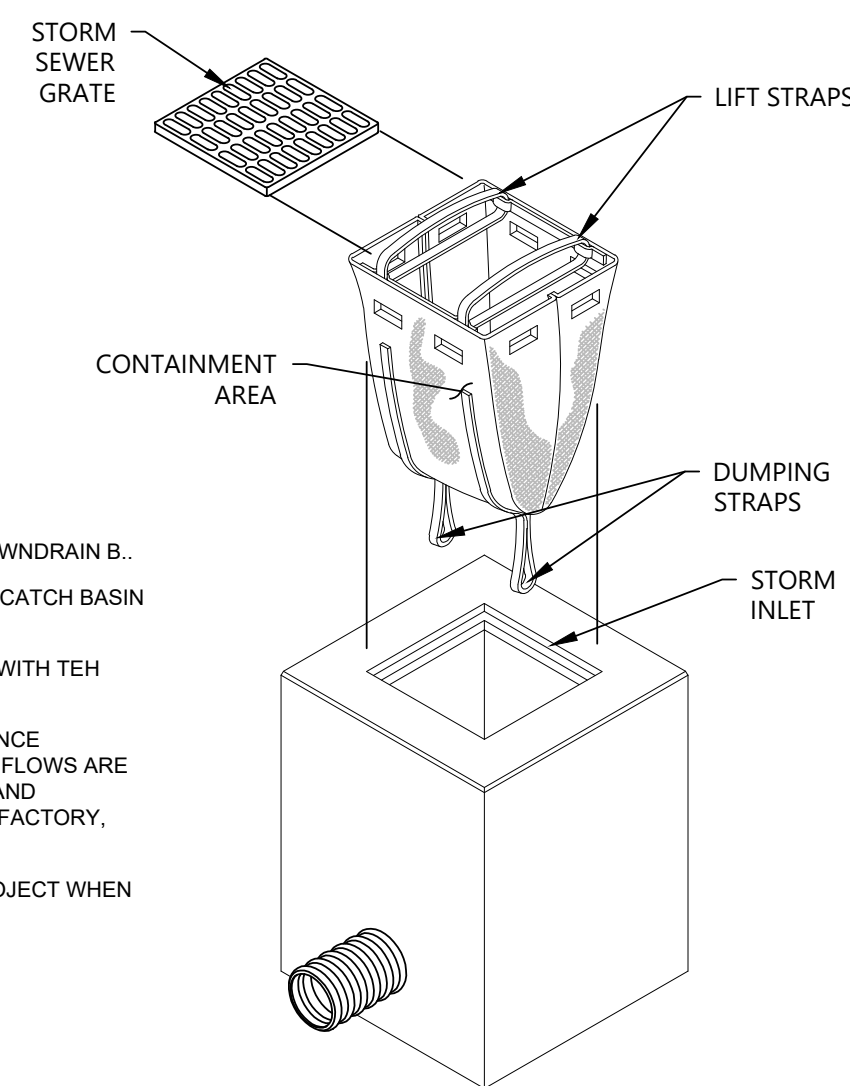
### MAINTENANCE

AREAS FAILING TO ESTABLISH VEGETATIVE COVER ADEQUATE TO PREVENT EROSION SHALL BE RESEED AS SOON AS SUCH AREAS ARE IDENTIFIED.

SEEDING PERFORMED DURING HOT AND DRY SUMMER MONTHS SHALL BE WATERED AT A RATE OF 1 INCH PER WEEK. ADDITIONAL MULCH SHALL BE PLACED AS NECESSARY TO COVER EXPOSED SOIL CONDITIONS WHEN OBSERVED DURING ROUTINE MAINTENANCE INSPECTIONS.

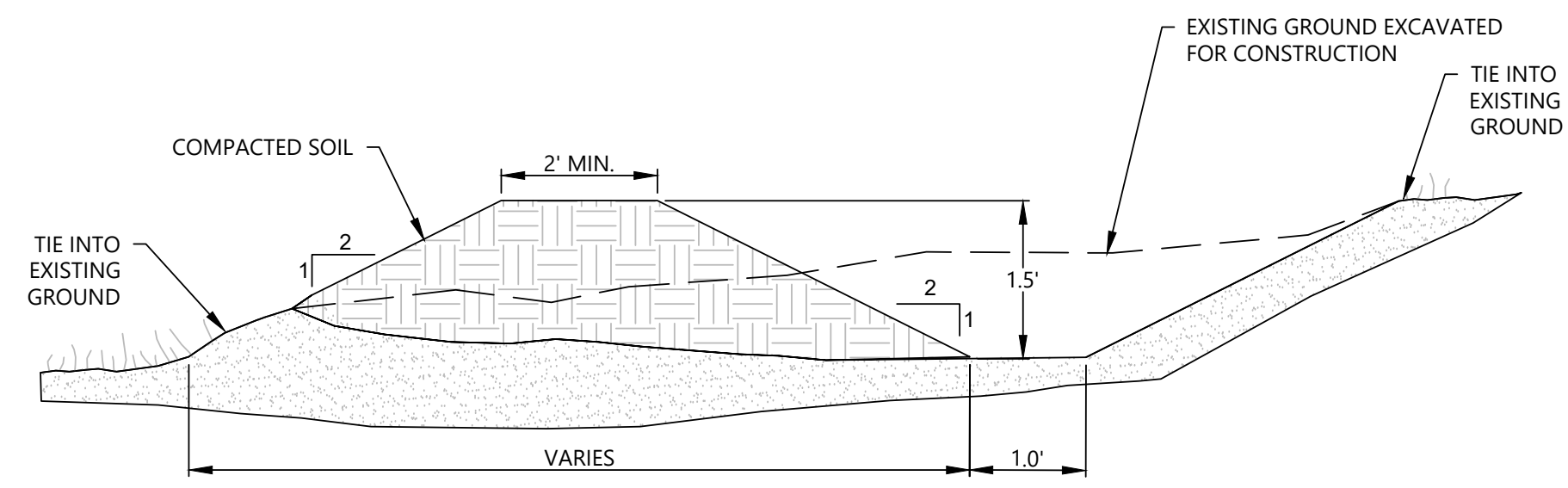


DETAIL - OUTLET PROTECTION



DANDY SACK (TM)

- NOTES:**
- DANDY SACK IS PROPOSED TO BE PLACED AT OUTFALL 017 AT DOWNDRAIN B. CONTRACTOR TO CONFIRM EXISTING CATCH BASIN SIZE. ACTUAL CATCH BASIN HAS A ROUND INLET.
  - ACCUMULATED SEDIMENT SHALL BE REMOVED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
  - CONTRACTOR MUST ROUTINELY CHECK DANDY BAG PERFORMANCE FOLLOWING RAIN EVENTS TO ENSURE SUFFICIENT STORMWATER FLOWS ARE PASSING THE STORM STRUCTURE WITHOUT CAUSING BACK-UPS AND OVERFLOWS INTO OTHER AREAS. IF PERFORMANCE IS NOT SATISFACTORY, NOTIFY ENGINEER.
  - DANDY SACK SHALL REMAIN IN-PLACE UNTIL THE END OF THE PROJECT WHEN VEGETATION HAS BEEN RE-ESTABLISHED.



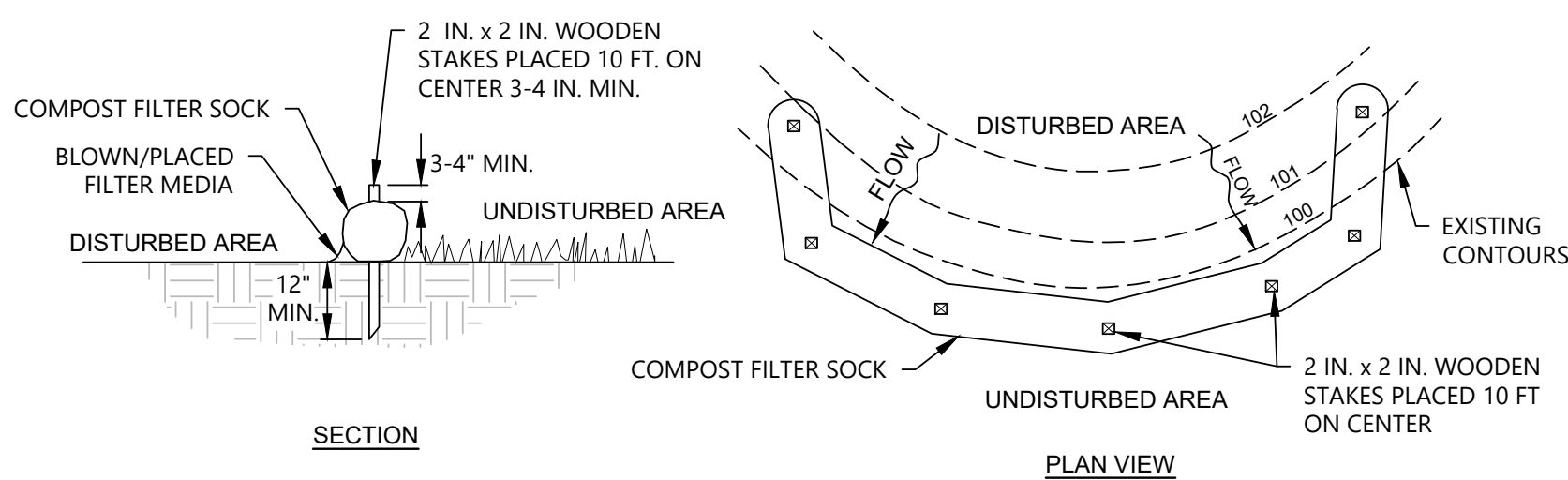
#### GENERAL NOTES:

1. REMOVE AND PROPERLY DISPOSE OF ALL TREES, BRUSH, STUMPS, AND OTHER OBJECTIONABLE MATERIAL.
2. ENSURE THAT THE MINIMUM CONSTRUCTED CROSS-SECTION MEETS ALL DESIGN REQUIREMENTS.
3. ENSURE THAT THE TOP OF THE CHANNEL IS NOT LOWER AT ANY POINT THAN THE DESIGN ELEVATION.
4. PROVIDE SUFFICIENT ROOM AROUND DIVERSIONS TO PERMIT MACHINE REGRADING AND CLEANOUT.
5. VEGETATE THE CHANNEL IMMEDIATELY AFTER CONSTRUCTION, UNLESS IT WILL REMAIN IN PLACE LESS THAN 30 WORKING DAYS.

#### MAINTENANCE NOTES:

1. INSPECT DIVERSIONS AT LEAST WEEKLY AND AFTER EACH RAINFALL EVENT THAT EXCEEDS 0.5 INCHES WITHIN A 24 HOUR PERIOD AND REPAIR IMMEDIATELY. CLEAN OUT SEDIMENT, STRAW, LIMBS, OR OTHER DEBRIS THAT COULD CLOG THE FLOW AREA AND REPAIR THE DIVERSION RIDGE AS NEEDED.

DETAIL - DIVERSION



DETAIL - FILTER SOCK

#### NOTES:

- COMPOST FILTER SOCK SHALL BE PLACED AT EXISTING LEVEL GRADE. BOTH ENDS OF THE BARRIER SHALL BE EXTENDED AT LEAST 8 FEET UP SLOPE AT 45 DEGREES TO THE MAIN BARRIER ALIGNMENT. MAXIMUM SLOPE LENGTH ABOVE ANY BARRIER SHALL NOT EXCEED THAT SPECIFIED FOR THE SIZE OF THE SOCK AND THE SLOPE OF ITS TRIBUTARY AREA.
- TRAFFIC SHALL NOT BE PERMITTED TO CROSS COMPOST FILTER SOCKS.
- ACCUMULATED SEDIMENT SHALL BE REMOVED WHEN IT REACHES 1/2 THE ABOVE GROUND HEIGHT OF THE BARRIER AND DISPOSED IN THE MANNER DESCRIBED ELSEWHERE IN THE PLAN.
- COMPOST FILTER SOCKS SHALL BE INSPECTED WEEKLY AND AFTER EACH RUNOFF EVENT. DAMAGED SOCKS SHALL BE REPAIRED ACCORDING TO MANUFACTURER'S SPECIFICATIONS OR REPLACED WITHIN 24 HOURS OF INSPECTION.
- BIODEGRADABLE COMPOST FILTER SOCKS SHALL BE REPLACED AFTER 6 MONTHS; PHOTODEGRADABLE SOCKS AFTER 1 YEAR. POLYPROPYLENE SOCKS SHALL BE REPLACED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.
- UPON STABILIZATION OF THE AREA TRIBUTARY TO THE SOCK, STAKES SHALL BE REMOVED. THE SOCK MAY BE LEFT IN PLACE AND VEGETATED OR REMOVED. IN THE LATTER CASE, THE MESH SHALL BE CUT OPEN AND THE MULCH SPREAD AS A SOIL SUPPLEMENT.

REV	DATE	JOB NO.	PROJECT TYPE	DES	DFTR	CHKD	ENGR	APPD
0	5/07/2021	7217-17-004K	CLOSURE CONSTRUCTION	DCV	DCV	CKH	JDR	MGR

DESC: ISSUED FOR BID

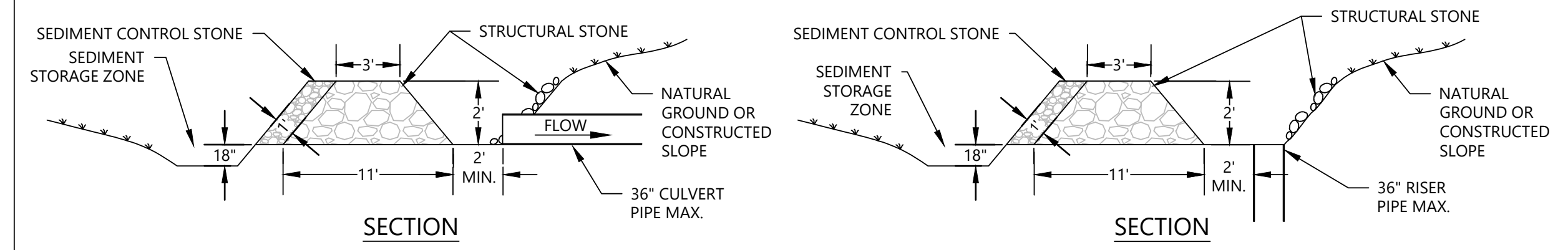
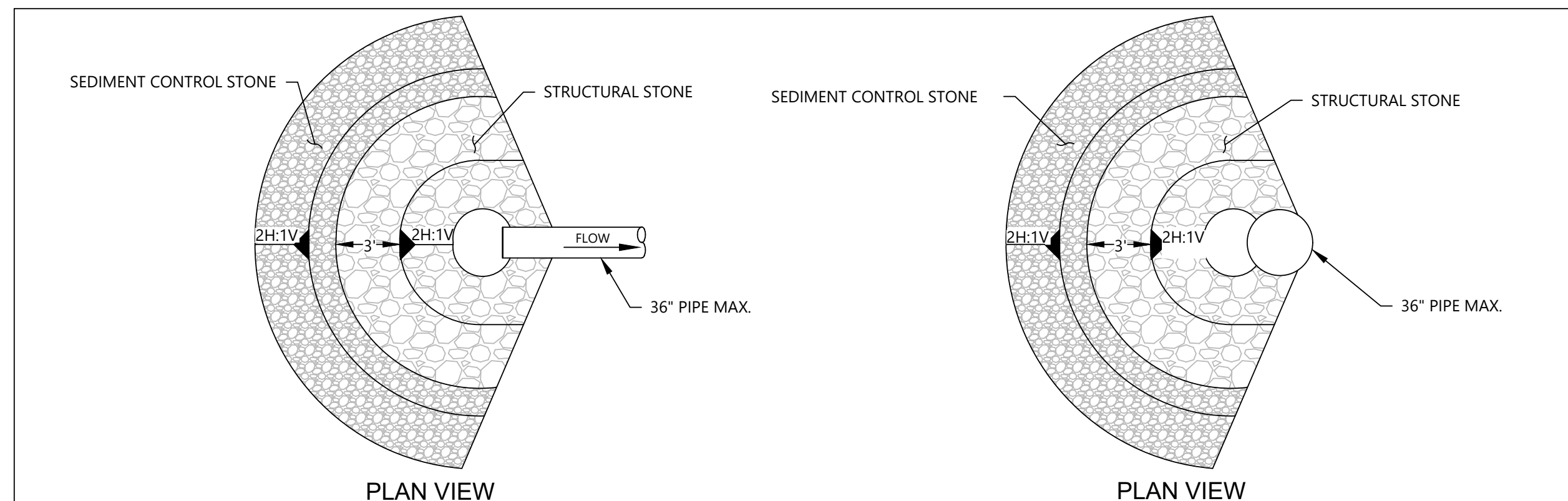
TITLE  
**DETAILS, EROSION AND SEDIMENT CONTROLS (1)**

FOR  
EAST BEND STATION - EAST CCR LANDFILL

PLANS PREPARED BY: <b>SME</b>	SCALE: AS SHOWN	DES: DCV
<b>DUKE ENERGY</b>	DWG TYPE: CIVIL	DFTR: DCV
6190 ENTERPRISE COURT DUBLIN, OH 43016 (614) 793-2226 WWW.SMEINC.COM	JOB NO: 7217-17-004K	CHKD: CKH
	DATE: 5/07/2021	ENGR: JDR
FILENAME: EBS_C907.007.020.DWG		APPD: MGR
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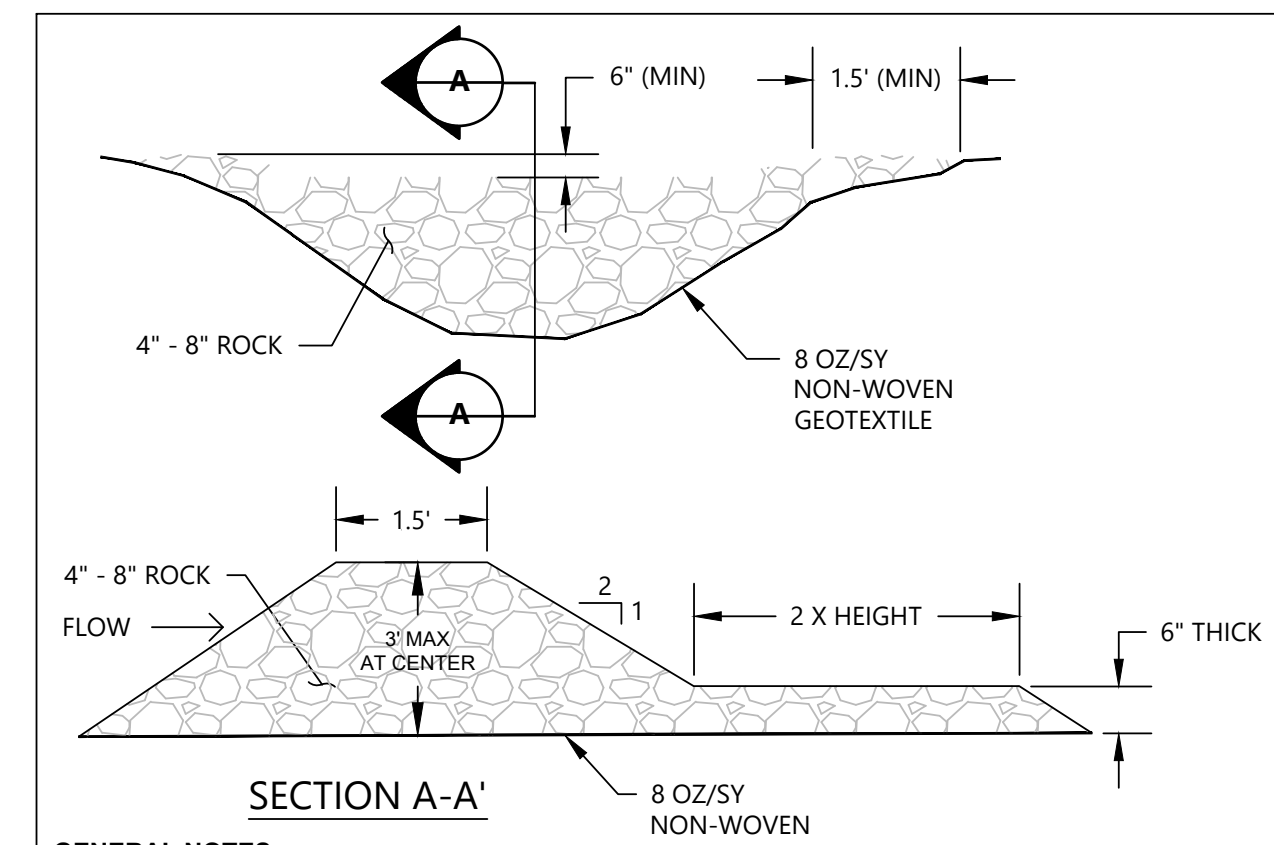






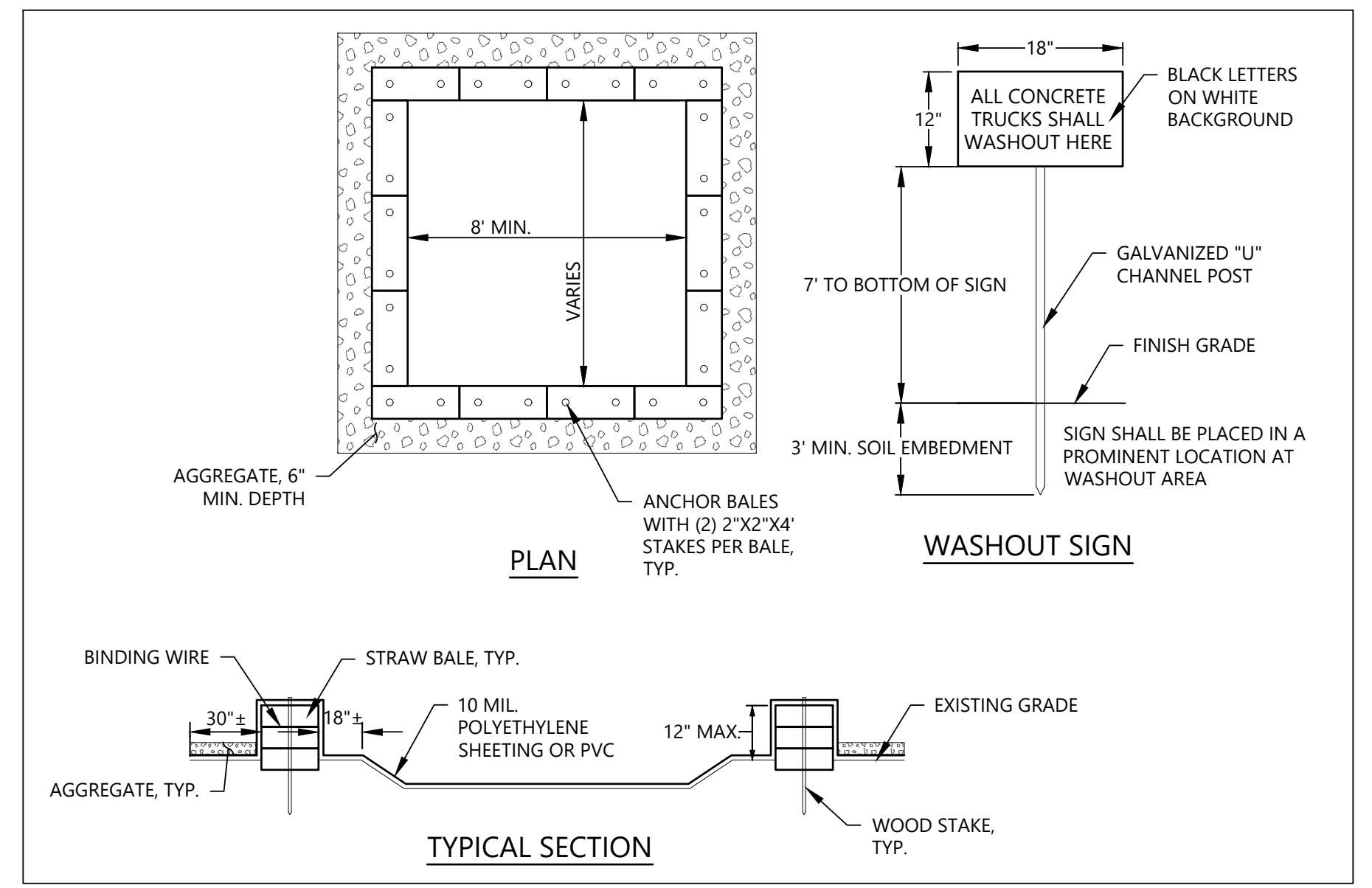
- GENERAL NOTES:**
- INSTALL ROCK PIPE INLET PROTECTION AT SURFACE WATER RISER INLETS.
  - STRUCTURAL STONE SHALL BE 8-INCH D50 RIPRAP.
  - SEDIMENT CONTROL STONE SHALL BE NO. 57 STONE.
  - DIMENSIONS ARE MINIMUM ACCEPTABLE UNLESS OTHERWISE SPECIFIED BY THE ENGINEER.
- MAINTENANCE NOTES:**
- THE MEASURE SHALL BE INSPECTED AFTER EVERY STORM OF MORE THAN 0.5 INCH AND REPAIRS MADE AS NECESSARY. AT LEAST ONCE PER WEEK, THE MEASURE SHALL BE INSPECTED AND REPAIRS MADE IMMEDIATELY.
  - REMOVE SEDIMENT AND RESTORE THE SEDIMENT STORAGE AREA TO ITS ORIGINAL DIMENSIONS WHEN THE SEDIMENT HAS ACCUMULATED TO ONE-HALF THE DESIGN DEPTH OF THE TRAP. PLACE THE SEDIMENT THAT IS REMOVED IN THE DESIGNATED DISPOSAL AREA AND REPLACE THE CONTAMINATED PART OF THE GRAVEL FACING.
  - CHECK THE STRUCTURE FOR DAMAGE. ANY RIPRAP DISPLACED FROM THE STONE HORSESHOE MUST BE REPLACED IMMEDIATELY.
  - AFTER ALL THE SEDIMENT-PRODUCING AREAS HAVE BEEN PERMANENTLY STABILIZED, REMOVE THE STRUCTURE AND ALL THE UNSTABLE SEDIMENT. SMOOTH THE AREA TO BLEND WITH THE ADJOINING AREAS AND PROVIDE PERMANENT GROUND COVER (SURFACE STABILIZATION).

DETAIL - INLET PROTECTION

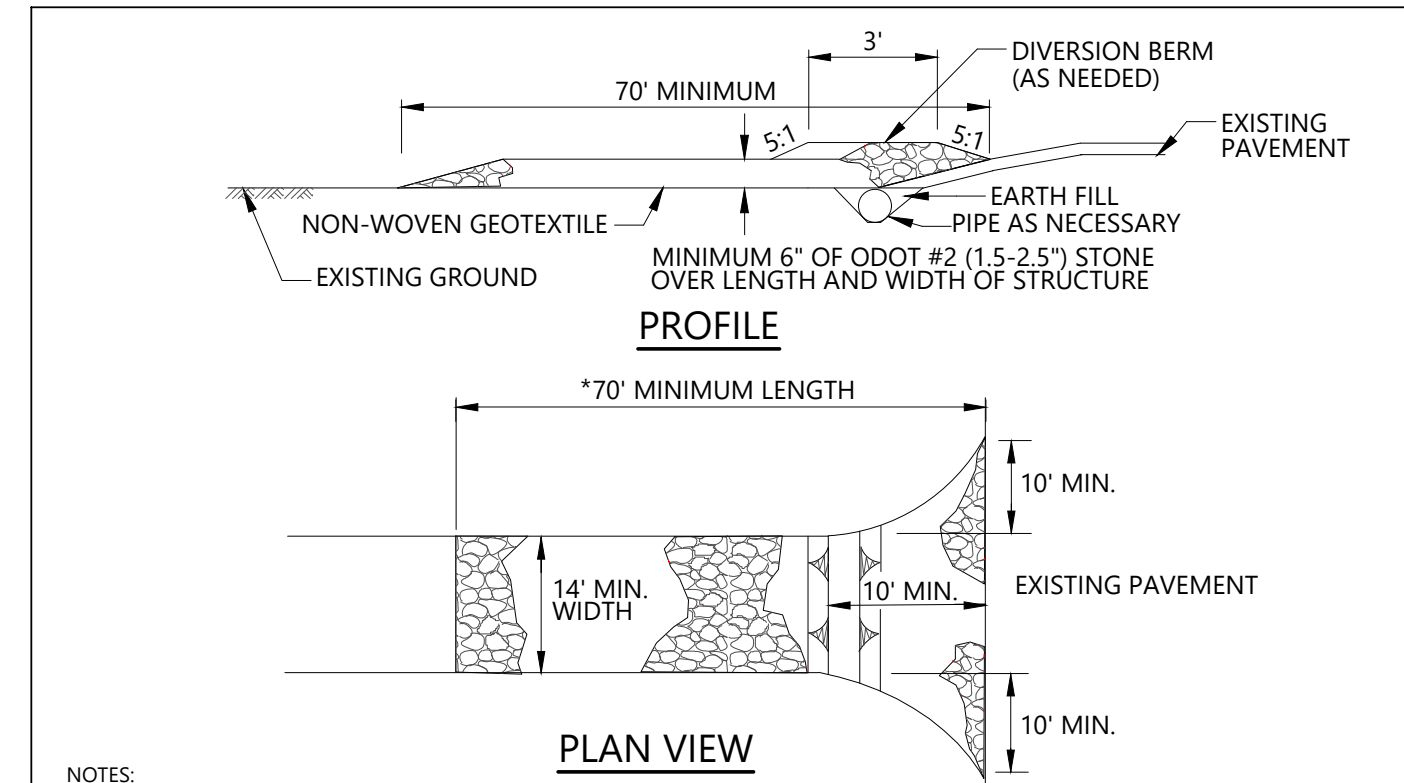


- GENERAL NOTES:**
- STONE SHOULD BE PLACED OVER THE CHANNEL BANKS TO KEEP WATER FROM CUTTING AROUND THE DAM.
  - THE CHECK DAM SHALL BE CONSTRUCTED OF 4-8 INCH DIAMETER STONE, PLACED SO THAT IT COMPLETELY COVERS THE WIDTH OF THE CHANNEL. ODOT TYPE D STONE IS ACCEPTABLE, BUT SHOULD BE UNDERLAIN WITH A GRAVEL FILTER CONSISTING OF ODOT NO. 3 OR 4 OR SUITABLE FILTER FABRIC.
  - MAXIMUM HEIGHT OF CHECK DAM SHALL NOT EXCEED 3.0 FEET.
  - THE MIDPOINT OF THE ROCK CHECK DAM SHALL BE A MINIMUM OF 6 INCHES LOWER THAN THE SIDES IN ORDER TO DIRECT ACROSS THE CENTER AND AWAY FROM THE CHANNEL SIDES.
  - THE BASE OF THE CHECK DAM SHALL BE ENTRENCHED APPROXIMATELY 6 INCHES.
  - SPACING OF CHECK DAMS SHALL BE IN A MANNER SUCH THAT THE TOE OF THE UPSTREAM DAM IS AT THE SAME ELEVATION AS THE TOP OF THE DOWNSTREAM DAM.
  - A SPLASH APRON SHALL BE CONSTRUCTED WHERE CHECK DAMS ARE EXPECTED TO BE IN USE FOR AN EXTENDED PERIOD OF TIME. A STONE APRON SHALL BE CONSTRUCTED IMMEDIATELY DOWNSTREAM OF THE CHECK DAM TO PREVENT FLOWS FROM UNDERCUTTING THE STRUCTURE. THE APRON SHOULD BE 6 IN. THICK AND ITS LENGTH TWO TIMES THE HEIGHT OF THE DAM.
  - STONE PLACEMENT SHALL BE PERFORMED EITHER BY HAND OR MECHANICALLY AS LONG AS THE CENTER OF CHECK DAM IS LOWER THAN THE SIDES AND EXTENDS ACROSS ENTIRE CHANNEL.
  - SIDE SLOPES SHALL BE A MINIMUM OF 2:1.
- MAINTENANCE NOTES:**
- INSPECT CHECK DAMS AND CHANNELS AT LEAST WEEKLY AND AFTER EACH SIGNIFICANT (0.5\"/>
  - ANTICIPATE SUBMERGENCE AND DEPOSITION ABOVE THE CHECK DAM AND EROSION FROM HIGH FLOWS AROUND THE EDGES OF THE DAM. CORRECT ALL DAMAGE IMMEDIATELY. IF SIGNIFICANT EROSION OCCURS BETWEEN DAMS, ADDITIONAL MEASURES CAN BE TAKEN SUCH AS: INSTALLING A PROTECTIVE RIPRAP LINER IN THAT PORTION OF THE CHANNEL (PRACTICE 6.31, RIPRAP-LINE AND PAVED CHANNELS).
  - REMOVE SEDIMENT ACCUMULATED BEHIND THE DAMS AS NEEDED TO PREVENT DAMAGE TO CHANNEL VEGETATION. ALLOW THE CHANNEL TO DRAIN THROUGH THE STONE CHECK DAM, AND PREVENT LARGE FLOWS FROM CARRYING SEDIMENT OVER THE DAM. ADD STONES TO DAMS AS NEEDED TO MAINTAIN DESIGN HEIGHT AND CROSS SECTION. \*REF. ODNR RAINWATER AND LAND DEVELOPMENT, 2006.

DETAIL - ROCK CHECK DAM

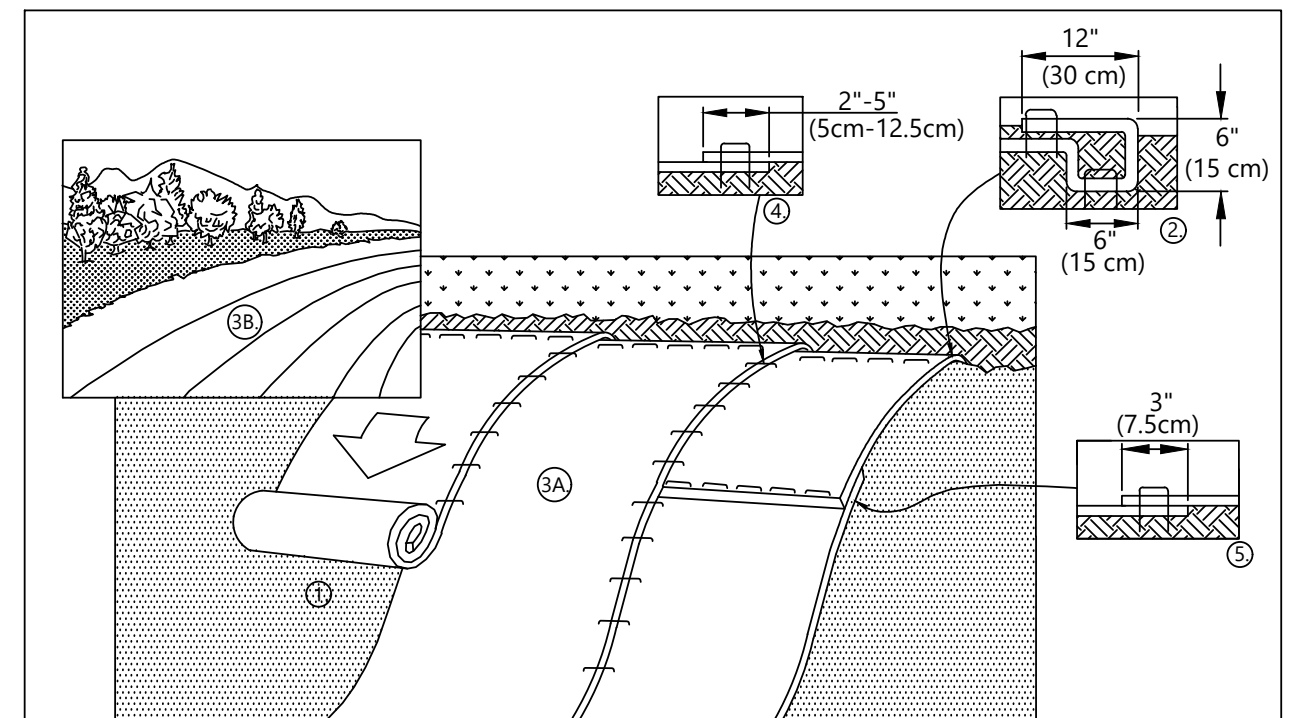


DETAIL - CONCRETE WASHOUT AREA



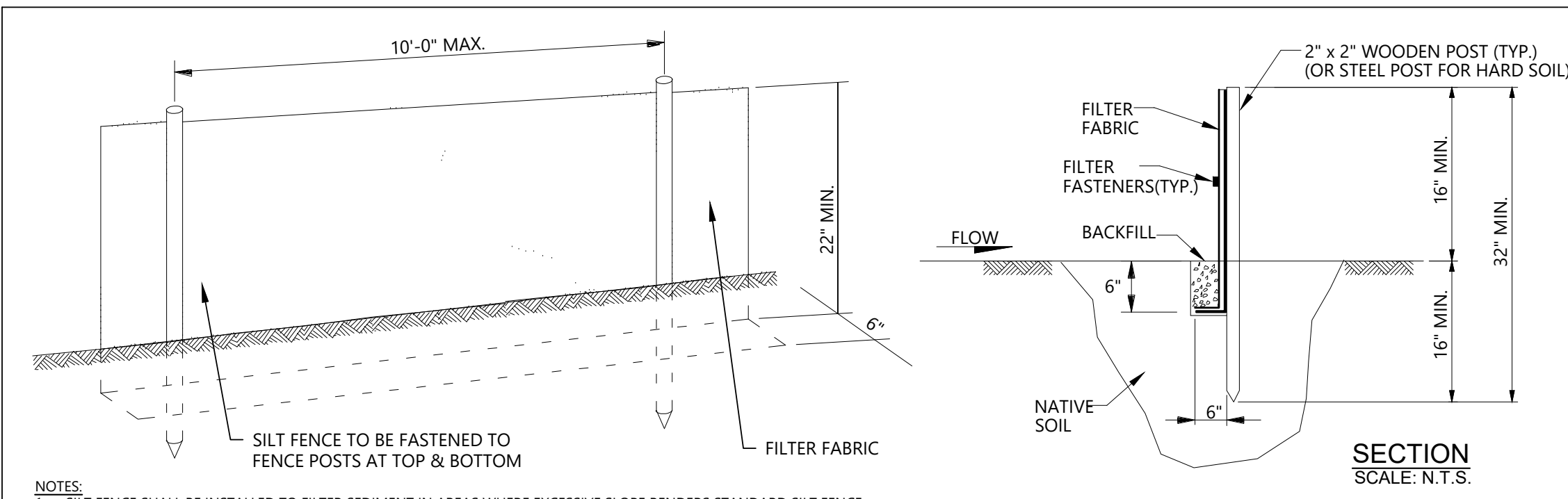
DETAIL - CONSTRUCTION ENTRANCE

- NOTES:**
- LENGTH - MINIMUM OF 70'.
  - WIDTH - 14' MINIMUM, SHOULD BE FLARED AT THE EXISTING ROAD TO PROVIDE A TURNING RADIUS.
  - GEOTEXTILE FABRIC (FILTER CLOTH) SHALL BE PLACED OVER THE EXISTING GROUND PRIOR TO PLACING STONE.
  - ODOT #2 STONE (1.5\"/>
  - SURFACE WATER - ALL SURFACE WATER FLOWING TO OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED THROUGH THE ENTRANCE, MAINTAINING POSITIVE DRAINAGE. PIPE INSTALLED THROUGH THE STABILIZED CONSTRUCTION ENTRANCE SHALL BE PROTECTED WITH A MOUNTABLE BERM WITH 5:1 SLOPES AND A MINIMUM OF 6\"/>
  - LOCATION - A STABILIZED CONSTRUCTION ENTRANCE SHALL BE LOCATED AT EVERY POINT WHERE CONSTRUCTION TRAFFIC ENTERS OR LEAVES A CONSTRUCTION SITE. VEHICLES LEAVING THE SITE MUST TRAVEL OVER THE ENTIRE LENGTH OF THE STABILIZED CONSTRUCTION ENTRANCE.



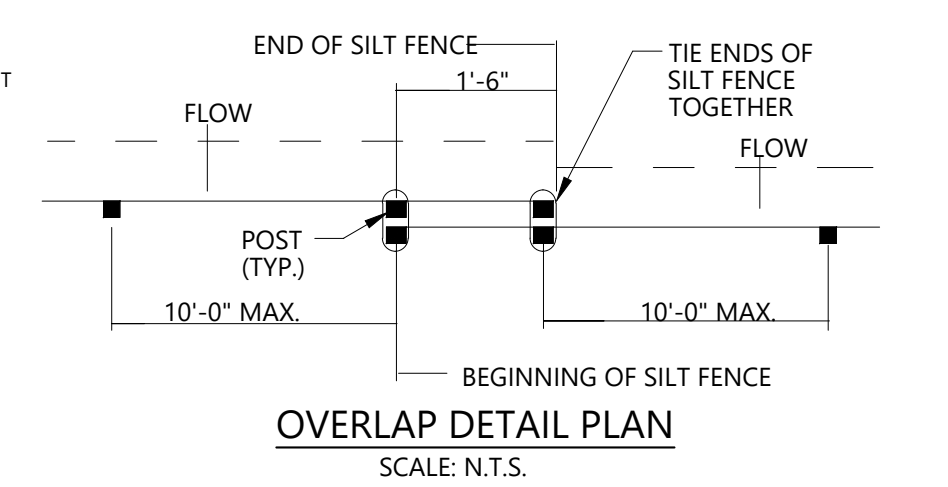
- PREPARE SOIL BEFORE INSTALLING ROLLED EROSION CONTROL PRODUCTS (RECP'S), INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED. NOTE WHEN USING CELL-O-SEED DO NOT SEED PREPARED AREA. CELL-O-SEED MUST BE INSTALLED WITH PAPER SIDE DOWN.
- BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE RECP'S IN A 6\"/>
- ROLL THE RECP'S (A) DOWN OR (B) HORIZONTALLY ACROSS THE SLOPE. RECP'S WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL RECP'S MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE. WHEN USING THE DOT SYSTEM, STAPLES/STAKES SHOULD BE PLACED THROUGH EACH OF THE COLORED DOTS CORRESPONDING TO THE APPROPRIATE STAPLE PATTERN.
- THE EDGES OF PARALLEL RECP'S MUST BE STAPLED WITH APPROXIMATELY 2\"/>
- CONSECUTIVE RECP'S SPLICED DOWN THE SLOPE MUST BE PLACED END OVER END (SHINGLE STYLE) WITH AN APPROXIMATE 2\"/>

DETAIL - EROSION CONTROL MATTING/SLOPE STABILIZATION



- NOTES:**
- SILT FENCE SHALL BE INSTALLED TO FILTER SEDIMENT IN AREAS WHERE EXCESSIVE SLOPE RENDERS STANDARD SILT FENCE INEFFECTIVE.
  - INSTALLATIONS SHALL BE PERIODICALLY CHECKED, THE SEDIMENT SHALL BE REMOVED WHEN IT REACHES ONE-THIRD THE HEIGHT OF THE FABRIC FENCE.
  - SILT FENCE SHALL BE LEFT IN PLACE UNTIL PERMANENT VEGETATIVE COVER IS ESTABLISHED.
  - SILT FENCE SHALL BE REPLACED WHENEVER IT HAS DETERIORATED TO SUCH AN EXTENT THAT IT REDUCES THE EFFECTIVENESS OF THE SILT FENCE.
  - AREA DISTURBED AS A RESULT OF REMOVING THE SILT FENCE SHALL BE RE-ESTABLISHED BY SEEDING IN ACCORDANCE WITH THE REVEGETATION PLAN.
  - SILT FENCE SHALL BE PLACED TO FOLLOW (RUN PARALLEL TO) THE CONTOURS.
  - ON UPSLOPE INSTALLATIONS, BOTH ENDS OF THE SEDIMENT BARRIER SHALL BE TURNED AND EXTENDED UPSLOPE.

DETAIL - SILT FENCE

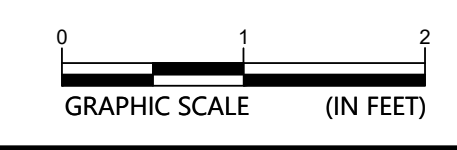


OVERLAP DETAIL PLAN



PLANS PREPARED BY:  
  
 6190 ENTERPRISE COURT  
 DUBLIN, OH 43016  
 (614) 793-2226  
 WWW.SMEINC.COM

REV	DATE	JOB NO.	PROJECT TYPE	DES	DFTR	CHKD	ENGR	APPD
0	5/07/2021	7217-17-004K	CLOSURE CONSTRUCTION	DCV	DCV	CKH	JDR	MGR
DESC: ISSUED FOR BID								
TITLE: <b>DETAILS, EROSION AND SEDIMENT CONTROLS (2)</b>								
FOR: EAST BEND STATION - EAST CCR LANDFILL								
SCALE: AS SHOWN			DES: DCV			DFTR: DCV		
DUKE ENERGY			JOB NO: 7217-17-004K			CHKD: CKH		
DATE: 5/07/2021			ENGR: JDR			APPD: MGR		
FILENAME: EBS_C907.007.021.DWG								
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DRAWING NO.			REVISION			0		



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EBS\_C907.007.021 REV. 0



**EAST BEND GENERATING STATION**  
**EAST CCR LANDFILL**  
**CLOSURE CONSTRUCTION**  
**BID SPECIFICATION**

**May 7, 2021**

**EAST BEND GENERATING STATION  
EAST CCR LANDFILL  
CLOSURE CONSTRUCTION BID SPECIFICATION**

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**APPENDICES**

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Appendix 3	Closure Plan, July 2020
Appendix 4	Best Management Practices/Pollution Prevention Plan, April 2017
Appendix 5	Landfill Permit, April 2021
Appendix 6	Title V Air Permit, April 2013
Appendix 7	Duke Energy Standard Operating Procedures

**EAST BEND GENERATING STATION  
EAST CCR LANDFILL  
CLOSURE CONSTRUCTION BID SPECIFICATION**

**1.0 PROJECT TITLE**

The specific project for which this document has been prepared will be known as:  
EAST CCR LANDFILL CLOSURE CONSTRUCTION.

**2.0 PROJECT LOCATION**

The East Bend Generating Station is located at 6293 Beaver Road, Rabbit Hash, KY 41091. The general area of the East Landfill is 2,900 feet east of the Power Plant. Two access points into the station are available for Contractor use:

- Main Station Entrance Road.
- Barge off-loading at southeast corner of the lined retention basin (bulk materials only and only with approval by Owner).

The Bidder shall satisfy itself as to the conditions and nature of these roads as well as other roads, bridges, and barge off-loading facilities at the plant to be utilized for transport of material, equipment, and labor to the site including any restrictions. The Bidder shall be familiar with the approved plant haul roads to be used for construction and hauling of materials.

**3.0 PROJECT SCOPE**

**3.1 Description of Work**

The general scope of work covered by this Bid Specification and associated drawings includes the provision of all supervision, labor, equipment, and material necessary to install the final cover system and complete other work identified in the documents. The general construction items include:

- Removal of select portions of existing concrete and rip-rap downdrains.
- Removal and stockpiling of portions of the existing soil cover system for reuse.
- Cut and fill placement to achieve Site Preparation Grade (grade upon which final cover materials are installed).
- Fine grading of all areas where final cover is to be installed.
- Installation of surface and sub-surface drainage controls.
- Installation of cover system geosynthetic materials.
- Installation of cover system soils.
- Installation of permanent haul road.
- Establishment of a vegetative cover on all disturbed areas.

All Work shall be performed to meet facility permit specifications and regulatory requirements including maintenance and cleanliness of the roads and Contractor areas

### 3.2 General Requirements

This work shall conform to, but not be limited to, the following items:

- Construction technical specifications outlining materials, procedures, inspection, monitoring, sampling, testing methods/frequencies, and documentation during site closure are contained in the Technical Specifications for Cover System Modifications, East Landfill, East Bend Station, Revised May 2021 hereafter referred to as the "Technical Specifications" (see Appendix 1). Bidder shall be familiar with and conform to the Technical Specifications.
- Construction quality assurance procedures outlining inspection, monitoring, sampling, testing methods/frequencies, and documentation during site closure are contained in the Construction Quality Control Plan – Final Cover, East Landfill, East Bend Station, Revised July 2020 hereafter referred to as the "CQC Plan" (see Appendix 2). Bidder shall be familiar with and conform to the CQC Plan.
- The construction and maintenance of all necessary berms, drainage ditches, temporary holding ponds and temporary haul roads.
- The control of fugitive dust at the work site, borrow areas, and haul roads. Such controls may include the covering of trucks beds with tarps and the wetting of haul roads as required and/or directed by Duke Energy. Fugitive dust control shall conform to all applicable federal, state and/or local environmental rules and regulations. See attached air permit (PTI) in Appendix 5.
- Submission of Daily Reports summarizing the work performed.
- The Contractor shall provide full time supervision of all on-site craft and subcontractors.
- The Contractor shall send at least one representative to weekly progress meetings scheduled by the Owner. The Contractor is expected to be prepared to discuss coordination of on-site work with Duke Energy during the meeting as well as providing the following updates:
  - Project Schedule;
  - Summary of Outstanding Requests for Information (RFI's) and Submittals;
  - Summary of expected work to be performed in the 2 weeks following the meeting.

The aforementioned items listed are major items required for the East Landfill closure construction. This list is not intended to address the entire Scope of Work. The Bidder must review the project drawings and the bid documents to ascertain the full scope of work requirements for these areas.

## 4.0 GENERAL REQUIREMENTS



4.1 Haul Roads

- 4.1.1 The Contractor is responsible for the construction of the road depicted in the drawings. This roads shall remain at the completion of work.
- 4.1.2 The Contractor is responsible for constructing temporary haul roads at their own expense. The temporary haul roads include, but are not limited to, access to the work areas, the excavated material stockpile areas, and any other haul roads required to perform work. Temporary roads needed to complete the work shall be removed at the completion of work.
- 4.1.3 The Contractor shall maintain all temporary haul roads utilized within the site at their own expense including dust control, grading, repairing potholes or erosion areas, and snow and ice control.
- 4.1.4 The Contractor is responsible for cleaning any spillages of material or debris on permanent and temporary haul roads at its own expense
- 4.1.5 Contractor is responsible for keeping haul roads and public roads clear of construction material and debris spillages.

4.2 Borrow Material

Material to be used as cover soil shall be obtained from on-site excavations and existing soil stockpiles shown on the drawings.

On-site excavated material which contains ash shall be used as fill beneath the cover system geosynthetics up to the elevation of the liner system. In the event more ash containing materials are excavated than are needed as fill beneath the geosynthetic materials, the excess material shall be placed and graded on the top of the landfill beneath the cover system geosynthetics. Material may only be placed on the stacker pad for disposal in West Landfill by the landfill operating contractor with the express authorization of Duke Energy's System Owner.

4.3 Conditions Affecting Work

The Bidders may visit the work site and take such other steps as may be reasonably necessary to ascertain the nature and location of the work, and the general and local conditions which can affect the work. Site visits shall be coordinated with Duke Energy.

4.4 Construction Facilities

- 4.4.1 The work areas required by the Contractor shall be assigned by Duke Energy. The Contractor shall set up office trailer(s) in the approved location on Drawing EBS\_C907.007.002 (Contractor Use Areas). Duke Energy will pay the expense for installing power (240/120 volt) to a trailer set up in the Contractor Trailer area.
- 4.4.2 Laydown and equipment parking shall be limited to the areas specifically identified on Drawing EBS\_C907.007.002 (Contractor Use Areas).
- 4.4.3 If additional facilities are required by the Contractor, they shall be at the Contractor's expense and subject to Duke Energy approvals.
- 4.4.4 The Contractor shall, at its own expense, make the necessary arrangements for the operation, safety, security, and upkeep, and grounds-keeping of office areas,

laydown areas, and parking areas.

4.4.5 The Contractor shall be responsible for monitoring the facility and shall conform to all applicable federal, state, and/or local environmental rules and regulations.

4.4.6 The Contractor is required to submit a Staging and Access Plan which identifies all locations of working and storage trailers, equipment staging areas, and material stockpile areas. The plan must show the proposed haul routes to soil stockpiles, water truck fill port and barge off-loading area (if planned for use). All temporary access roads proposed by the Contractor to access the site which are not shown on the Drawings shall also be included in the plan. Plan shall be submitted as part of Bid submittal.

#### 4.5 Communications

The Contractor shall arrange, provide, and maintain, at its own expense, communication equipment including telephone and internet service required in connection with the Work. Duke will provide radios for on-site use. Contractor will be responsible for returning Duke provided radios and replacing any lost or damaged radios at the end of the project.

#### 4.6 Lighting

When any work is performed when daylight is obscured, the Contractor shall, at its own expense, provide artificial light sufficient to safely perform work and permit inspection of the work area. If the lighting is deemed insufficient by Duke Energy to perform the work safely and effectively, the Owner can stop the work until requested modifications are made. Work hours shall abide by Section 4.20 unless written permission is received from Duke Energy.

#### 4.7 Existing Utilities and Pipelines

4.7.1 Contractor shall be responsible for identification, location, and protection of existing utilities, both above and below grade, within and near work areas.

4.7.2 The accompanying drawings indicate the general location of known existing utilities. Notwithstanding the information shown on the drawings, the Bidder shall satisfy itself as to the exact location of these items on and in the vicinity of the job site.

4.7.3 The Contractor shall take all necessary measures to prevent disturbance and damage to the above items. Temporary utility crossings for construction access shall be avoided but, where necessary, shall be subject to approval by the Duke Energy Engineer.

#### 4.8 Water Supply (for Contractor's use)

4.8.1 Water for construction purposes including soil moisture control and dust control is available for Contractor's use from a truck fill port located at the cooling towers (see drawing EBS\_C907.007.002) . Water containers and the distribution of drinking water to the Contractor's employees will be the responsibility of the Contractor.

4.8.2 Use of water from existing treatment or sediment ponds is prohibited.

#### 4.9 Signs

The Contractor shall, at its own expense, be responsible for all necessary signs within the landfill areas, along other Duke Energy owned roads, and along public roads planned for use. The size, color, lettering, and location of all signs shall be subject to approval of Duke Energy. Signs shall be installed for the following purposes:

- a. Standard road signs
- b. Warning and danger signs
- c. Control signs
- d. Safety signs
- e. Location indication

Additional signs shall not be erected without the approval of the Duke Energy Engineer.

#### 4.10 Refuse Disposal

- 4.10.1 Except as otherwise provided for by the Technical Specifications in Appendix 1 of this specification, the Contractor shall be responsible for the collection and disposal of refuse from the premises and work areas at its own expense. Refuse waste shall be hauled to an appropriately licensed state or county landfill.
- 4.10.2 The Contractor shall periodically perform inspection tours along the haul roads and public roads used by his forces and properly dispose of any construction related refuse found.
- 4.10.3 The dumping of refuse, sewage, oil or toxic waste into any creek or other watercourse shall not be permitted.

#### 4.11 Security

- 4.11.1 The Contractor shall, at its own expense and as may be necessary, assume full responsibility for the security of the work area. Security shall include, at the Contractor's discretion, all fences, lights, guards, flagmen, watchmen and other measures necessary. The above security should provide for the protection of the areas being worked, for the public, and for all persons employed in connection with the work throughout the duration of the Agreement.
- 4.11.2 Contractor personnel are required to enter the work area through station security check-point.

#### 4.12 Electrical Power

Duke Energy will cover the monthly cost of the electricity at no cost to the Contractor. Contractor shall be responsible for all electrical power and other utility costs above those to be provided by Duke Energy.

#### 4.13 Interference with Traffic and Adjoining Properties

- 4.13.1 The Contractor shall conduct its operations in such a manner that interference with traffic or adjoining properties is avoided and the Contractor shall not enter any property other than that of the Owners unless otherwise directed or designated by Duke Energy. The Contractor must coordinate their activities with the Landfill Operations Contractor and Owner, as waste placement may be on-going during the

initial phases of closure and access to stockpiled soils are within the areas used by the Operations Contractor.

4.13.2 The Contractor shall immediately report to Duke Energy, complete details of any complaints received from any property owners.

4.14 Observation Wells and Piezometers

4.14.1 The Contractor shall be held financially responsible for any damage to the well(s), piezometer(s), and associated equipment in and around the work area. In the event damage Duke Energy will retain separate contractors to repair the damage and the closure contractor shall bear the cost of the repair. Contractor is responsible for requesting information on existing equipment and shall not remove any equipment until receiving written approval by Duke Energy.

4.14.2 This equipment includes but is not limited to:

1. Water supply wells
2. Ground water monitoring wells
3. Piezometers
4. Inclinometers
5. Survey Monuments

4.15 Surveys

A Kentucky Registered Land Surveyor will be contracted by the Contractor. Contractor is responsible for any and all surveying needed for the completion of their work.

4.16 Hazardous Substances

4.16.1 The Contractor shall submit a Spill Prevention, Control and Countermeasure (SPCC) Plan to the station environmental coordinator. The SPCC Plan shall be submitted for approval to Duke Energy prior to mobilization. No work, including mobilization, will be allowed to begin until the SPCC is approved by the Owner.

4.16.2 Should there be any release of oils, hazardous material, etc., the Contractor shall immediately contact the station environmental coordinator and the Duke Energy project manager. When appropriate Contractor shall also immediately implement the SPCC Plan and

4.17 Fuel

Contractor's bid price shall include the cost to provide all fuel necessary to operate his equipment throughout the contract period. If the contractor elects to store fuel on-site in temporary facilities, storage shall conform to all applicable federal, state, and local laws and be approved by Duke prior to being placed on site.

4.18 Permits

Contractor shall be responsible for obtaining all state or local permits needed for their work which are not specifically included as part of this Specification.

4.19 Testing

Owner will provide personnel to observe or complete the field testing services required by the CQC Plan and the Technical Specifications. Testing will be in accordance with the CQC Plan and the Technical Specifications. Contractor shall facilitate testing and inspection of his work.

Failure of the Owner or Owner's Representative to identify a construction deficiency does not relieve the contractor of their responsibility to properly construct in accordance with the contract documents.

4.20 Work Hours

Work hours, work days, and locations shall be approved by the Duke Energy Project Manager or Construction Manager. Unless specifically approved by Duke Energy, working hours shall be limited to between 7:00 AM and 7:00 PM local time Monday through Saturday.

5.0 TERMS AND MISCELLANEOUS

5.1 Purchase Order

Project work shall be completed in accordance with the terms and conditions of the Purchase Order authorizing for the work, this bid specification, and the project drawings.

5.2 Extra Work

The Contractor agrees that, in the performance of any extra Work requested by Duke Energy, Contractor's CPE-10 labor rate shall be the amount billed throughout the project. Time sheets for the Work performed, shall be signed on a daily basis. Signed time sheets must accompany related invoices as back up documentation.

6.0 REFERENCE DRAWINGS

6.1 Closure Construction Drawings

Drawing Set Titled: Closure Construction, East CCR Landfill, East Bend Generating Station, Revised May 2021

6.2 East Landfill Permit Drawings

Drawing Set Titled: Landfill Cover System Modification, East Special Waste Landfill East Bend Station, Revised December 2020.

6.3 KYTC Standard Drawings

As referenced.

7.0 BID FORM

7.1 Pricing

Bidders shall submit their quotations on the provided Pricing Proposal page. The pricing proposal page list all the work items for which Duke Energy requests a price to be submitted. Each items shall include all labor, equipment, and material needed to construct the item and the bidder shall input their pricing for each item. Note that the Engineer's quantities are estimates only; contractor is required to verify all quantities of work associated with their bid.

Bidder shall also provide their own estimated quantity for each item. If Bidder

believes a significant deviation exists between Engineer's estimated quantity and the actual quantity of work required, Bidder shall bring the issue to the attention of Duke Energy prior to submitting the bid, to ensure Bidder's understanding of item is correct.

The prices quoted herein will be the basis for payment for all work performed under the Agreement. All prices shall be firm for the duration of the Agreement.

All items listed in the pricing schedule are the Duke Energy's best estimate for the work required, but no guarantee is made that these are all the items needed to complete the project. If after studying the project specifications, CQC Plan, and drawings, the Bidder determines that there is a work item missing, the Bidder shall notify Duke Energy prior to submitting a bid.

#### 7.1.1 Requests for Information and Substitutions

Duke Energy will attempt to respond to Bidder Requests for Information and Requests for Substitutions within 3 working days of contractor submittal. All Bidder Requests for information and Requests for Substitution must be submitted on or before noon of the date listed in Contract Schedule.

Request for substitution must clearly identify to which Item the substitution applies and must include not only alternate product information, **but also a demonstration of equivalency to the original item.**

#### 7.1.2 Bid Alternatives

Bidders may provide bid alternatives with bid submittal. However, Bidder must provide pricing for work as specified in addition to any alternatives proposed. Failure to include pricing as specified is grounds for classification of bid as non-responsive.

#### 7.1.3 Contract Basis

Contract is unit price. Contractor will be incrementally paid based on the unit price bid for each item multiplied by the measured quantity of the item installed and accepted less prior payments for the item. The estimated quantities of the items are not guaranteed and are solely for the purpose of bid comparison and determining an initial Contract Price. Actual quantities of the items shall be measured as described in the Technical Specifications. Items which are measured by area and length shall be measured in Plan View without adjustment for slopes.

#### 7.1.4 Pricing Items

The following list includes a summary description of each pay item listed on the Proposal Page form and indicates which materials and work items are to be included in the price quoted for that item. The summary of each pay item given herein and on the pricing forms is for identification of the pay items only, and is not intended to define the full scope of work covered by that item. The full scope of work is described in the Technical Specifications provided in Appendix 1.

##### 7.1.4.1 Mobilization

Item includes, but is not limited to, mobilizing and demobilizing 100% of all labor, equipment, materials, and any other items necessary to perform the work. This item includes compliance with contract general conditions, installation and removal of

temporary roads, surveying, and other work required by the documents not specifically cover by the pay items.

#### 7.1.4.2 Erosion and Sedimentation Control

Item includes, but is not limited to, preparation of a Storm Water Pollution Prevention Plan (SWPPP), installation of erosion and sedimentation controls, inspection of erosion and sedimentation controls, maintenance of erosion and sedimentation controls, sediment management, establishment of temporary vegetative cover, and final removal of erosion and sedimentation controls. The SWPPP and erosion and sedimentation controls shall address all areas of contractor disturbance for the duration of the Contract. SWPPP shall be provided for Owner review per the Contract Schedule. No work, including mobilization, will be allowed to begin until the SWPPP is approved by the Owner. It is the Bidder's responsibility to maintain and update both the SWPPP and erosion controls as site conditions change.

#### 7.1.4.3 Demolition, Concrete Downdrains

Item includes, but is not limited to, removal of concrete downdrains designated for demolition to include loading, hauling, and transport of the debris to an *appropriately licensed facility*.

#### 7.1.4.4 Demolition, Riprap Downdrains

Item includes, but is not limited to, removal of rip rap downdrains designated for demolition to include loading, hauling, and transport of the debris to an appropriately licensed facility. Material which is suitable for re-use in the stilling basins may be stockpiled and placed as part of the construction contract.

#### 7.1.4.5 Existing Cover Removal & Stockpiling

Item includes, but is not limited to, stripping of existing cover soils to achieve site preparation grades (grade upon which cover system geosynthetics will be installed). This item applies where site preparation grades are not provided on the drawings. Rather, these areas will be stripped to a typical depth, taking care to avoid mixing waste with the soil. Work also includes surveying the areas prior to stripping and re-surveying the areas after stripping is complete. Stripping of adjacent areas outside the excavation limits is not allowed. In the event that stripped material is observed to contain waste, material can be, either, re-used as fill beneath the final cover system geosynthetics or be placed for disposal in the Top Deck area. Only material which is free of waste may be re-used as cover soils above the cover system geosynthetics. Topsoil shall be stockpiled separately from in-organic sub-soils. No additional payment will be made for re-handling of temporarily stockpiled material. Maintaining the stockpiles is incidental to the excavation. No temporary stockpiles shall remain at the completion of work.

#### 7.1.4.6 Excavation and Stockpiling

Item includes, but is not limited to, excavation of material to achieve site preparation grades (grade upon which cover system geosynthetics will be installed) and other grades depicted on the drawings. This item applies where proposed grades are provided on the drawings excluding the Top Deck area. Work includes surveying the areas after excavation. Excavated material containing waste can be, either, re-

used as fill beneath the final cover system geosynthetics or be placed for disposal in the Top Deck area. Only material which is free of waste may be re-used as cover soils above the cover system geosynthetics. Topsoil shall be stockpiled separately from in-organic sub-soils. No additional payment will be made for re-handling of temporarily stockpiled material. Maintaining stockpiled material is incidental to the excavation. No temporary stockpiles shall remain at the completion of work.

#### 7.1.4.7 Excavation and Disposal of Waste Material on Top Deck

Item includes, but is not limited to, excavation of existing waste or mixed soil and waste ; and, placement of the material in the top deck area. Work also includes surveying the areas prior to excavation and re-surveying the areas after stripping is complete. No additional payment will be made for re-handling of temporarily stockpiled material. Maintaining the stockpiles is incidental to the excavation. No temporary stockpiles shall remain at the completion of work.

#### 7.1.4.8 Fill to Site Preparation Grade (excludes top deck)

Item includes, but is not limited to, placement of fill to achieve site preparation grade (grade upon which cover system geosynthetics will be installed). This item applies where site preparation grades are provided on the drawings excluding the Top Deck area. Material can be soil, waste, or mixed soil and waste. Material can be soil excavated as project work, be from designated on-site borrow sources, or can be excavated waste from the top deck. Work includes surveying the areas after fill placement. Dust and moisture control are incidental to the fill placement.

#### 7.1.4.9 Fine Grading

Item includes, but is not limited to, fine grading of the surface upon which the cover system geosynthetics will be installed. This item includes all areas of final cover system installation. This item also includes re-work of the fine grading if erosion occurs prior to deployment of geosynthetics, or if erosion develops on the geosynthetic subgrade following geosynthetic deployment due to Contractor's failure to protect the work. Work shall be completed immediately prior to deployment of cover system geosynthetics and includes grading, smooth drum rolling, and removal of material from the subgrade which is unsuitable.

#### 7.1.4.10 Cover System, Geomembrane, 40 mil LLDPE Textured

Item includes, but is not limited to, providing and installing the cover system geomembrane. Excavation and filling of anchor trenches, providing panel layout plan, and field testing are incidental to the geomembrane installation. Work also includes surveying of surface prior to geosynthetics deployment. No additional payment shall be made for seaming, overlaps, repairs, patches, embedment, cut-offs, rejected material, or material not installed.

#### 7.1.4.11 Cover System, Geocomposite Drainage Net

Item includes, but is not limited to, providing and installing the cover system drainage net. Excavation and filling of anchor trenches, and field testing are incidental to the drainage net installation. Wrapping of Geocomposite drainage net around the bench and slope drains is incidental to drainage net installation. No additional payment shall be made for seaming, overlaps, repairs, patches, embedment, cut-offs, rejected material, or material not installed.



#### 7.1.4.12 Cover System, Infiltration Layer

Item includes, but is not limited to, placing and spreading the soil infiltration layer above the cover system geosynthetic materials. Only material which is free of waste may be used. Excavation and hauling of the material from stockpiles and other on-site borrow sources as well as dust control and moisture control are incidental to the fill placement. Work includes survey of placed fill material.

#### 7.1.4.13 Cover System, Erosion Layer

Item includes, but is not limited to, placing and spreading the soil erosion layer (vegetative layer) above the soil infiltration layer. Only material which is free of waste may be used. Excavation and hauling of the material from stockpiles and other on-site borrow sources as well as dust control and moisture control are incidental to the fill placement. Work includes survey of placed fill material.

#### 7.1.4.14 Seed & Mulch

Item includes establishment of a permanent vegetative cover on the soil erosion layer. Work includes, but is not limited to, fine grading, seed bed preparation, fertilizer, seeding, and mulching. Item also includes establishment of a vegetative cover on all areas disturbed by the contractor both on and off the landfill. Measurement for payment is limited to the area identified for re-vegetation on the drawings. No additional payment shall be made for re-seeding of failed growth areas within the contract warranty period. If erosion or other damage occurs prior to the establishment of satisfactory vegetative cover, such damage shall be repaired and areas revegetated at no additional cost to Owner.

#### 7.1.4.15 Erosion Control Blanket

Item includes, but is not limited to, providing and the specified erosion control blanket on the finished grade of the cover system. No additional payment shall be made for seaming, overlaps, repairs, patches, embedment, cut-offs, rejected material, or material not installed.

#### 7.1.4.16 Haul Road, Granular Base

Item includes, but is not limited to, placing and spreading of the haul road granular base layer. Underlying geotextile installation is incidental to this item. Import of material, proof-rolling, compaction, fine grading, dust control, and surveying surface of placed material are incidental to the stone installation.

#### 7.1.4.17 Haul Road, Granular Wearing Surface

Item includes, but is not limited to, placing and spreading of the haul road granular wearing surface. Import of material, proof-rolling, compaction, fine grading, dust control, and surveying surface of placed material are incidental to the stone installation.

#### 7.1.4.18 Haul Road, Chip and Seal

Item includes, but is not limited to, placing of asphalt seal coats and asphalt seal aggregate on the shoulders of the haul road. Import of material, spreading, compaction, dust control, and surveying limits of placed material are incidental to the item.

7.1.4.19 Perimeter Service Road Restoration

Item includes, but is not limited to, placing and spreading of the granular wearing surface along the existing perimeter road and along the re-aligned service road on the east side of landfill. Installation of geotextile (new portion only), import of material, proof-rolling, compaction, fine grading, dust control, and surveying surface of placed material are incidental to the stone installation.

7.1.4.20 Bench Drain, Bench Drain Pipes, 6-in dia. Perforated

Item includes, but is not limited to, installation of perforated pipes in the groins of the landfill benches. Excavation, backfill, bedding, fittings, joining, and field testing/reporting are incidental to the pipe installation.

7.1.4.21 Slope Drain Pipes, 6-in dia. Perforated

Item includes, but is not limited to, installation of perforated pipes across the landfill slopes. Excavation, backfill, fittings, joining, and field testing/reporting are incidental to the pipe installation.

7.1.4.22 Ditch Drain Pipes, 6-in dia. Perforated

Item includes, but is not limited to, installation of perforated pipes along landfill haul road ditches. Excavation, backfill, fittings, joining, and field testing/reporting are incidental to the pipe installation.

7.1.4.23 Subsurface Drain Pipes, 4-in dia. Perforated

Item includes, but is not limited to, installation of perforated pipes across the landfill haul road. Excavation, backfill, fittings, joining, and field testing/reporting are incidental to the pipe installation.

7.1.4.24 Underdrain Outlet Pipes, 6-in dia. non-perforated

Item includes, but is not limited to, installation of non-perforated underdrain outlet pipes across the landfill benches and at other locations designated on the drawings. Excavation, backfill, fittings, joining, and field testing/reporting are incidental to the pipe installation.

7.1.4.25 Underdrain Outlet Headwalls

Item includes, but is not limited to, installation of pre-cast concrete headwalls at underdrain outlets. Each pipe outlet shall have a headwall. Excavation, backfill, grouting around pipe, and downslope erosion protection stone and geotextile are incidental to the headwall installation.

7.1.4.26 HydroTurf CS (geomembrane and fabric)

Item includes, but is not limited to, providing and installing the HydroTurf System (geomembrane and fabric) excluding the Hydrobinder infill which is paid separately. Excavation and filling of anchor trenches, providing panel layout plan, and field testing are incidental to the system installation. Work also includes surveying of surface prior to geosynthetics deployment. No additional payment shall be made for seaming, overlaps, repairs, patches, embedment, cut-offs, rejected material, or material not installed.

#### 7.1.4.27 Hydrobinder Infill

Item includes, but is not limited to, placing and spreading of the granular hydrobinder infill for the HydroTurf system. Import of material and verification of thickness are incidental to the infill placement.

#### 7.1.4.28 Geomembrane, 30 mil RPE (PE-R)

Item includes, but is not limited to, providing and installing the exposed geomembrane in the landfill perimeter ditch. Excavation and filling of anchor trenches, providing panel layout plan, and field testing are incidental to the geomembrane installation. Work also includes surveying of surface prior to geosynthetics deployment. No additional payment shall be made for seaming, overlaps, repairs, patches, embedment, cut-offs, rejected material, or material not installed.

#### 7.1.4.29 Geomembrane, 60 mil HDPE, Textured

Item includes, but is not limited to, providing and installing the perimeter ditch geomembrane where removed to achieve proposed grades. Excavation and filling of anchor trenches, providing panel layout plan, and field testing are incidental to the geomembrane installation. Work also includes surveying of surface prior to geosynthetics deployment. No additional payment shall be made for seaming, overlaps, repairs, patches, embedment, cut-offs, rejected material, or material not installed.

#### 7.1.4.30 Perimeter Ditch, Channel Lining, Class II

Item includes, but is not limited to, placing and spreading of additional riprap within the re-graded perimeter ditch on east side of landfill. As practical, the existing channel lining material shall be removed, stockpiled, and re-installed. Import of additional material and shaping of stone within the channel are incidental to the stone placement.

#### 7.1.4.31 Gabion Baskets

Item includes, but is not limited to, providing and installing gabion baskets, stone, and on-site assembly at Downdrains C and D. Import of all materials and placement of stone within the baskets are incidental to the gabion basket construction.

#### 7.1.4.32 Top Deck Diversion Berm

Item includes, but is not limited to, placing, shaping, and compaction of the runoff diversion berms on the landfill top deck. Only material which is free of waste may be used. Excavation and hauling of the material from stockpiles and other on-site borrow sources, as well as dust control, are incidental to the fill placement.

#### 7.1.4.33 Stilling Basins, No 8 Stone, Bedding

Item includes, but is not limited to, placing and spreading of bedding stone for the riprap basins. Underlying geotextile (where required), import of material, and fine grading are incidental to the stone placement.

7.1.4.34 Stilling Basins, No. 2 Stone, Run-Out

Item includes, but is not limited to, placing and spreading of stone in the channel downstream of the riprap basins. Underlying geotextile (where required), import of material, and fine grading are incidental to the stone placement.

7.1.4.35 Stilling Basins, Channel Lining, Class IV

Item includes, but is not limited to, placing and spreading of riprap within the stilling basins. Import of material and shaping of stone within the basin are incidental to the stone placement.

8.0 Construction Schedule

As part of bid submittal Contractor shall provide a two part schedule. The first part shall be a list of all major work milestones. Additional milestones are at the discretion of the bidder. The second part shall be a bar graph of the construction schedule showing all work activities to be performed by the Contractor. No compensation shall be made to the Contractor for lost time due to weather.

**APPENDIX 1**

**CONSTRUCTION QUALITY CONTROL PLAN**

**EAST BEND STATION**

**EAST LANDFILL**



East Bend Station, East Landfill  
Construction Quality Control Plan -  
Final Cover  
Boone County, KY  
S&ME Project No. 7217-17-004E

PREPARED FOR:  
**Duke Energy**  
6293 Beaver Rd.  
Union, KY 41091

PREPARED BY:  
**S&ME, Inc.**  
6190 Enterprise Court  
Dublin, OH 43016

**August, 2019**  
**Rev. July, 2020**

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**East Bend Station, East Landfill**  
**Construction Quality Control Plan - Final Cover**  
Boone County, KY  
S&ME Project No. 7217-17-004E

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## 1.0 General

This Construction Quality Control (CQC) Plan has been developed in support of the closure of the East Coal Combustion Residual Landfill (East Landfill) at the East Bend Generating Station in Boone County, Kentucky. The landfill is permitted through the Commonwealth of Kentucky under Permit No. 008-00006.

This plan has been developed in general accordance with:

- The existing permit for the landfill;
- Title 401 KAR Chapter 45 of the Special Waste Landfill Rules for the State of Kentucky;
- Title 401 KAR Chapter 46 of the Coal Combustion Residual Landfill Rules for the State of Kentucky; and,
- 40 CFR Part 257 (US EPA CCR Rules).

The purpose of this plan is to outline the procedures to be used to certify the design and construction of the final cap system construction at the East Landfill. Construction of the bottom liner of all landfill phases and associated leachate collections systems (where applicable) was completed prior to preparation of this plan.

Preparation of this plan was necessitated to maintain construction compliance with the 'Final Rule on Coal Combustion Residuals Generated by Electric Utilities (CCR Rules)' that now governs the landfill construction in addition to the landfill permit from the State of Kentucky. The CCR Rules are effective as of October 19, 2015. The rules require changes to the construction process for the cap placement.

This CQC Plan is written using generic terminology (i.e., "Permitting Agency", "Owner," or "Owner's Representative") rather than actual names or entities.

### 1.1 Scope of the CQC Plan

For each of the constructed components of the landfill, this CQC Plan describes, as applicable, the following:

- Material Requirements;
- Installation Procedures;
- Sampling and testing procedures to be used in the field, and in the lab;
- Required test parameters and frequency;
- Procedures to be followed if a test fails;
- The management structure, experience, & training of the testing personnel; and,
- Contingency plans for anticipated and unanticipated construction difficulties.



## 1.2 Final Cover System Components

The final cap system may include the following components (from bottom to top above the in-place materials):

1. Intermediate Soil Cover System or Waste;
2. LLDPE Geomembrane (Section 2.0);
3. Geocomposite Drainage Layer (Section 3.0);
4. ClosureTurf® System for Downdrains (Section 4.0);
5. Infiltration Layer (Section 5.0); and,
6. Erosion Layer (Section 6.0).
7. Aggregate (Section 7.0);

## 1.3 References to Standards

The CQC Plan and construction drawings includes references, where appropriate, to test procedures and materials of the following organizations:

American Society for Testing and Materials (ASTM).

American Association of State Highway Transportation Officials (AASHTO)

Concrete Reinforcing Steel Institute (CRSI).

Geosynthetics Research Institute (GRI)

Kentucky Transportation Cabinet (KYTC) '*Standard Specifications for Road and Bridge Construction*' (Edition of 2012).

## 1.4 Responsibility and Authority

The principal parties involved in the CQC include the Permitting Agency, the Owner, the Engineer, the Owner's Representative, the Soils CQC Laboratory, the Geosynthetics CQC Laboratory, and the Contractor. The general responsibilities and authorities of each of these parties are described in the following paragraphs. The responsibility and/or authority of a given party may be modified or expanded as dictated by specific project needs during Pre-Construction Meetings. It is understood that the Owner may also serve as the Contractor or Owner's Representative for selected construction elements.

### 1.4.1 Permitting Agency

The Permitting Agency is authorized to issue the permit for construction of the landfill, based on review and acceptance of the permit application, as well as regulatory responsibility for the design, operation, construction,



and closure of the landfill. The Permitting Agency is the Kentucky Department of Environmental Protection, Division of Waste Management (KDEP-DWM).

The Permitting Agency will perform inspections during the construction progress to determine compliance with the approved plans and applicable regulations. KDEP-DWM will be given at least two (2) working days prior notice of completed crucial phases of cap construction. Crucial phases include, but are not limited to: intermediate soil cover system, geomembrane installation, geocomposite drainage layer installation, infiltration layer and erosion layer. KDEP-DWM will also perform a final inspection at the completion of construction.

#### *1.4.2 Owner*

The Owner is responsible for coordination during the permitting, design, bid, and construction phases of the landfill. The Owner is responsible for all correspondence with the Permitting Agency. The Owner also manages the activities of the Engineer and the Owner's Representative. This responsibility includes compliance with the permit and the submission of CQC documentation demonstrating that the facility was constructed in accordance with the design documents. The Owner is also responsible for procuring a Contractor(s) as required for landfill construction.

The Owner has the authority to select and dismiss parties charged with permitting, design, construction, and CQC. The Owner has the authority to accept or reject permitting documents, design plans and specifications, CQC Plans, and CQC reports. The Owner also has the authority to accept or reject the Contractor's materials and/or workmanship.

#### *1.4.3 Engineer*

The Engineer is the firm, retained by the Owner, responsible for preparing permit and design documents for application to the Permitting Agency. The design documents include the CQC Plan construction plans, technical specifications, and other documents which support the design of the landfill. The permit and design documents provide the minimum requirements, and are the governing documents when a material specification contradiction arises.

During construction, the Engineer may be requested to clarify discrepancies in the documents or the CQC Plan, and may approve substantive changes to the design plans or specifications of the facility. Substantive changes include any changes that modify or impact the technical basis for any engineered component of the facility design.

#### *1.4.4 Owner's Representative*

The Owner's Representative is responsible for observing and documenting on-site activities related to the permit and design documents. In general, the responsibilities and authorities of the Owner's Representative include:

- Complete understanding of the permit documents, construction plans, and specifications in relation to all aspects of the CQC Plan.
- Scheduling, coordinating, and performing CQC activities.
- Performing independent on-site observation of the work in progress to assess compliance with the permit and design documents.



- Recognizing and reporting deviations from the CQC Plan, permit documents, design plans, and technical specifications to the Owner.
- Recognizing and reporting deviations in construction from the design and permit documents.
- Secure documents that approve changes to the permit or design documents.
- Verifying that test equipment meets testing and calibration requirements, and that the tests are conducted according to standardized procedures.
- Recording and maintaining test data.
- Identifying CQC tested work that should be accepted, rejected, or further evaluated.
- Verifying that corrective measures are implemented.
- Documenting and reporting CQC activities.
- Collecting the data needed for record documentation.
- Maintaining open lines of communications with other parties involved in the construction.

The Owner's Representative CQC personnel will be on-site as needed to perform construction observation, testing, and reporting in accordance with, and at the frequencies described in this Construction Quality Control Plan and the Technical Specifications. The Owner's Representative quality control (QC) personnel will be on-site on a full-time basis during major construction activities, including during geosynthetic liner installation, during drainage layer placement and during infiltration layer construction.

The Owner's Representative is responsible for issuing certification reports for major construction activities. These certifications shall bear the seal of a Professional Engineer registered in the state of Kentucky. Section 3.0 addresses documentation and construction certification requirements in detail.

The Certifying Professional Engineer is responsible for conducting random inspections to verify the following:

- Adequacy of the work being completed by the Owner's Representative QC personnel;
- Adequacy of the Contractor's work;
- Conformance of the construction to the permit and design documents; and,
- Absence of defects or damage to the materials used for the construction of the landfill systems.

The frequency of such random inspections is a function of the type and quantity of the construction activity being completed; generally, for each 25 days that the Owner's Representative CQC personnel are on-site, the Certifying Professional Engineer will complete one random inspection.

#### *1.4.5 Soils CQC Laboratory*

The Soils CQC Laboratory is responsible for performing the laboratory testing to determine compliance with specific characteristics of the soil materials. The Soils CQC Laboratory is also responsible for providing adequate documentation of analytical results, test methods followed, and testing equipment used. Work of the Soils CQC Laboratory will be reported to the Owner's Representative.

#### *1.4.6 Geosynthetics CQC Laboratory*

The Geosynthetics CQC Laboratory is responsible for performing the laboratory testing required to determine specific characteristics of the geosynthetic materials. The Geosynthetics CQC Laboratory is also responsible for





providing adequate documentation of analytical results, test methods followed, and testing equipment used. Work of the Geosynthetics CQC Laboratory will be reported to the Owner's Representative.

#### *1.4.7 Contractor*

The Contractor, including any subcontractors, is responsible for constructing the components of the landfill. The Contractor may be either the Owner of the landfill, or a construction company retained by the Owner.

### **1.5 Project Meetings**

To achieve a high degree of quality during construction, clear, open channels of communication are essential. All meetings will be open to representatives of the Permitting Agency. The following meetings, which are discussed in more detail in the following sections, may be held as appropriate or when requested by the Owner:

- Resolution Meeting,
- Pre-Construction Meeting,
- Coordination Meetings,
- Progress Meetings, and
- Problem or Work Deficiency Meetings.

#### *1.5.1 Resolution Meeting*

Following the completion of the contract documents, and selection of an Owner's Representative for the project, a Resolution Meeting may be held, at the discretion of the Owner. This meeting shall include the involved parties, including the Owner, Engineer, and the Owner's Representative. The purpose of this meeting is to begin planning for coordination of tasks, anticipate problems that might cause difficulties or delays in construction, and to review the CQC Plan. In particular, requirements for testing, repair, etc., should be known and accepted. The meeting may include the following activities:

- Distribute relevant documents;
- Review critical design details of the project;
- Review the CQC Plan;
- Make appropriate modifications to the CQC Plan;
- Review protocols for testing and reporting;
- Confirm the methods for documenting and reporting, and for distributing documents and reports; and,
- Confirm the lines of authority and communication.

The Owner's Representative will document the meeting. The Resolution Meeting may be combined with the Pre-Construction Meeting described in the following section.

#### *1.5.2 Pre-Construction Meeting*

A Pre-Construction Meeting will be held at the project site. The meeting will be attended by the Owner, the Engineer, the Owner's Representative, the Contractor, the Permitting Agency, and other involved parties, and address the following topics:



- Lines of Communication;
- Distribution of Documents;
- Site Requirements;
- Construction;
- Construction Quality Control Plan;
- Inspections by Permitting Agency;
- Compliance with Approved Plans and Applicable Regulations;
- Project Deliverables, and;
- Invoicing Procedures and Hierarchy.

### *1.5.3 Coordination Meetings*

Whenever necessary, meetings will be held between the Owner's Representative, Contractor, and other involved parties. Those attending will coordinate the work and CQC activities to be completed that day. The Owner's Representative will document the meeting as part of the Owner's Representative's daily record keeping requirements.

### *1.5.4 Progress Meetings*

A weekly progress meeting will be held between the Owner, Owner's Representative, Contractor, and other involved parties as necessary. This meeting will typically be held once every two (2) weeks, but the frequency may be adjusted at the Owner's discretion based on the current and projected rate of work. Those attending will discuss current progress, planned activities, and new business or revisions to the work as part of the Owner's Representative's daily record keeping requirements.

### *1.5.5 Problem or Work Deficiency Meetings*

A special meeting will be held if a problem or deficiency which would impact the construction schedule has been identified or is likely to occur. The meeting will be attended by the Contractor, affected subcontractors, Owner, and Owner's Representative. The purpose of the meeting is to define and resolve the problem or work deficiency as follows:

- Define and discuss the problem or deficiency.
- Review alternative solutions.
- Implement an action plan to resolve the problem or deficiency.

The meeting will be documented by the Owner's Representative, as per the Owner's Representative's daily record keeping requirements. The Owner's Representative will also prepare meeting minutes.

## **1.6 Experience and Training of Key Personnel and Organizations**

The following qualifications shall be required of the key personnel and organizations involved in the construction of the landfill.



### *1.6.1 Owner's Representative*

The Owner's Representative shall be a qualified engineer/engineering firm with experience in construction quality assurance and quality control, particularly on projects involving similar landfill construction. The Owner's Representative shall designate a Certifying Engineer who is a Professional Engineer registered in the Commonwealth of Kentucky. The Certifying Engineer shall be solely responsible for the CQC personnel and their activities, as well as the preparation of the certification reports to certify the project has been constructed in accordance with the CQC Plan, permit documents, approved Permit, design plans, and technical specifications. The Owner's Representative shall be capable of assigning technically qualified personnel for on-site monitoring, as needed. The firm designated as the Owner's Representative shall possess a thorough knowledge of earthwork, geosynthetics and/or landfill construction.

### *1.6.2 Soils CQC Laboratory*

The soils CQC Laboratory shall be experienced in performing laboratory tests to determine soils characteristics as required by this CQC Plan. The soils CQC Laboratory shall demonstrate that it follows the standard test methods listed in the CQC Plan and maintains the appropriate calibrated equipment to perform the tests. The Soils CQC Laboratory shall also demonstrate to the Owner's Representative that it adheres to a formal in-house quality control program, and can provide the required analytical documentation and reports. The testing laboratory shall be AASHTO accredited for all soil test methods performed in support of this CQC Plan.

### *1.6.3 Geosynthetics CQC Laboratory*

The Geosynthetics CQC Laboratory shall be experienced in performing laboratory tests to determine geosynthetic characteristics as required by the CQC Plan. The Geosynthetics CQC Laboratory shall demonstrate that it follows the standard test methods listed in the CQC Plan, and maintains the appropriate calibrated equipment to perform the tests. The Geosynthetics CQC Laboratory shall also demonstrate to the Owner's Representative that it adheres to a formal in-house quality control program, and can provide the required analytical documentation and reports. The Geosynthetics CQC Laboratory shall be accredited by the Geosynthetics Accreditation Institute (GAI), Laboratory Accreditation Program.

### *1.6.4 Contractor*

The Contractor shall be capable of assigning the personnel and equipment required to perform the work within the schedule. The Contractor shall be capable of demonstrating, to the satisfaction of the Owner, successful completion of similar sized landfill construction projects.

The Contractor's subcontractors shall be pre-qualified and approved by the Owner, and shall be specialists in their area of work. The subcontractors shall also be capable of demonstrating, to the satisfaction of the Owner, successful completion of similar sized construction projects.



## 2.0 Geomembrane

This section addresses activities associated with the geomembrane to be used in the final cover system. The geomembrane is to be placed directly over the waste, or directly over the intermediate soil cover where this material is in-place.

### 2.1 Material Requirements

The geomembrane for the landfill cover system will consist of a combination of the following:

1. Primary Geomembrane: 40-mil double-sided textured linear low density polyethylene (LLDPE) geomembrane as defined in the technical specification Section 02672. One side of the geomembrane shall be white. This geomembrane will be utilized with a Geocomposite drainage layer defined in technical specification 02675 and a minimum of 24-inches of cover soil (Section 5.0 and 6.0 of this CQC Plan).
2. Downdrains ~~Only~~ <sup>and Ditches</sup>: 50-mil textured LLDPE structured geomembrane with Super GripNet and integral drainage layer as defined in the technical specification Section 02679. This geomembrane will be utilized with the ClosureTurf® system as defined in the technical specification Section 02680.

The LLDPE geomembrane will be placed directly on the waste material where waste has reached final grades, or on intermediate soil cover if already present over waste material.

### 2.2 Geosynthetic Manufacturer and Contractor

The Geosynthetic Installer is the party responsible for installation of the geomembrane. The manufacturer is the party that supplies the geosynthetic products.

#### 2.2.1 Manufacturer Submittals

The Geosynthetic Installer will submit the following as obtained from the geosynthetic manufacturer to the Owner's Representative:

- ◆ Test data for material and resin for each liner type. The results of these tests must meet the minimum required physical properties for LLDPE geomembrane specified in table 02672-B, or 02679-B of the Technical Specifications;
- ◆ MQC Material Certification for liner rolls and resin used in manufacturing them;
- ◆ Description of spark testing and Manufacturer Quality Control (MQC) Program for testing the geomembrane material and resin. These tests should include those presented in Tables 02672-A, or 02679-A of the Technical Specifications; and
- ◆ Manufacturer's installation instructions.

#### 2.2.2 Contractor Submittals

The Geosynthetic Installer will submit the following to the Engineer prior to installation for review:

- ◆ Proposed geomembrane field panel layout drawings and details, including anchor trenches and connections to inlet/outlet structures (if any);
- ◆ Representative samples of proposed geomembrane material; and



- ◆ Qualifications and resumes of the Geosynthetic Installer superintendent and quality control foreman.

The Geosynthetic Installer will submit representative samples of the proposed geomembrane to the Engineer or a geosynthetic testing laboratory as directed by the Engineer. The Owner's Representative shall perform interface friction testing to evaluate the interface shear strength between the geomembrane and the overlying and underlying materials, as specified in Section 02672 or 02679 of the Technical Specifications.

## 2.3 Geomembrane Material Testing

### 2.3.1 *Manufacturer Quality Control Testing*

The manufacturer shall sample and test the LLDPE geomembrane material prior to shipment to the site, at minimum frequencies specified in 02672-A or 02679-A of the Technical Specifications.

Any engineered sample that does not comply with the requirements of Technical Specifications shall result in rejection of the roll from which the sample was obtained. The Contractor shall replace any rejected roll at no additional cost to the Owner. The Contractor shall require the manufacturer to sample and test each roll manufactured in the same lot or batch, or at the same time, as the failing roll. Sampling and testing of rolls shall continue until acceptable results are established.

### 2.3.2 *Conformance Testing*

The Owner's Representative shall obtain samples of the geomembrane for conformance testing. Samples may be obtained prior to shipment at the manufacturing facility by the manufacturer, Engineer or the geosynthetic laboratory. The minimum number of samples shall be one per 100,000 ft<sup>2</sup> or 1 per lot, whichever provides the larger number of tests. The samples must be representative of the materials supplied and exclude the outer wrap of the engineered turf if evidence of scuffing or other damage is observed. Samples should extend across the full roll width and be at least 3 feet wide.

Representative samples will be sent to a geosynthetics laboratory for conformance testing. The laboratory testing program will be directed by the Engineer and include but is not necessarily limited to the tests described in the following table.



**Table 2-1: Geomembrane Conformance Testing Summary**

Test	Method	Frequency
Thickness	ASTM D5994	One (1) test per 100,000 square feet or one (1) test per lot, whichever is more frequent
Density	ASTM D1505 and/or D 792	
Asperity Height <sup>(1,2)</sup>	ASTM D 7466 or GRI GM 12	
Carbon Black Content <sup>(4)</sup>	ASTM D1603	
Tensile Properties <sup>(3)</sup> (including break strength and break elongation)	ASTM D6693	
Tear Resistance	ASTM D1004	
Puncture Resistance	ASTM D4833	

- (1) Alternate the Measurement side for double sided textured sheet
- (2) For structured geomembrane in the downdrains this Includes measurement of drainage stud height and friction spike height (Super GripNet®).
- (3) Machine direction (MD) and cross machine direction (XMD) average values should on the basis of 5 test specimens each direction.
- (4) For white surface geomembranes, specimen shall be prepared in accordance with GSI White Paper #36 using the 'shaving technique. GSI White Paper #36 is published by the Geosynthetics Research Institute and is available on their website at [www.geosynthetic-institute.org](http://www.geosynthetic-institute.org).

If a representative sample does not comply with the requirements of Section 02672 or 02679 of the Technical Specifications, the roll of geomembrane that is in non-conformance shall be replaced at no additional cost to the Owner. The Geosynthetic Installer shall perform additional conformance testing on the closest numerical roll on both sides of the failed roll. Sampling and testing of rolls shall continue until acceptable results are established.

The Owner's Representative shall monitor the rolls upon delivery to the site and report observed deviations from the requirements of the Technical Specifications to the Contractor. At their discretion, the Owner's Representative may sample rolls from each shipment of geomembrane delivered to the site.

## 2.4 Geomembrane Installation

### 2.4.1 Meetings

A geomembrane pre-construction meeting will be held prior to installation. At a minimum, the Contractor, Geosynthetic Installer, Owner and Owner's Representative will be in attendance. The Technical Specifications, design drawings and quality control procedures will be reviewed and discussed.

### 2.4.2 Inspections

The Permitting Agency (KDEP-DWM), shall be given at least two (2) working days prior notice to the planned start of geomembrane installation for performance of an inspection.



### *2.4.3 Field Panel Identification*

The Geosynthetic Installer shall number each panel with an identification code using the format P1, P2, etc. Panels in the field must be numbered in the order in which the panels are actually laid regardless of pre-construction numbering. The Owner's Representative will record the location and date of installation of each panel using the identification code.

### *2.4.4 Field Seaming*

Field seaming shall be in accordance with US EPA. Technical Guidance document: "The Fabrication of Polyethylene FML Field Seams" EPA/530/SW-89/069, the manufacturer's recommendations and/or according to the Technical Specifications, whichever is more stringent. Seaming may be extrusion or fusion welding or a combination of these methods. The Engineer reserves the right to reject any proposed seaming method believed to be unacceptable. Additional concepts and requirements of proper field seaming are found in the Technical Specifications.

Adjoining liner panels shall be overlapped as recommended by the manufacturer, but not less than 4 inches, by adequately lapping the edges of the sheets. The overlap shall not exceed 6 inches for double-wedge fusion welds.

Section 02672 and 02679 of the Technical Specifications provides more in-depth details on the requirements for liner handling, placement, field seaming, and installation in general.

### *2.4.5 Trial Seams*

Contractor shall perform a trial seam in the morning and afternoon for each machine/welder combination. A trial seam is also required if there is a change of machine or welder, a loss of power for the machine or any prolonged idle period during the day. The Owners Representative or his representative may request additional trial seams at his discretion.

The trial seam should be approximately 5 feet long. A sample will be collected from the trial seam near the center of the sample. The welder, date, time and equipment, as well as ambient temperature, welding temperature, and seaming parameters will be recorded in the Geomembrane Trial Seam Log by the Owners representative for each trial seam.

A minimum of ten specimens from each sample will be tested; five in peel and five in shear. All tested seams shall be Film Tear Bond (FTB) type failures to qualify as acceptable seams. Testing will be performed in the field by the Contractor under the observation of the Owners Representative.

All trial seams must pass the seam strength requirements presented in Technical Specifications 02672-B or 02679-B.

### *2.4.6 Seam Monitoring*

During seaming, the Owner's Representative will observe the seams for the proper preparation, grinding technique and for evidence of overheating. Where observations indicate that repairs are needed, the method of repair will be determined in the field by the Owner's Representative. The repairs will be logged in the Geomembrane Repair Testing Log by the Owner's Representative.



At the discretion of the Owner's Representative, coupons may be cut from the end of the extrusion seams and the bottom side of the seam will be observed for visible warping or deformation.

The Owner's Representative will observe the geomembrane during the cooler parts of the day to check for slack. Any areas where "trampolining" occurs will be marked and logged in the Geomembrane Defect Log by the Engineer for repair by the Geosynthetic Installer.

All repair locations shall be patched and tested in accordance with Section 02672 of the Technical Specifications prior to acceptance. All patches shall extend a minimum of 6 inches beyond the repair location. All repairs will be logged in the Geomembrane Repair Testing Log by the Owner's Representative.

#### *2.4.7 Non-Destructive Testing*

The Geosynthetic Installer is responsible for the completion of non-destructive testing of the entire length of field seams. The testing will be vacuum, air pressure and/or spark testing as outlined in the Technical Specifications.

Non-destructive testing will be monitored by the Owner's Representative on a full-time basis.

#### *2.4.8 Destructive Testing*

Destructive seam samples will be obtained by the Owner's Representative and tested by the Geosynthetics Laboratory. Testing frequency is at least one sample per 500 cumulative linear feet of field seam at locations specified by the Owner's Representative. The name of the sample (e.g. LDT-1), date, time, equipment, seam number, and seaming parameters will be marked on each sample and recorded by the Owner's Representative in the Geomembrane Defect Log. Test samples will be at least 39 inches long and 12 inches wide.

A minimum of five peel specimens will be tested for each sample in accordance with ASTM D6392. At least five specimens from each sample will be tested for bonded shear strength in accordance with ASTM D6392. Peel tests will be performed on both sides of a double-wedge fusion seam.

All destructive tests seams must meet the requirements presented in Technical Specifications 02672 or 02679.

#### *2.4.9 Repair Procedures and Verification*

The Geosynthetic Installer shall visually inspect the geomembrane surface for defects. Portions of the geomembrane exhibiting defects, or failing a destructive or nondestructive test, must be repaired by the Geosynthetic Installer. Repairs shall be made in accordance with the Technical Specifications.

Each liner repair shall be recorded by the Owner's Representative in the Geomembrane Repair Testing Log including the date of repair, liner panel identification number, repair location, type of defect, cause of defect, and details of repairs made. Each repaired area shall be required to pass non-destructive testing. Large repair areas may require additional destructive test sampling.





#### *2.4.10 Acceptance and Closeout Procedures*

The Contractor is responsible for providing a record drawing of each layer of geomembrane installation. The record drawings shall include panel corners, transitions in panel geometry, repair locations, the outside bottom corner of the anchor trench, and other significant features. Survey timing should be coordinated with the Geosynthetics Installer and the Owner's Representative so as not to impact the construction schedule of the geosynthetics. The record drawing does not require certification by a Professional Surveyor.

The Geosynthetic Contractor's installation supervisor shall observe and check all phases of the geomembrane installation. The Contractor will retain all ownership and responsibility for the geomembrane until acceptance by the Owner. The Owner shall accept the geomembrane after:

- installation and repair are complete,
- record drawings has been submitted, and
- Owner's Representative has received and accepted all necessary documentation for the installation in accordance with requirements of the Quality Assurance Plan.

When the geomembrane is finally accepted by the Owner, the Geosynthetic Contractor shall submit a Letter of Acceptance to the Owner that the installation conforms to the requirements of the Manufacturer.

The Geosynthetic Contractor shall provide a one (1) year non pro-rata written warranty, beginning on the date of the Letter of Acceptance from the Owner, on materials and installation workmanship including joints, penetrations, seams and connections, whether prefabricated or constructed in the field for the geomembrane.



## 3.0 Geocomposite Drainage Layer

Geocomposite drainage layers are incorporated as part of the cover system in all areas where the 40 mil textured LLDPE geomembrane is installed.

### 3.1 Materials

The geocomposite drainage layer shall consist of an HDPE geonet drainage core with nonwoven geotextiles heat bonded to each side.

### 3.2 Geocomposite Manufacturer and Contractor

The Geosynthetic Installer is the party responsible for installation of the geocomposite material. The manufacturer is the party that supplies the geosynthetic products.

#### 3.2.1 *Manufacturer Submittals*

The Geosynthetic Installer will submit the following as obtained from the geosynthetic manufacturer to the Owner's Representative:

- ◆ Manufacturer's product information and manufacturer quality control test results. The results of these tests must meet the minimum required physical properties for geocomposite specified in Table 02675-B of the Technical Specifications; and
- ◆ Manufacturer's installation instructions.

#### 3.2.2 *Contractor Submittals*

The Geosynthetic Installer shall submit representative samples of the geocomposite material to the Engineer or a geosynthetic testing laboratory as directed by the Engineer. The Owner's Representative shall perform interface friction testing and transmissivity testing on the representative samples to evaluate the proposed materials are in compliance with Section 02675 of the Technical Specifications.

## 3.3 Geocomposite Material Testing

### 3.3.1 *Manufacturer Quality Control Testing*

The manufacturer shall sample and test the geocomposite material prior to shipment to the site, at minimum frequencies specified in Table 02675-A of the Technical Specifications.

Any geocomposite sample that does not comply with the requirements of Section 02675 of the Technical Specifications shall result in rejection of the roll from which the sample was obtained. The Contractor shall replace any rejected roll at no additional cost to the Owner. The Contractor shall require the manufacturer to sample and test each roll manufactured in the same lot or batch, or at the same time, as the failing roll. Sampling and testing of rolls shall continue until acceptable results are established.



### 3.4 Conformance Testing

The Owner’s Representative shall obtain samples for conformance testing. Samples may be obtained prior to shipment at the manufacturing facility by the manufacturer, Owner’s Representative or the geosynthetic laboratory. The minimum number of samples shall be one per 100,000 ft<sup>2</sup> or 1 per lot, whichever provides the larger number of tests. Samples should extend across the full roll width and be at least 3 feet wide.

Representative samples will be sent to a geosynthetics laboratory for conformance testing. The laboratory testing program will be directed by the Engineer and include but is not necessarily limited to the tests in the following table.

**Table 3-1: Geocomposite Conformance Testing Summary**

Test	Method	Frequency
Thickness	ASTM D5199	One (1) test per 100,000 square feet or one (1) test per lot, whichever is more frequent.
Density	ASTM D1505	
Bond Strength (Ply Adhesion)	ASTM D7005	
Transmissivity	ASTM D4716	One (1) test per 1,000,000 square feet or one (1) test per lot, whichever is more frequent.

If a representative sample does not comply with the requirements of Section 02675 of the Technical Specifications, the roll of geocomposite material that is in nonconformance shall be replaced at no additional cost to the Owner. The Geosynthetic Installer shall perform additional conformance testing on the closest numerical roll on both sides of the failed roll. Sampling and testing of rolls shall continue until a pattern of acceptable results is established.

The Owner’s Representative shall monitor the geocomposite rolls upon delivery to the site and report observed deviations from the requirements found in Section 02675 of the Technical Specifications to the Contractor. At the Owner’s Representative’s discretion, the Owner’s Representative will sample rolls from each shipment of geocomposite delivered to the site.

### 3.5 Geocomposite Installation

Each component of the geocomposite shall be secured or seamed to the like component at overlaps. The geocomposite shall be joined and repaired according to Section 02675 of the Technical Specifications. The Owner’s Representative will observe geocomposite installation and repairs.

#### 3.5.1 Inspections

The Permitting Agency (KDEP-DWM), shall be given at least two (2) working days prior notice to the planned start of geocomposite installation for performance of an inspection.



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### **3.6 Acceptance and Closeout Procedures**

The Geosynthetic Contractor shall provide a one (1) year non pro-rata written warranty, beginning on the date of the Letter of Acceptance from the Owner, on materials and installation workmanship including joints, penetrations, seams and connections, whether prefabricated or constructed in the field for the geocomposite.



## 4.0 ClosureTurf® System

This section addresses activities associated with the installation of the engineered turf and sand infill components of the ClosureTurf® system proposed for use in ~~at down drain locations only~~. The engineered turf and sand infill are only to be used at the down drain locations in conjunction with the 50-mil textured LLDPE structured geomembrane (MicroDrain®).

and ditches.

The following section addresses the engineering properties and installation of the engineered turf and sand infill layer for the ClosureTurf® system. Engineering properties and installation requirements for the LLDPE structured geomembrane are included in Section 2.0 of this CQC Plan and Technical Specification 02679.

### 4.1 Material Requirements

The geomembrane for the ClosureTurf® system will consist of a 50-mil LLDPE structured geomembrane. The bottom of the geomembrane (placed against the waste) will be textured with Super GripNet®. The top of the geomembrane (against the engineered turf) will be structured with the drainage studs.

Above the geomembrane is an engineered turf layer consisting of two polypropylene woven geotextiles tufted with polyethylene yarns overlying the 50 mil LLDPE structured geomembrane. The polyethylene yarn shall conform to the color selected by the owner at the time of construction. The properties for the engineered turf are defined in Tables 02680-A and 02680-B of technical specification 02680.

All sand placed for the closure turf down drains shall consist of HydroBinder® infill.

The HydroBinder infill is a cementitious infill and shall meet the requirements of Technical Specification 02680.

### 4.2 Geosynthetic Manufacturer and Contractor

The Geosynthetic Installer is the party responsible for installation of the ClosureTurf® system. The manufacturer is the party that supplies the geosynthetic products.

#### 4.2.1 Manufacturer Submittals

The Geosynthetic Installer will submit the following as obtained from the geosynthetic manufacturer to the Owner's Representative:

- ◆ Certificate of Compliance that shows proposed material for this project will meet the project specifications;
- ◆ Indicate tentative product order date and manufacturer location;
- ◆ Provide representative manufacturer Product Data sheets;
- ◆ Provide manufacturer's quality control program, including test procedures and frequencies for this product, and
- ◆ Manufacturer's installation instructions.

#### 4.2.2 Contractor Submittals

The Geosynthetic Installer will submit the following to the Engineer prior to installation for review:



- ◆ Proposed ClosureTurf® downdrain system field panel layout drawings and details, including anchor trenches and transitions to existing concrete structures;
- ◆ Qualifications and resumes of the Geosynthetic Installer superintendent and quality control foreman.
- ◆ Contractor shall provide documentation of proposed hydrobinder supplier and test results required by Technical Specification 02680.

### 4.3 ClosureTurf® Material Testing

#### 4.3.1 Manufacturer Quality Control Testing

The manufacturer shall sample and test the engineered turf material prior to shipment to the site, at minimum frequencies specified in Table 02680-A of Section 02680 of the Technical Specifications.

Any engineered turf sample that does not comply with the requirements of Technical Specifications shall result in rejection of the roll from which the sample was obtained. The Contractor shall replace any rejected roll at no additional cost to the Owner. The Contractor shall require the manufacturer to sample and test each roll manufactured in the same lot or batch, or at the same time, as the failing roll. Sampling and testing of rolls shall continue until acceptable results are established.

#### 4.3.2 Conformance Testing

##### 4.3.2.1 Engineered Turf

The Owner’s Representative shall obtain samples for conformance testing. Samples may be obtained prior to shipment at the manufacturing facility by the manufacturer, Engineer or the geosynthetic laboratory. The minimum number of samples shall be one per 400,000 ft<sup>2</sup> or 1 per lot, whichever provides the larger number of tests. The samples must be representative of the materials supplied and exclude the outer wrap of geomembrane if evidence of scuffing or other damage is observed. Samples should extend across the full roll width and be at least 2 feet wide.

Representative samples will be sent to a geosynthetics laboratory for conformance testing. The laboratory testing program will be directed by the Engineer and include but is not necessarily limited to the tests described in the following table.

**Table 4-1: Engineered Turf Conformance Testing Summary**

Test	Method	Frequency
Total Product Weight	ASTM D5261	One (1) test per 400,000 square feet or one (1) test per lot, whichever is more frequent
CBR Puncture	ASTM D6241	
Tensile Strength of Product (XD/MD) <sup>(1)</sup>	ASTM D4595	
Tensile Strength of Yarn	ASTM D2256	

(1) Machine direction (MD) and cross machine direction (XMD) average values should on the basis of 5 test specimens each direction.



If a representative sample does not comply with the requirements of Section 02680 of the Technical Specifications, the roll of engineering turf that is in non-conformance shall be replaced at no additional cost to the Owner. The Geosynthetic Installer shall perform additional conformance testing on the closest numerical roll on both sides of the failed roll. Sampling and testing of rolls shall continue until acceptable results are established.

The Owner's Representative shall monitor the rolls upon delivery to the site and report observed deviations from the requirements of the Technical Specifications to the Contractor. At their discretion, the Owner's Representative may sample rolls from each shipment of engineered turf delivered to the site.

#### 4.3.2.2 Sand Infill - Hydrobinder®

HydroBinder® is a proprietary cementitious product used as an infill component of the ClosureTurf® system. Conformance testing of the HydroBinder® with cementitious infill is not required.

The infill material may be delivered in either pallet form of 80 lb. bags or 3000 lb. bulk super sacks. Cement, except as otherwise specified herein, will be a brand of Portland Cement, meeting ASTM C 150 and will be Type I or Type II. Only one brand of cement will be used throughout the duration of this Contract. The cementitious infill mix design will conform to the requirements of ASTM C 387 for high strength mortars. The cementitious infill mix will have a minimum 28 day compressive strength of 5000 psi per ASTM C109 / C109M.

Verification of the compressive strength will be completed by the manufacturer and a certified test report supplied with each batch/lot of Hydrobinder® material delivered to the site.

Gradation documentation shall be provided by the supplier of the Hydrobinder® product. No additional on-site conformance testing is required. Samples can be obtained for gradation testing (ASTM D6913) at the discretion of the Owner's Representative.

## 4.4 **Engineered Turf Installation**

### 4.4.1 *Inspections*

The Permitting Agency (KDWP-DWM), shall be given at least two (2) working days prior notice to the planned start of closure turf installation for performance of an inspection.

### 4.4.2 *Field Panel Identification*

The Geosynthetic Installer shall number each panel with an identification code using the format T1, T2, etc. The numbering shall use a method that will no longer be visible following sand installation. Panels in the field must be numbered in the order in which the panels are actually laid regardless of pre-construction numbering. The Owner's Representative will record the location and date of installation of each panel using the identification code.



#### *4.4.3 Field Seaming*

Engineered turf can be seamed using the fusion seaming method or the sewn seam method. Section 02680 of the Technical Specifications details the requirements for turf handling, placement, field seaming, and installation in general.

#### *4.4.4 Trial Seams*

Contactor shall perform a trial seam for each machine/welder combination as follows:

1. At daily start-up;
2. Every 5 hours of operations after start-up;
3. Immediately after any break;
4. Anytime the machine is turned off form more than 30 minutes.

The Owners Representative or his representative may request additional trial seams at his discretion. The trial seam should be approximately 3 feet long and at least 12 inches wide. A sample will be collected from the trial seam near the center of the sample. The welder, date, time and equipment, as well as ambient temperature, welding temperature, and seaming parameters will be recorded in the Engineered Turf Trial Seam Log by the Owners representative for each trial seam.

All trial seams must comply with the 'Visual Passing Criteria' discussed in Technical Specifications 02680. Additional trial seam requirements are included in Technical Specification 02680.

#### *4.4.5 Seam Monitoring*

During seaming, the Owner's Representative will observe the seams for the proper preparation, overlap and for evidence of overheating. Where observations indicate that repairs are needed, the method of repair will be determined in the field by the Owner's Representative.

All repair locations shall be patched and tested in accordance with Section 02680 of the Technical Specifications prior to acceptance. All repairs will be logged in the Engineered Turf Repair Testing Log by the Owner's Representative.

#### *4.4.6 Repair Procedures and Verification*

The Geosynthetic Installer shall visually inspect the engineered turf surface for defects. Portions of the engineered turf exhibiting defects, must be repaired by the Geosynthetic Installer. Repairs shall be made in accordance with Section 02680 of the Technical Specifications.

Each liner repair shall be recorded by the Owner's Representative in the Engineered Turf Repair Testing Log including the date of repair, liner panel identification number, repair location, type of defect, cause of defect, and details of repairs made.

#### *4.4.7 Acceptance and Closeout Procedures*

The Contractor is responsible for providing a record drawing of both the geomembrane and engineered turf layers for the ClosureTurf® installation. The record drawings shall include panel corners, transitions in panel





geometry, repair locations, the outside bottom corner of the anchor trench, and other significant features. Survey timing should be coordinated with the Geosynthetics Installer and the Owner’s Representative so as not to impact the construction schedule of the geosynthetics. The record drawing does not require certification by a Professional Surveyor.

The Geosynthetic Contractor’s installation supervisor shall observe and check all phases of the geomembrane installation. The Contractor will retain all ownership and responsibility for the geomembrane until acceptance by the Owner. The Owner shall accept the geomembrane after:

- installation and repair are complete,
- record drawings has been submitted, and
- Owner’s Representative has received and accepted all necessary documentation for the installation in accordance with requirements of the Quality Assurance Plan.

When the geomembrane is finally accepted by the Owner, the Geosynthetic Contractor shall submit a Letter of Acceptance to the Owner that the installation conforms to the requirements of the Manufacturer.

The Geosynthetic Contractor shall provide a one (1) year non pro-rata written warranty, beginning on the date of the Letter of Acceptance from the Owner, on materials and installation workmanship including joints, penetrations, seams and connections, whether prefabricated or constructed in the field for the geomembrane.

#### 4.5 Hydrobinder® Installation

The Hydrobinder® shall be installed only after an area has been approved by the Owner’s Representative. Installation requirements for the Hydrobinder® is included in the Section 02680 of the Technical Specifications.

The Owner’s Representative will complete thickness measurements using a digital caliper at a minimum rate of 20 locations per acre. The Hydrobinder® installation thickness requirements are summarized in Table 5-3.

**Table 4-2: Sand Infill Thickness Verification Summary**

Product	Minimum Thickness	Maximum Thickness	Verification
Hydrobinder®	0.75 inches	1.0 inch	20 measurements per acre

##### 4.5.1 *Equipment on ClosureTurf®*

Equipment travel on top of the ClosureTurf® system is restricted both before and after sand infill installation. Allowable equipment, ground pressures and tire pressures are detailed in Technical Specification 02680.



## 5.0 Infiltration Layer

### 5.1 Material

The infiltration layer will consist of on-site or off-site soils which are free of organic material refuse or debris placed directly over the geosynthetic liner system components. The infiltration layer thickness shall be a minimum of 18 inches. Additional material requirements are included in Specification 02320, Backfill, Fill Type ~~S1~~.

S2

### 5.2 Construction

Placement of the infiltration layer will be placed in 2 lifts. The soil shall be placed in accordance with the requirements of Section 6.3. The initial lift must be at least 12 inches and no greater than 15 inches thick. The second lift should be approximately 6 inches thick. The soil shall be spread and compacted using a low ground pressure dozer. The Owner's Representative will monitor operational cover placement on a full-time basis.

Wrinkles in the underlying geosynthetics resulting from protective cover placement will be "walked out" prior to additional protective cover placement. Excessive wrinkles will be observed by the Owner's Representative for possible repair by the Geosynthetic Installer.

When placing protective soil cover, do not drive directly on the geosynthetic materials. Only use equipment to place, spread, and compact infiltration layer that produces ground pressures compliant with the following section.

#### 5.2.1 Inspections

The Permitting Agency (KDEP-DWM), shall be given at least two (2) working days prior notice to the planned start of infiltration layer installation for performance of an inspection.

### 5.3 Placement of Soil on Drainage Layer

The Contractor will be required to place all soil materials located on top of a geotextile in such a manner as to ensure the following:

- The geotextile and underlying material are not damaged;
- Minimal slippage occurs between the geotextile and underlying layers; and,
- Excess stresses are not produced in the geotextile.

Unless otherwise specified by the Engineer, a minimum thickness of 12 inches of soil will be required between low ground-pressure equipment and the geotextile. The CQA Manager will perform close inspection of the placement and spreading of any soils over the geotextile with earthmoving equipment.

Equipment used for placing the overlying material on the geosynthetics shall conform to the maximum ground pressure limitations in the following table.



**Table 5-1 – Equipment Ground Pressure Restrictions on Soil Placement above Geosynthetics**

Thickness of Material above Geomembrane (in)	Maximum Equipment Ground Pressure (psi)
<12	Equipment not permitted
12 -24	< 10

## 5.4 Testing

### 5.4.1 In-Place Testing

In-place testing of the infiltration layer is not required. However, the Owner’s Representative will monitor infiltration layer placement and can request additional passes of the low-ground pressure dozer at their discretion.

### 5.4.2 Laboratory Testing

Bulk samples of the infiltration layer are not required to be collected. However, the Owner’s Representative can collect samples at their discretion if suspicious soils are encountered based on look or smell. Testing for loss-on-ignition (LOI) can be performed by the Owner’s Representative. If greater than 3% organics, as determined by weight, is found in the soil, the material will be rejected for use in the infiltration layer.



## 6.0 Erosion Layer

### 6.1 Material

The erosion layer will consist of on-site or off-site soils which are capable of supporting vegetation. The infiltration layer thickness shall be approximately 6 inches. In all locations, the infiltration layer and erosion layer must be a minimum of 24-inches thick. Additional material requirements are included in Specification 02320, Backfill, Fill Type S5.

### 6.2 Construction

Placement of the erosion layer can be completed a single lift by spreading with a dozer. The soil shall be placed in accordance with the requirements of Section 6.3. The Owner's Representative will monitor the erosion layer placement on a full-time basis.

#### 6.2.1 Inspections

The Permitting Agency (KDEP-DWM), shall be given at least two (2) working days prior notice to the planned start of erosion layer installation for performance of an inspection.

### 6.3 Testing

#### 6.3.1 In-Place Testing

In-place testing of the infiltration is not required. However, the Owner's Representative will monitor infiltration layer placement and can request additional passes of the low-ground pressure dozer at their discretion.

#### 6.3.2 Laboratory Testing

Bulk samples of the erosion layer are not required to be collected. The material placed for the erosion layer must contain organics as determined based on look and smell. At their discretion, the Owner's Representative can collect samples if the presence of organics is in question. Testing for loss-on-ignition (LOI ASTM D7348) can be performed by the Owner's Representative. If less than 2% organics, as determined by weight, is found in the soil, the material will be rejected for use in the erosion layer.

### 6.4 Seeding

A vegetative cover shall be established on the erosion to minimize erosion of the soil cover and reduce run-off velocities.

#### 6.4.1 Materials Requirements and Application Rates

##### 6.4.1.1 Seed

After the topsoil has been prepared, the seed mix will be applied at the following per acre rates:

- ◆ 16 lbs. Red Fescue (*Festuca rubra*);
- 40



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- ◆ 12 lbs. Indian grass (*Sorghastrum nutans*);
- ◆ 10 lbs. Kentucky Bluegrass (*Poa pratensis*);
- ◆ 8 lbs. Perennial Ryegrass (*Lolium perenne*);
- ◆ 8 lbs. Little Bluestem (*Andropogon gerardii*);
- ◆ 4 lbs. White Clover (*Trifolium repens*).

For fall applications also include 30 lbs. of Winter Rye (*Secale cereale*); or, for spring applications include 10 lbs. of Annual Ryegrass (*Lolium multiflorum*).

and Summer

The varieties of grass seed to be furnished shall bear a tag on each bag showing species, lot number, grower's name, the percent of purity, the percent of germination, and the weed content. Tags shall be provided to the Owner's Representative.

All seeds shall be free from noxious weeds and under no condition shall the total weed content of any lot of seed or seed mixture exceed one-half of one percent by weight.

No seed shall be utilized which has a mix date older than one year. The Owner reserves the right to test, reject, or approve any and all seed after delivery.

#### 6.4.1.2 Fertilizer

Commercial grade 10-20-10 fertilizer shall be applied at a minimum rate of 500 pounds per acre.

#### 6.4.1.3 Mulch

All mulch material shall be free from mature seedbearing stalks, roots, and noxious or prohibited weeds. Alfalfa, clover, and salt grass hay are not acceptable. Straw mulch shall include baled wheat, oats, or straw. It shall be dry and reasonably free of weeds, stalks, or other foreign material. Mulch shall be applied at a minimum rate of 2 tons per acre.

#### 6.4.2 *Handling and Placement*

Establishment of a vegetative cover shall begin as soon as possible after the placement of soil cover materials.

Fertilizer shall be spread uniformly over all areas to be seeded and the areas then loosened by discing, harrowing, or other approved methods immediately prior to seeding. The soil shall be loosened to a depth of approximately three inches.

Seed shall be sown immediately following preparation of the area for seeding. Seed shall be sown by methods which provide for uniform distribution of the seed mix. After broadcasting or otherwise applying the seed, the surface of the seedbed shall be raked, culti-packed, or brush dragged very lightly. All raking shall be done in a direction parallel to contour lines.

Mulch shall be applied to the sown area within 24 hours of seeding and spread to a uniform depth. A mechanical blower may be used to apply mulch material, provided the machine has been specifically designed and approved



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for this purpose. Machines which cut mulch into short pieces shall not be permitted. Mulch shall be placed in a moist condition or shall be sprinkled immediately after placement.

## **6.5 Inspection and Repair**

The Owner or Owner's Representative shall inspect and document the vegetative cover between the period of 5 and 7 months after the sowing of seed and again between the period of 11 and 13 months after the sowing of seed. If during the second inspection any areas larger than 100 square feet having less than 40% vegetative cover are identified, the areas shall be revegetated within 30 days of the completion of the inspection.



## 7.0 Aggregate

This section applies to aggregate used in the following locations, or any other aggregate designated on the drawings or construction documents:

1. Aggregate bedding for the underdrains of the final cap system,
2. Aggregate for construction of the haul road,
3. Aggregate for the ditch transitions at the base of the haul road,
4. Any other areas where aggregate is placed in the final cover system that is not specifically identified within this section.

Construction quality control for the aggregate shall be in accordance with the requirements of Section 8.0 of this Construction Quality Control Plan.

### 7.1 Material Requirements

The aggregate material will be a well-graded, clean rock obtained from a source included on the Kentucky Transportation Cabinet (KYTC) Aggregate Source List and shall be free from fines, frozen material, and deleterious substances.

The aggregate material for the underdrains within the final cap system shall be consistent with the requirements for KYTC Section 805 for Gradation Size No. 57. Material shall consist of uncrushed aggregate. Crushed or partially crushed aggregate is not permitted.

The aggregate material for the underdrain outlets shall also consist of Granular Base material consisting of KYTC Section 805, Gradation Size No. 2.

The aggregate material for the haul road above the final cover system shall consist of 6-inches of KYTC Section 805.06, Crushed Stone Base above 6-inches of Granular Base material consisting of KYTC Section 805, Gradation Size No. 2.

The aggregate material for the landfill ditch transitions at the bottom of the haul road shall consist of KYTC Section 805, Gradation Size No. 8 for bedding stone, Channel Lining Class III or Channel Lining Class II as detailed in the drawings.

### 7.2 Sampling and Testing Procedures

If aggregate material is obtained from a source included on the KYTC Aggregate Source List, sampling and testing of the aggregate described herein will not be required. If aggregate is obtained from a source not included on the KYTC Aggregate Source List, the sampling and testing described in this section shall be required.

Before the aggregate material is delivered to the site, the material will be pre-qualified to verify that it meets the material specifications, which are described in Section 8.1. The Contractor shall submit a sample of the proposed aggregate material to the Owners Representative for review. The Contractor shall also identify the proposed source for the aggregate material.



After approval is received and the materials is shipped to the site, representative aggregate samples will be collected from on-site stockpiles at a rate of at least one (1) sample per every three-thousand (3,000) cubic yards of material that will be used in the construction. Each sample will be tested in the Soils CQC Laboratory to determine the following soil properties:

- Grain size distribution in accordance with ASTM D-422 for the sieve method.

The laboratory testing will be compare to the properties described in Section 8.1 for compliance.

### 7.2.1 Test Results

The results of the pre-qualification testing shall be evaluated in accordance with the following procedure:

- If the test values for each sample meet or exceed the material requirements identified in Section 8.2 of this CQC Plan, the sample passes.
- If the test values for each sample do not meet the material requirements in Section 8.1, additional evaluation procedures will be implemented by the Owner's Representative. The following additional tests required for further evaluation shall be completed at the expense of the Contractor:
  - ◆ For the failing parameter(s), perform two (2) additional test on the sample. These tests may be performed by another Soils CQC Laboratory at the discretion of the Owner's Representative, and the Owner.
  - ◆ If both the re-test values for the additional test meet material requirements, the sample passes.
  - ◆ If one (1) or both of the samples fail to meet the material requirements, the Owners Representative will direct the Contractor to identify a new source for the material.

### 7.2.2 Test Reports

The soils CQC Laboratory shall report the results of all testing to the Owner's Representative. The Owner's Representative shall review the results, verify the suitability of the material for use in the construction, and submit the results to the Owner.

## 7.3 Placement

Granular Wearing Surface material shall be placed in accordance with KYTC Section 302.

Granular Base Material shall be placed and compacted with a minimum of four coverages of a steel drum roller.

The aggregate shall be placed to the minimum lines, grades and thicknesses as shown on the drawing. Aggregate placement shall be completed using equipment that complies with ground pressure requirements listed in the CQC Plan and the Technical Specifications for the respective cover system installed.





## 7.4 Compaction and Testing

Granular Wearing Surface shall be compacted to a minimum of 98 percent of maximum dry density as determined by the 'Standard Compaction' test (ASTM D698) with a moisture content between minus two (-2) and plus two (+2) percent of optimum moisture. Compaction testing shall be completed by the Owner's Representative at a rate of not less than 1 test per 500 cubic yards.

No testing requirements are specified for the other aggregates for the closure project.

## 7.5 Construction

The Owner's Representative shall visually observe the placement of the aggregate material. At the discretion of the Owner's Representative or the Owner, additional samples may be collected during placement to verify that the material meets the material requirements in Section 7.1 of this CQC Plan. The test results from any such samples will be collected, analyzed, and the results reported as described in Section 7.2.



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## 8.0 Surveying

The final cover area shall be surveyed both before geomembrane layer placement and after erosion layer placement by a qualified land surveyor registered in the Commonwealth of Kentucky. The survey shall be completed using a grid system, with no more than 50 feet between grid points. The survey shall verify that the final cover system meets or exceeds a thickness of 24-inches at each survey point. The survey shall also identify the construction limits of the geosynthetic liner system. The construction limits shall be identified at every corner with no more than 50 feet between survey points along linear sections. The survey shall be prepared in the coordinate system used by the permit drawings (KY State Plane North, 1601, NAD 27). The survey shall be stamped by the surveyor and provided to the Owner's Representative.



## **9.0 Contingency Plan for Unanticipated Construction Difficulties**

Notification of unanticipated defects in workmanship, and repairs and retesting during the final cover system construction will be as described in the following Sections.

### **9.1 Notification**

The Owner's Representative shall notify the Contractor immediately upon discovering a defect in the workmanship. After determining the extent and nature of the defect, the Owner's Representative shall notify the Owner. The Owner or Owner's Representative will immediately notify the Permitting Agency if continued construction difficulties are encountered. This notification will include identifying the proposed solution to the construction difficulty.

### **9.2 Repairs and Retesting**

The Contractor shall correct the deficiency to the satisfaction of the Owner's Representative, the Owner, and the Permitting Agency. If a design criterion cannot be met, or unusual weather conditions hinders the work, then the Owner's Representative shall develop and present to the Owner suggested solutions for approval.

After the Contractor has repaired a deficiency, the Owner's Representative shall visually examine the area. The defect will be corrected before any additional work is performed by the Contractor in the area of the deficiency.



## 10.0 Documentation and Certification

An effective CQC Plan depends largely on recognition of all construction activities that should be monitored, and on assigning responsibilities for the monitoring of each activity. This is most effectively accomplished and verified by the documentation of quality control activities. The Owner's Representative shall document that quality control requirements have been addressed and satisfied. The Engineer shall conduct a final inspection on the completed facilities prior to the issuance of each Certification Report. The Permitting Agency, KDEP-DWM, shall be given at least two (2) working days prior notice of performance of a final inspection.

The Owner's Representative shall provide the Owner with data sheets and other supporting documents which verify that all monitoring activities have been carried out. The Owner's Representative shall also maintain, at the job site, a complete file of design plans, design specifications, the CQC Plan, checklists, test procedures, daily logs, and other pertinent documents.

### 10.1 Daily Recordkeeping

Standard reporting procedures shall include preparation, by the Owner's Representative, of a daily report which, at a minimum, shall consist of the following:

- Daily summary report including memoranda of meetings and/or discussion with the Owner and/or Contractor(s).
- Observation logs.
- Test data sheets.

Other forms of daily recordkeeping to be used, as appropriate, include construction problem and solution data sheets, and photographic reporting data sheets. This information shall be periodically submitted to and reviewed by the Owner.

#### 10.1.1 Daily Summary Report

The Owner or Owner's Representative shall prepare a Daily Summary Report which shall include the following information when applicable:

- An identifying sheet number for cross referencing and document control;
- Date, project name, location, and other identification;
- Weather conditions;
- Information on meetings held or discussions which took place (when applicable);
- Names of parties in discussions (when applicable);
- Relevant subject matter or issues;
- Decisions reached (when applicable);
- Descriptions and locations of ongoing construction;
- Descriptions and specific locations of areas, or units, of work being tested and/or observed and documented;
- Locations where tests and samples were taken or reference to specific observation logs and/or test data sheets where such information can be found;



- A summary of field/laboratory test results or reference to specific observation logs and/or test data sheets;
- Calibrations or recalibrations of test equipment and actions taken as a result of recalibration, or reference to specific observation logs and/or test data sheets (when applicable);
- Off-site materials received, including quality verification documentation;
- Decisions made regarding acceptance of units of work and/or corrective actions to be taken in instances of substandard quality, and;
- The Owner's Representative's name.

### *10.1.2 Construction Problem and Solution Report*

Reports describing special construction situations, as required by the Owner, shall be prepared by the Owner's Representative, and cross-referenced to specific observation logs and test data sheets. These reports shall include the following information:

- An identifying sheet number for cross-referencing and document control.
- A detailed description of the situation or deficiency.
- The location and probable cause of the situation or deficiency.
- How and when the situation or deficiency was found or located.
- Documentation of the corrective action taken to address the situation or deficiency.
- Final results of any responses.
- Any measures taken to prevent a similar situation from occurring in the future.
- The signature of the Owner's Representative.

The Owner shall be made aware of any significant recurring non-conformance with the design specification. The Owner's Representative shall then determine the cause of the non-conformance and recommend appropriate changes in procedure or specification to the Owner. These changes will be submitted to the Engineer for approval. When this type of evaluation is made, the results shall be documents, and any revision made to procedures, design specifications, or permit specifications will be approved by the Engineer, Owner, and if necessary, the Permitting Agency.

### *10.1.3 Design and/or Specification Changes*

Design and/or permit specification changes may be required during construction. In such cases, the Owner's Representative shall notify the Owner. The Owner shall then notify the Permitting Agency, if necessary. Design and/or permit specification changes shall be made only with the written agreement of the Owner and the Engineer.

## **10.2 Reporting**

The Owner's Representative shall prepare periodic reports, which summarize construction activities and the results of observations and tests. Progress reports shall be prepared at regular time intervals to document the status of the work. Certifications shall be prepared at the completion of major construction activities. At the completion of the work, final documentation shall be prepared and shall include a professional engineers seal and supporting field and laboratory test results.



### 10.2.1 Progress Reports

The Owner's Representative shall prepare a Progress Report at time intervals established at the pre-construction meeting, and submit the report to the Owner. At a minimum, this report shall include the following information:

- A unique identifying sheet number for cross-referencing and document control.
- The date, project name, location, and other information.
- A summary of work activities during progress reporting period.
- A summary of construction situation, deficiencies, and/or defects occurring during the progress reporting period.
- A summary of test results, failures, and retests.
- The signature of the Owner's Representative's representative.

The Owner's Representative shall distribute copies of the Progress Reports as decided upon at the pre-construction meeting.

### 10.2.2 Certification of Construction Activities

At the completion of construction of the final cover system, the Owner's Representative shall prepare a Construction Progress Report (CPR). The CPR shall describe activities associated with the construction including construction procedures, and observations and tests performed by the CQC personnel. At a minimum, each certification report shall include:

- Summaries of all construction activities.
- Observation logs and test data sheets including sample location plans and supporting field and laboratory test results.
- Construction problems and solutions reports.
- Changes from design and material specifications, and
- As-Built Drawings.

The CPR shall document all cap construction activities and be submitted to the Permitting Agency (Kentucky Department of Environmental Protection, Division of Waste Management) for review and acceptance upon the completion of cap construction. The CPR shall be certified by a Professional Engineer licensed in the Commonwealth of Kentucky pursuant to KRS Chapter 322.

The Certification Report shall include a certification which shall be signed by both the certifying engineer and the owner. The certification statement shall be as follows:

*"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the persons or persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for such violations."*



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The as-built survey data shall include scale plans depicting the survey point locations associated with the construction and the construction boundaries. Surveying shall be completed by a qualified land surveyor. The drawings shall be prepared in the coordinate system used by the permit drawings (KY State Plane North, 1601, NAD 27, NGVD 29).

**APPENDIX 2**

**TECHNICAL SPECIFICATIONS**

**EAST BEND STATION**

**EAST LANDFILL**





May 2021

**Technical Specifications**  
**East Bend Station, East Landfill Final Cover Modifications**  
Boone County, Kentucky  
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## ***DIVISION 1 - GENERAL REQUIREMENTS***

01000            General Requirements

## **DIVISION 2 - SITE CONSTRUCTION**

02000	Mobilization
02010	Demolition
02060	Aggregate
02315	Excavation
02320	Backfill
02324	Trenching
02500	HDPE Pipe
02672	Linear Low Density Polyethylene (LLDPE) Geomembrane
02673	High Density Polyethylene (HDPE) Geomembrane
02674	Nonwoven Geotextiles
02675	Geocomposite Drainage Layer
02676	PE-R Geomembrane
02679	Linear Low Density Polyethylene (LLDPE) Structured Geomembrane
02680	ClosureTurf®
02900	Erosion and Sediment Control
02924	Seeding and Mulching



**Technical Specification 01000 – General Requirements**  
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**Mar 2021**

Reference: **Technical Specification 01000 – General Requirements**  
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## Section 01000 General Requirements

### 1.0 General Information

Existing topographic information shown on the plans is based on an aerial survey performed by Kucera International Inc. on July 28, 2020. Map accuracy is 2 foot contour interval at a scale of 1 inch = 200 feet. The coordinate system used for both existing features and proposed work is State Plane, Kentucky 1601 North, North American Datum (NAD) 1927, North Geodetic Vertical Datum (NGVD) 1929. All other surveying required to assure compliance with the plans is the responsibility of the Contractor. The Contractor is to verify that survey benchmarks and intended elevations for the work are as indicated on the plans. Any property corner pins or permanent survey markers disturbed during construction shall be reset by a Registered Surveyor at the Contractor's expense.

It is the responsibility of the Contractor to visit the site and verify the extent of the work to be performed prior to submitting a Bid.

Where "Owner" is referred to in the plans it shall mean Duke Energy. Where the "Engineer" is referred to it shall mean the Project Engineer from S&ME, Inc. or his representative. KYDEP or KDEP refers to the Kentucky Department of Environmental Protection. KYTC refers to the Kentucky Transportation Cabinet.

The Standard Specifications for Road and Bridge Construction, published by the KYTC (2019 Edition) together with the Construction Quality Control (CQC) Plan, Technical Specifications, and Drawings shall govern materials and workmanship involved in the construction of the Landfill. Where discrepancies are identified between the Technical Specifications and the CQC Plan, the more stringent will apply.

Field and laboratory testing and sampling shall be performed by the Owners representative. The Contractor shall cooperate with the necessary personnel to allow for proper testing and inspection of the work. The Owner's Representative is authorized to observe all work performed and materials furnished. Such observation may extend to all or any part of the work and to the preparation, fabrication or manufacture of the materials furnished. The Owner's Representative is not authorized to issue instructions contrary to the Contract, or to act as foreman for the Contractor. However, the Owner's Representative has the authority to reject work or materials until any questions at issue are referred to and as the Engineer or Owner decides.

The Contractor shall keep the site free of trash, litter and waste material and shall maintain the site in a neat and orderly condition throughout the entire project. The Contractor shall remove all mud, soil and debris that may be tracked onto local roads or Plant access roads by his equipment or that of Subcontractors or Suppliers daily.

The Contractor shall be responsible for recording all the approved changes to these plans on a set of Record Drawings during construction. These plans are to be submitted to the Engineer at completion of the project. Any modification to the work as shown on these drawings must have prior written approval from the Owner.



Contractor is responsible for any and all surveying required for his work including surveying for measurement and payment. Additionally, a topographic survey utilizing a 50-foot grid pattern is required for:

1. Existing Ground Surface prior to Cover Soil Stripping in Areas where Site Preparation Grades are not provided;
2. Geosynthetic Liner (Site Preparation) Grade;
3. Top of Infiltration Layer;
4. Top of Erosion Layer;

Survey of the top of the geosynthetic liner surface is not required. At the contractor's discretion, the elevation of the top of the geosynthetic liner can be either surveyed or calculated by adding a constant thickness to the elevation of the top of prepared subgrade. This thickness will be agreed upon using project specific materials and obtaining a measurement at the beginning of construction. Other surveying is required for certification of work as noted within the CQC Plan or these Articles. Digital files shall be submitted to the Engineer for review in the latest version of AutoCAD.

All work is to be completed in accordance with the plans as deemed acceptable to the Owner and Engineer. No work is to commence prior to authorization by the Owner and Engineer.

The Contractor shall secure and pay for all permits and government fees, licenses, and inspections necessary for the proper execution and completion of the improvements shown on the plans.

The Contractor and all the Subcontractors shall be solely responsible for complying with all Federal, State and Local safety requirements together with exercising caution at all times for the protection of persons (including Employees) and property. It is also the sole responsibility of the Contractor and Subcontractors to initiate, maintain and supervise all safety requirements, precautions and programs in connection with the work.

The cost of any dewatering operation required for the construction shall be included in the price bid for the various items.

The Contractor shall repair any and all existing work damaged during, or due to the execution of, this Contract at their own expense. All said work to be repaired or replaced to the satisfaction of the Owner's Engineer or Duke Energy.

Construction activities outside the hours of 7:00 AM and 7:00 PM or outside the hours allowed for construction by local ordinances or regulations are not permitted without prior approval from Duke Energy.

## 2.0 Notification Requirements

The Kentucky Department of Environmental Protection, Division of Waste Management (KDEP-DWM) is the regulatory agency for the landfill. The CQC Plan requires that KDEP-DWM be given advance notice of the start of construction activities throughout the project. In support of providing these notices, the Owner and the Engineer must be notified 4 days in advance of the following construction activities:



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1. Installation of intermediate cover soil system,
2. Installation of geomembrane,
3. Installation of Geocomposite Drainage Layer,
4. Installation of Hydro Turf,
5. Placement of the Infiltration Layer, and
6. Placement of the Erosion Layer.
7. Completion of project/performance of final inspection.

If proper notification is not received, the Owner reserves the right to delay the activity.

### **3.0 Utility Protection**

The contractor shall be responsible for the investigation, location, support, protection and restoration of all existing utilities and appurtenances whether shown on the plans or not. The Contractor shall call Kentucky 811 (800-752-6007) at least 72 hours prior to construction and shall notify all utility companies at least 48 hours prior to work in the vicinity of their utilities. The Contractor shall coordinate all work with the Owner and/or East Bend Station Personnel when near existing Plant utilities.

### **4.0 Schedule**

The platform for the project schedule shall be in an electronic format agreeable to the Owner. Specific schedule format shall include activities, start date, finish date, duration, activity logic (predecessor and successor activities), percent progress, and milestones.

The Owner reserves the right to request the addition of milestones to the project schedule if it is deemed that insufficient information was provided. During construction, the schedule shall be updated on a monthly basis and as otherwise requested by the Owner.

A construction sequencing plan shall be submitted by the Contractor at the start of construction. The Owner will coordinate the plan with the on-site Operations contractor performing waste placement.

Bidders shall submit a proposed project schedule with their bids and the successful Bidder shall submit a final project schedule within 15 days of award.

### **5.0 Submittals Procedures**

The Contractor is required to provide various submittals for review during the project as noted within the Contract documents. These submittals are for review by the Owner and/or their Engineer.

- A. Transmit each submittal with Engineer accepted form.
- B. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.



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- C. Identify Project, Contractor, Subcontractor and Supplier; pertinent drawing and detail number, and specification section number, appropriate to submittal.
- D. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.
- E. Identify variations from Contract Documents and product or system limitations, which may be detrimental to successful performance of completed Work.
- F. When revised for resubmission, identify changes made since previous submission.
- G. Submittals not requested will not be recognized or processed.

The Owner and/or Engineer reserve the right to request additional submittals at any time during construction, when the need for additional information is identified.

## 6.0 Temporary Controls

### A. Barriers

1. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

### B. Water Control

1. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
2. Provide water barriers as required to protect site from soil erosion according to project's Erosion and Sedimentation Control Plan.'
3. Contact water shall not be permitted to flow off-site. All contact water must be directed to the drainage ditches on the south side of the landfill that flow into the coal pile runoff ditch or the retention basin. Contact water is defined as any water that comes into contact with the landfill waste materials.

### C. Dust Control

1. Execute Work by methods to minimize raising dust from construction operations.
2. Provide positive means to prevent air-borne dust from dispersing into atmosphere.
3. The Contractor shall follow the approved Dust Control Plan (Bid Specification, Appendix 6) for the existing landfill as directed by Duke Energy.

## 7.0 Temporary Facilities

- A. Contractor shall provide portable toilet and hand-wash facilities for their employees and subcontractors in accordance with OSHA's per-person ratio, at no additional expense to the owner



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(price to be included in the base bid). Toilets will be serviced and maintained such that no sustained nuisance odors come from them.

- B.** Contractor shall provide a construction trailer which shall be placed at Duke Energy approved location.
- C.** Contractor shall provide office space for CQA personnel in the Contractors office trailer. Office space shall be separate from the contractor's facilities by a wall with a separate door and of a size adequate to include one desk, electricity, and climate controls. The Contractor is responsible for obtaining building permits, as needed.

## 8.0 Site Security

- A.** The Contractor is responsible for securing the work area, equipment, and materials. Owner will not be responsible for vandalism, damage, or theft of equipment and materials on the job site.

## 9.0 Product Substitution Procedures

- A.** Substitutions may be considered when a product becomes unavailable through no fault of Contractor.
- B.** Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- C.** Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.
- D.** Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- E.** A request constitutes a representation that Contractor:
  - 1.** Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
  - 2.** Will provide same warranty for Substitution as for specified product.
  - 3.** Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
  - 4.** Waives claims for additional costs or time extension which may subsequently become apparent.
  - 5.** Will reimburse Owner and/or Engineer for review or redesign services associated with re-approval by authorities having jurisdiction.
- F.** Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.
- G.** Substitution Submittal Procedure:
  - 1.** Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.



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2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
3. Engineer will notify Contractor in writing of decision to accept or reject request.

**END OF SECTION**





**Technical Specification 02000 - Mobilization**  
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**May 2021**

Reference: **Technical Specification 02000 - Mobilization**  
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## Section 02000 Mobilization

### 1.0 General

#### 1.1 Summary

- A. This item of work includes the furnishing of labor and equipment necessary for performing the work required under the contract not specifically included in any other items. Work includes but is not limited to Project Management, mobilization of construction trailers and equipment, preparation and implementation of required project Plans, and the development of equipment and material staging areas. The work also includes providing access to the work area as required to complete the construction.
- B. The Contractor shall keep the site of the work free from trash, litter, and waste material and shall maintain the site in a neat and orderly condition throughout the period of the work. All damages to structures and property caused by the Contractor's operations shall be repaired and the surrounding grounds shall be cleared of all rubbish caused by construction.
- C. At completion, this item shall include: demobilization of all personnel, equipment, and materials, removal of all temporary buildings, roads and other structures, and returning the entire premises to a clean and acceptable condition. Additionally, this item shall include restoration and re-vegetation of any and all areas disturbed by contractor operations, not otherwise included for payment under the Contract. Specific areas of restoration and re-vegetation included as part of mobilization are as follows:
  - 1. Temporary access roads;
  - 2. Laydown areas;
  - 3. Borrow Areas / Pits;
  - 4. SPCC structures;
  - 5. Temporary stockpile areas; and,
  - 6. Other areas of disturbance beyond design cuts and fills.
- D. Owner reserves the right to request the Contractor to re-seed and re-mulch as necessary to restore the site to original condition.
- E. No additional compensation will be made to the Contractor for re-mobilization after his equipment has been removed from the site.



## 1.2 Unit Price – Measurement

### A. Mobilization

#### 1. Basis of Measurement: Lump Sum

Contractor will be paid on a percent-complete basis throughout construction as agreed to by the Owner. Final payment will not be made until all equipment has been removed from the site and site restoration activities, including establishment of vegetation is completed.

**END OF SECTION**



**Technical Specification 02010 – Demolition**  
**East Bend Station, East Landfill Final Cover Modifications**  
Boone County, Kentucky  
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**Mar 2021**

Reference: **Technical Specification 02010 – Demolition**  
**East Bend Station, East Landfill Final Cover Modifications**  
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## Section 02010 Demolition

### 1.0 General

The following technical specification addresses all materials being removed and not relocated under the new construction.

#### 1.1 Section Includes:

This item of work includes furnishing all labor, equipment, and material necessary for demolition, removal and disposal of existing structures within the work area. The work includes but is not necessarily limited to:

- A. Removal of concrete downdrains and walls where identified on the Construction Drawings.
- B. Removal of rock check dam structures as necessary to facilitate the new construction.
- C. Removal of existing rip-rap downdrains on the landfill exterior slopes.
- D. Removal of other previously unidentified items that are encountered during construction and are approved for removal by the Owner.

#### 1.2 Related Sections:

- 1. Section 02000 - Mobilization

#### 1.3 Unit Price – Measurement

- A. Demolition
  - 1. Measurement for purpose of payment shall be based on the linear feet of concrete or rip-rap downdrain removed. The linear feet shall be measured along the flowline of the channel from upstream to downstream in 2-dimensional plan view. Removal of any concrete walls along the flowline are incidental to the concrete downdrain removal. Removal of the concrete channel at the base of the landfill slope where noted is to be included in the linear feet cost of downdrain removal. Quantity measurements do not continue along the flowline of the perimeter ditch.
  - 2. Removal of all other items are considered incidental to the project and are not a separate measurement item.

#### 1.4 References

- A. Occupation Health and Safety Administration (OSHA) Guidelines.



- B. Construction Drawings.

## 1.5 Regulatory Requirements

- A. Conform to OSHA regulations and any local codes for demolition of structures, safety of adjacent structures, dust control, runoff control and disposal.
- B. Obtain required permits from local authorities when required.
- C. Notify affected utility companies before starting work and comply with their requirements.
- D. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials.
- E. Coordinate work with utility companies in the event their utilities are affected by the work.

## 1.6 Materials and Equipment

Materials and equipment to be determined by Contractor.

## 2.0 Execution

- A. All materials being removed shall be first offered to the Owner and if not accepted shall then be properly disposed of off-site at a properly licensed disposal area consistent with the materials being removed.
- B. The Contractor shall verify the limits of demolition with the Owner's Representative prior to commencement of the work.
- C. All concrete limits shall be saw-cut as depicted on the drawings. The saw-cut shall be completed in a neat manner with an abrasive saw so as not to damage the portion of the concrete to remain.
- D. Cavities left by structure removal shall be suitably backfilled and compacted in accordance with the Construction Drawings and Technical Specification 02320.
- E. The Contractor shall adhere to the fugitive dust suppression plan to control dust and dirt caused by the demolition work.
- F. The Contractor is responsible for all demolition and removal necessary to accomplish the proposed closure activities as shown on these drawings.
- G. The Contractor may complete the demolition in any sequence and at any time as needed to facilitate construction operations. The Contractor is responsible for repair of any areas that erode as a result of the removal of the existing downdrains prior to completing the remaining portions of the work in that area. The Contractor is also responsible for completing the work in a manner that meets the Control of Water requirements for the project, including the potential contact water created from precipitation following removal of the existing concrete.

**END OF SECTION**



**Technical Specification 02060 - Aggregates**  
**East Bend Station, East Landfill Final Cover Modifications**  
Boone County, Kentucky  
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**May 2021**

Reference: **Technical Specification 02060 - Aggregates**  
**East Bend Station, East Landfill Final Cover Modifications**  
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## Section 02060 Aggregate

### 1.0 General

#### 1.1 Summary

**A.** Section Includes:

1. No. 57 stone for use around bench drains.
2. No. 8 bedding stone for haul road ditch termination.
3. No. 2 stone placed at underdrain outlets and at the haul road stilling basins.
4. Class II Channel Lining in the landfill perimeter ditch.
5. Class IV Channel Lining at the haul road ditch termination.
6. Stone for Gabions
7. Granular Base for haul road
8. Granular wearing surface for haul road
9. Chip Seal finish for haul road shoulders
10. Furnishing all labor, equipment and materials necessary to install gabion baskets at downdrain locations in accordance with KYTC Section 813.12.

**B.** Related Sections:

1. Section 02320 – Backfill - Structural
2. Section 02500 – HDPE Pipe
3. Section 02674 – Nonwoven Geotextile

#### 1.2 Unit Price – Measurement

**A.** Aggregate (unless otherwise noted):

1. Basis of Measurement: By the delivered tons or as otherwise indicated in other Sections of these Specifications. Payment quantities shall not include quantities placed beyond the lines and grades shown on the Drawings or materials used for other roads for other purposes.
  - a. Includes supplying aggregate materials, hauling, stockpiling, and placement.
  - b. Requested payment quantities will be submitted by the Contractor with documented delivery tickets with final approval by the Engineer. If a dispute exists relative to payment quantities, the Contractor, at his expense, will uncover any buried or covered material for re-evaluation.
2. Aggregate (No. 57) placed around bench drains is incidental to the bench drain quantity and is not a separate pay item.





Technical Specification 02060 - Aggregates  
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3. Aggregate (No. 2 stone) placed at underdrain outlets is incidental to the underdrain outlet headwall and is not a separate pay item.
4. Gabion basket material and installation cost is incidental to the gabion stone and is not a separate pay item.
5. Asphalt emulsion for chip seal is incidental to the delivered tons of aggregate for chip seal and is not a separate pay item.

### 1.3 References

A. Kentucky Transportation Cabinet

1. *Standard Specifications for Road and Bridge Construction*, Edition of 2019, Approved for June 1, 2019, Published by the Kentucky Transportation Cabinet.

B. American Society for Testing and Materials (ASTM) standards:

1. ASTM C33 – Standard Specification for Construction Aggregates
2. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregate.
3. ASTM D422 - Standard test Method for Particle-Size Analysis of Soils (Grain Size with Hydrometer).
4. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
5. ASTM D1556 – Standard Test Method for Density of Soil In Place by the Sand-Cone Method.
6. ASTM D2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
7. ASTM D4253 – Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
8. ASTM D4254 – Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
9. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
10. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

### 1.4 Submittals

- A. Materials Source: Submit name of imported materials suppliers and description of material.
- B. Manufacturer's/Supplier's Certificate: Certify material meet or exceed specified requirements. The specified requirements for this project includes documentation that the Manufacturer/Supplier is listed on the most current version of the List of Approved Materials and is a listed source on the KYTC aggregate source list.
- C. Gabion baskets: Submit name of material supplier and description of material.



- D. Chip Seal: Submit mix design at least 14 days prior to construction. Mix design shall be prepared by laboratory, to verify the compatibility of the aggregate, asphalt emulsion and other additives.
- E. Requested payment quantities will be submitted by the Contractor with final approval by the Engineer.

## 1.5 Quality Assurance

- A. Furnish each aggregate material type from the approved source through the Work.
- B. The aggregate Manufacturer/Supplier must be listed on the most current version of the List of Approved Materials for the aggregate proposed for use on the project.
- C. The gabion basket material proposed shall be on the KYTC List of Approved Materials.
- D. The laboratory performing the chip seal mix design shall be a KYTC approved laboratory.
- E. Perform work in associated with the Kentucky Transportation Cabinet Standard Specifications for Roads and Bridges or as otherwise specified.

## 2.0 Products

### 2.1 Fine and Coarse Aggregate Materials

- A. Gradation Size No. 57 stone:
  - 1. Material shall be No. 57 size stone in accordance with KYTC Section 805 or approved equal.
  - 2. Material shall consist of uncrushed natural river gravel; crushed aggregate is not permitted.
- B. Gradation size No. 8 stone:
  - 1. Material shall be No. 8 size stone in accordance with KYTC Section 805 or approved equal.
  - 2. Material shall consist of uncrushed natural river gravel; crushed aggregate is not permitted.
- C. Gradation size No. 2 stone:
  - 1. Material shall be No. 2 size stone in accordance with KYTC Section 805 or approved equal.
- D. Class IV Channel Lining:
  - 1. Material shall be Channel Lining, Class IV, in accordance with KYTC Section 805.13 or approved equal with the following modifications:
    - a. Class IV Channel Lining Material shall have a  $D_{50}$  of 9-inches.
- E. Stone for Gabions
  - 1. Material shall be in accordance with KYTC Section 805.13.06 or approved equal.



**F.** Granular Base:

1. Material Shall consist of KYTC Section 805, Gradation Size No. 2.

**G.** Granular Wearing Surface

1. Material shall consist of KYTC Section 805.06, Crushed Stone Base (Dense Graded Aggregate).

**H.** Chip Seal

1. Furnish undiluted CRS-1P polymer modified emulsion that conforms to AASHTO M316, the requirements of KYTC Section 806.05 and Table 02060-1.
2. Aggregate shall be a cleaned damp aggregate cover material from a KYTC approved source meeting the requirements of KYTC Section 805. Aggregate size shall be 9-M. Aggregate shall have no more than 3.0 percent passing the No. 200 sieve (KYTC 805.05.04).

**I.** Gabion Baskets

1. Material shall be in accordance with KYTC Section 813.12.

## 2.2 Source Quality Control

- A.** None required provided that the material is hauled from the same approved source(s) throughout the project.
- B.** Owner's Representative reserves the right to re-test material arriving on-site at their discretion. Re-testing will be performed to meet KYTC Section 805 requirements. If material is found to be out of specification, material will be removed from site and replaced at Contractor's cost.



**Table 02060-1: Emulsified Asphalt Specification**

Property	Method	CMS-1P
<u>Test on Emulsion</u>		
Viscosity @ 122 °F (SFS)	AASHTO T 59	100 - 350
Residue, w%, minimum. (1)	AASHTO T 59	67
pH	ASTM E 70	2.0-5.0
Sieve, w%, max.	AASHTO T 59	0.1
Oil distillate, w%, max.	AASHTO T 59	0.5
<u>Test on Residue</u>		
Viscosity @ 140 °F, P, maximum.	AASHTO T 201	3000
Penetration @ 39.2 °F, minimum.	AASHTO T 49	40
Elastic Recovery on residue by distillation, %, minimum (2)	AASHTO T 301	50
<u>Test on Polymer</u>		
Tensile strength, die C dumbbell, psi, minimum	ASTM D 412 (3)	500
Swelling in rejuvenating agent, % maximum; 48 hours exposure @ 104 °F	ASTM D 471 (4)	
<u>Test on Rejuvenating Agent</u>		
Flash point, COC, °F	AASHTO T 48	380 Min
Viscosity, 140 °F, CST	AASHTO T 201	50-175
Saturate, % by wt.	ASTM D 2007	30 Max
Asphaltenes	ASTM D 2007	1.0 Max.
<u>Test on Residue from RTFO</u>		
Weight Change, %	AASHTO T 240	6.5 Max.
Viscosity Ratio		3 Max

(1) Exception to AASHTO T59: Bring the temperature on the lower thermometer slowly to 350 ± 10 °F. Maintain at this temperature for 20 minutes. Complete total distillation in 60 ± 5 min from first application of heat.

(2) Elastic Recovery @ 10 °C (50 °F): Hour glass sides, pull 20 cm, hold 5 minutes then cut, let sit 1 hour.

(3) Tensile Strength Determination: Samples for testing for tensile strength in accordance with ASTM D412 shall be tested with the following test procedure modifications:

(4) Prepare the polymer film, dilute the waterborne polymer to 40% Total Solids Content and pour 57 g into a Teflon or silicone release mold of dimensions 7" X 7" X 1/4". Allow to dry at 23°C (73 °F) and 50% RH (controlled conditions) for 7 – 10 days total time, during which time the film should be flipped around once, preferably after 3 or 4 days. The film should be transparent in the end. To drive out any residual water, place the film in an oven at 50 °C for 30 min. Dried film thickness should be 25 ± 5 mils. Discard films <20 mil. Cut out dumbbell-shaped test specimens of dimension 75 mm total length, 25 mm mid-section (L) and 4 mm width of mid-section. Grip in Instron machine with gap size 1 inch, use 8 in/min cross-head speed.



## 3.0 Execution

### 3.1 Stockpiling

- A. Stockpile materials on site at locations agreed upon by Engineer and Owner.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate differing materials with dividers or stockpile apart to prevent mixing.
- D. Direct surface water away from stockpile site so as to prevent erosion or deterioration of materials.

### 3.2 Stockpile Cleanup

- A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water and restore to original site conditions.

### 3.3 Examination

- A. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

### 3.4 Preparation

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place aggregate fill on soft, muddy, or frozen surfaces.

### 3.5 Placement

- A. Granular Wearing Surface material shall be placed in accordance with KYTC Section 302.
- B. Granular Base Material shall be placed in lifts not exceeding 12 inches. Each lift shall be compacted with a minimum of four coverages of a steel drum roller, having a minimum weight of 10 tons.
- C. Spread aggregate over prepared substrate to a total thickness as specified on Drawings.
- D. Level and contour surfaces to elevations and gradients indicated.
- E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

### 3.6 Tolerances

- A. Scheduled Compacted Thickness: Not less than the minimum design thickness, not more than 10% greater than design.

### 3.7 Field Quality Control

- A. Laboratory Testing:
  - 1. Perform laboratory material tests as necessary to perform field testing of materials as designated in Part B. of this section.
- B. In Place Compaction and Natural Moisture Content Tests



Technical Specification 02060 - Aggregates  
East Bend Station, East Landfill Final Cover Modifications

Boone County, Kentucky  
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1. Granular Wearing Surface material shall be compacted to a minimum of 98 percent of maximum dry density as determined by the 'Standard Compaction' test (ASTM D698) with a moisture content between minus two (-2) and plus two (+2) percent of optimum moisture. Compaction testing shall be completed by the Owner's Representative at a rate of not less than 1 test per 500 cubic yards.
  2. Granular Base Material shall be compacted to a minimum density of 80 percent of relative density as determined by ASTM D4253 and ASTM D4254. Testing shall be accomplished by proofroll of the completed base material and visual observation and acceptance by the Engineer.
- C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

### 3.8 Chip Seal

A. Equipment:

1. Provide, and keep on the project during installation, an accurate thermometer, hand brooms, and other small tools and equipment essential for completion of the work.
2. The asphalt distributor for the application of the emulsion shall have full circulation spray bar with adjustable width and capable of heating and circulating the emulsion simultaneously, conforming to Section 406.02.05. The distributor shall also be equipped with a volume measuring device and a thermometer for measuring the emulsion temperature in the tank. For each emulsion application, follow manufactures recommendations for proper nozzle type and adjustment.
3. The aggregate spreader shall be a front discharge, continuous mechanical feed, self-propelled aggregate spreader with a screen capable of removing oversized materials. It must have computerized control for adjusting and regulating application rates, as well as width, from the operating platform. Ensure the spreader can evenly distribute the aggregate from the transporting vehicle directly onto the finished aggregate surface in smooth, uniform layers, independent of the forward speed. The spreader must be capable of being filled and moved without discharging aggregate. The spreader must be equipped with a locking mechanism compatible with the triaxle trucks used to supply aggregate.
4. Rollers. Double steel wheel type roller shall weigh at least 5 tons but no more than 8 tons. A pneumatic tired roller (if used) shall weigh at least 5 tons.

B. Construction

1. Weather Limitations: Application of chip seal shall be applied when air temperature is at least 50 degrees F and rising and a minimum surface temperature of 70 degrees F. Do not construct when the ambient temperature within the preceding 24 hours has been 35 degrees F or lower. Do not proceed with construction if rain is expected in a minimum period of 4 hours.
2. Surface Preparation: All surfaces intended for application shall be thoroughly cleaned of all vegetation, loose material, dirt, or other objectionable material immediately before application of emulsion using a mechanical sweeper and wire hand brooms, when necessary. Clean the edges of the surface providing a full and uniformly clean width of roadway. Where mud or earth exists, remove it in advance and allow surface to thoroughly dry before applying emulsion.



**C. Application**

1. A double layer chip seal shall be installed to the limits as shown on the drawings at the finished aggregate surface. The placement area includes the sloped shoulders and the outside 2 feet of the haul road, on each side.
2. Double chip seal treatment shall consist of two single layers. The first layer of material shall be applied at 40-50% of the total combined material rate. The second layer shall be applied at 50-60% of the total combined material rate. The second layer of chip seal shall not be applied until three days after placement of the first layer. Sweep the first layer before starting the construction of the second layer of chip seal. Application rates are provided in Table 02060-2.

**Table 02060-2 Application Rates of Materials for Double Layer Chip Seal**

Properties	Total Rate Minimum	Total Rate Maximum	Minimum for a Single Layer	Maximum for a Single Layer
Application rate of emulsion, gal/sqyd	0.60	0.76	0.30	0.38
Emulsion temperature, F	120	180	120	180
Application rate of aggregate, lb/sqyd	30	40	15	20

3. Emulsion. Heat and maintain emulsion between 120 and 180 degrees F during application. Polymer modified emulsion shall be applied when air temperature is at least 50 degrees F and rising and a minimum surface temperature of 70 degrees F. Emulsion shall be applied using a pressure distributor in a uniform, continuous quantity at specified rates.
4. Do not allow distributor to apply asphalt material ahead of aggregate spreader for more than 150 feet. When the chip seal treatment is constructed in half-widths, provide complete coverage by overlapping the 2 applications approximately 4 inches along centerline and sweep the centerline before constructing the adjoining lane.
5. Aggregate cover material shall be cleaned to remove dirt and dust, ensuring appropriate adhesion with emulsion. Aggregate shall be damp during application. Aggregate shall only be stockpiled once per project and must be placed on a pad clean from unwanted materials and debris. The stockpile shall be rejected when the aggregate doesn't meet the requirements. Prior to breaking of the emulsion, aggregate shall be continuously and evenly spread with the proper equipment at the specified rates. Spreading equipment shall not contact the asphalt material before it is covered with aggregate. Precautions should be taken not to exceed the designated rate by more than 5 percent. Use hand brooms to correct any irregularities.
6. A double steel wheel roller shall be used for the required rolling of the aggregate. A pneumatic tire roller can be used in combination with the steel wheel roller, if necessary to provide an acceptable finished product. Rolling shall be done no more than 5 minutes after the spreading of aggregate. Operate the roller in a manner preventing the dislodgment of newly applied aggregate. Rolling should proceed from the outer edge to the center, with each pass overlapping the previous by one-half. Rolling shall consist of at least 2 passes or more with the double steel



wheel roller. Roller speeds shall not exceed 5 mph. Additional roller patterns and/or equipment may be required as directed by the engineer depending on speed of application.

7. Power sweep and/or vacuum the completed application to remove all excess aggregate after each day(s) of production. If allowed by the engineer, water may be applied during sweeping process. A second sweeping may be required following the initial application day.

### 3.9 Protection of Work

- A. Reshape and re-compact aggregate fills subjected to vehicular traffic.
- B. Protect aggregate fills from loss of proper cover until backfill is complete.
- C. Prevent fines migration into aggregate stockpiles or aggregate placed for the construction.
- D. The haul road finished grade construction and chip seal application shall be completed at the end of the project. If the Contractor elects to compact the install the haul road and then use it for construction, the haul road may require re-construction at the end of the project. Any re-work of the haul road is to be completed by the Contractor at no additional cost to the owner.

**END OF SECTION**





**Technical Specification 02315 - Excavation**  
**East Bend Station, East Landfill Final Cover Modifications**  
Boone County, Kentucky  
S&ME Project No. 7217-17-004K

**August 2019, Rev. July 2020, Apr. 2021**

Reference: **Technical Specification 02315 - Excavation**  
**East Bend Station, East Landfill Final Cover Modifications**  
Boone County, Kentucky  
S&ME Project No. 7217-17-004K



## Section 02315 Excavation

### 1.0 General

#### 1.1 Summary

- A.** This item of work includes furnishing all labor, equipment, and material necessary to remove and stockpile soils from the site prior to placement of fill or other construction activities. Includes excavation, loading, hauling, scraping, dust control, placing where required, stockpile maintenance, other maintenance, temporary erosion control measures as needed including temporary stockpile stabilization if necessary, and removing accumulated water during construction. The work items include but is not necessarily limited to:
1. Existing Cover Removal and Stockpiling;
  2. Excavation and Stockpiling;
  3. Excavation and Disposal of Waste Material on Top Deck
  4. Fine Grading, and;
  5. Other general site excavation and grading not specifically noted herein.

#### 1.2 Related Sections:

1. Section 02320 – Backfill – Structural
2. Section 02324 - Trenching
3. Section 02500 – HDPE Pipe

#### 1.3 Unit Price – Measurement

- A.** Contractor shall be responsible for making measurements of materials for purpose of payment. Documentation of measurement, including calculations where appropriate, shall be submitted with request for payment. Owner may, at his discretion, verify Contractor measurements.
- B.** Existing Cover Soil Removal and Stockpiling
1. Basis of Measurement: By the cubic yard excavated. The quantity of material removed and stockpiled will be based upon survey data submitted by the Contractor for the excavation area and the placement area (stockpile or re-use in Construction). The quantity of excavated material will be based upon the volume of material between the original ground surface survey prior to beginning excavation and the excavated and/or stripped surface following excavation. A survey should be performed on a grid pattern, as approved by the Engineer, of ground surface elevations in the area both before and after excavation. The Contractor must be careful to collect grade breaks and excavation edges for an accurate survey. The Engineer shall check the as-built



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finished grades for comparison to the proposed grades to verify the excavated material was not removed beyond that specified. This item applies to areas where site preparation grades are not provided.

**C. Excavation and Stockpiling**

1. **Basis of Measurement:** By the cubic yard excavated. The quantity of material removed and stockpiled or placed in the landfill is found to be mixed with waste will be based upon survey data submitted by the Contractor for the excavation area and the placement area (stockpile or re-use in Construction). The quantity of excavated material will be based upon the volume of material between the original ground surface survey prior to beginning excavation and the excavated and/or stripped surface following excavation. A survey should be performed on a grid pattern as approved by the Engineer of ground surface elevations in the area both before and after excavation. The Contractor must be careful to collect grade breaks and excavation edges for an accurate survey. The Engineer shall check the as-built finished grades for comparison to the proposed grades to verify the excavated material was not removed beyond that specified. This item applies to areas where site preparation grades are provided.

**D. Excavation and Disposal of Waste Material on Top Deck:**

1. **Basis of Measurement:** By the cubic yard excavated. The quantity of material removed and placed on the top deck of the landfill will be based upon survey data submitted by the Contractor for the excavation area and the placement area (landfill top deck). The quantity of excavated material will be based upon the volume of material between the original ground surface survey prior to beginning excavation and the excavated and/or stripped surface following excavation. A survey should be performed on a grid pattern as approved by the Engineer of ground surface elevations in the area both before and after excavation. The Contractor must be careful to collect grade breaks and excavation edges for an accurate survey. The Engineer shall check the as-built finished grades for comparison to the proposed grades to verify the excavated material was not removed beyond that specified.

**E. Fine Grading:**

1. **Basis of Measurement:** The contractor shall be paid per acre for fine grading completed within the project area immediately prior to geosynthetic deployment. Measurement will be made based on the total two-dimensional (plan view) surface area in acres based on as-built conditions. No allowance will be made for extending the work area beyond that designated on the project documents.

**F. Other general site excavation and grading:**

1. General site excavation and grading includes any and all excavation, handling, stockpiling, placement of fill, and grading necessary for the construction of the landfill which are not



specifically identified in these specifications and/or included for payment as part of other items of work.

## 1.4 References

- A. N/A

## 1.5 Submittals

- A. N/A

## 2.0 Products

### 2.1 Excavated Materials

#### A. Waste

1. Waste is defined as previously placed POZ-O-TEC or bottom ash that is excavated to meet the lines and grades shown on this project.
2. Waste is also defined as soil containing any amount of POZ-O-TEC or bottom ash that cannot be easily separated.

#### B. Soil

1. Soil is defined as previously placed cover soil that is excavated from the landfill.
2. Soil should not contain any amount of POZ-O-TEC or bottom ash (waste).

## 3.0 Execution

### 3.1 Examination

- A. The Owner and Owner's Representative will assist the Earthwork Contractor in the determination of Structural Fill and non-select material during excavation operations. The Earthwork Contractor will be responsible for excavating, transporting, stockpiling, placing and compacting all materials as needed.

### 3.2 Excavation and Stockpiling of Soils

- A. Soils present above the proposed construction grades shall be excavated and stockpiled for future use at locations approved by the Owner. Care shall be taken to avoid mixing waste with soils. Soils mixed with waste shall be placed within the landfill prior to the placement of final cover. Contractor to work with Owner's Representative to determine if sufficient waste present to warrant placement within the landfill. Soils excavated which will be reused as structural fill may be placed in temporary stockpiles. The temporary stockpile shall be within the proposed construction footprint or in the



laydown areas allowed by the Owner for construction. No temporary stockpiles shall remain at the completion of the work.

- B. Stockpiling of soils is not required if a fill placement area is ready. However, the Owner's Representative must be allowed to assess the material for placement at the specified location.
- C. Excavated sub-soils shall be stockpiled separately from topsoil.
- D. Contractor shall establish separate piles for excavated soils based on their qualification as Fill Types, S1, S2 and S5, as detailed in Technical Specification 02320.
- E. Work includes maintaining stockpiles and establishment of a vegetative cover on stockpiled material in accordance with project SWPPP.

### 3.3 Excavation of Waste

- A. Waste present above the proposed construction grades, or soils excavated and found to be mixed with waste, shall be excavated and hauled to the landfill top deck for placement in the landfill.

### 3.4 Fine Grading

- A. The finished slopes to receive the geosynthetic liner shall be smooth and planar in accordance with both this specification and the subgrade specification for the geosynthetic to be placed. If undulations or irregularities exist on the excavated surface due to varying cover thicknesses or waste depths, these will be fine graded under this item.

### 3.5 Protection of Work

- A. Reshape stockpiles that are subject to erosion.
- B. Regrade excavated surfaces that are subjected to erosion prior to deployment of the geosynthetic liner system.
- C. Protect completed excavation areas from precipitation or by drying by smooth drum rolling all areas where no further work is immediately planned.
- D. Remove standing water from excavation area by pumping.

**END OF SECTION**



**Technical Specification 02320 - Backfill**  
**East Bend Station, East Landfill Final Cover Modifications**  
Boone County, Kentucky  
S&ME Project No. 7217-17-004E

**August 2019, Rev. July 2020, May 2021**

Reference: **Technical Specification 02320 - Backfill**  
**East Bend Station, East Landfill Final Cover Modifications**  
Boone County, Kentucky  
S&ME Project No. 7217-17-004E



## Section 02320 Backfill – Structural

### 1.0 General

#### 1.1 Summary

- A. This item of work includes furnishing all labor, equipment, and material necessary to place and compact soils or waste in accordance with the project documents and this specification. Includes hauling, scraping, dust control, scarifying substrate surface, moisture conditioning, placing where required, compacting, maintenance, temporary erosion control measures as needed including temporary stockpile stabilization if necessary, and removing accumulated water during construction.
- B. The work includes, but is not necessarily limited to:
  - 1. Fill to Site Preparation Grade (Fill Type S1);
  - 2. Infiltration Layer Placement (Fill Type S2);
  - 3. Erosion Layer Placement (Fill Type S5);
  - 4. Waste Placement (Fill Type S6);
  - 5. Top Deck Diversion Berm Placement (Fill Type S1), and;
  - 6. Other fill placement not specifically noted herein (Fill Type S1).
- C. Definitions
  - 1. Fill Type S1, structural fill, defined as compacted fill for surface water control systems, roadways or other systems as required to meet proposed grades. Includes all soil fill proposed for the project except that specifically designated as S2 or S5.
  - 2. Fill Type S2, infiltration layer, defined as fill placed to achieve proposed cover system elevations for the infiltration layer.
  - 3. Fill Type S5, erosion layer, defined as fill placed to achieve proposed cover system elevations for the infiltration layer.
  - 4. Fill Type S6, waste, defined as waste placed on the landfill top deck that was excavated elsewhere on-site to achieve grades (for Excavation, see Specification 02315).
  - 5. Other fill placement includes any and all soil handling, stockpiling, placement of fill, and grading necessary for the construction of the landfill which are not specifically identified in these specifications and/or included for payment as part of other items of work.



## 1.2 Related Sections:

1. Section 02315 - Excavation
2. Section 02324 - Trenching
3. Section 02500 – HDPE Pipe
4. Section 02610 – Pipe Culverts
5. Section 02672 – Linear Low Density Polyethylene (LLDPE) Geomembrane.
6. Section 02674 – Nonwoven Geotextile
7. Section 02675 – Geocomposite
8. Section 02680 – Closure Turf

## 1.3 Unit Price – Measurement

### A. Fill Type S1, Structural Fill:

1. Basis of Measurement: By the cubic yard filled except as noted herein. The quantity of structural fill will be based upon the in-place volume between the excavated surface and the structurally filled surface as determined by survey information collected before and after the structural fill placement. A grid pattern of ground surface elevations as approved by the Engineer in the area shall be surveyed and reference points installed by the Earthwork Contractor prior to structural backfill placement and prior to placement of any overlying material. The Engineer shall check the as-built finished grades and determine the backfilled volume of structural fill based on survey data provided by the Contractor.
2. Structural fill placed for Underdrain backfill is incidental to the underdrain and is not a separate pay item.
3. Structural fill placed for anchor trench backfill is incidental to the geomembrane installation and is not a separate pay item.

### B. Fill Type S2, Infiltration Layer:

1. Basis of Measurement: By the cubic yard filled. The quantity of infiltration layer fill will be based upon the in-place volume between the filled, excavated and/or stripped surface prior to infiltration layer placement and the filled surface as determined by survey information collected before and after the infiltration layer fill placement. A grid pattern as approved by the Engineer of ground surface elevations in the area shall be surveyed and reference points installed by the Contractor prior to infiltration layer placement and prior to placement of any overlying material. The Engineer shall check the as-built finished grades and determine the backfilled volume of subgrade based on survey data provided by the Contractor.

### C. Fill Type S5, Erosion Layer:

1. Basis of Measurement: By the cubic yard filled. The quantity of the erosion layer fill will be based upon the in-place volume between the top of the infiltration layer and the filled surface as determined by survey information collected before and after the erosion layer fill placement. A grid pattern as approved by the Engineer of ground surface elevations in the area shall be





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surveyed and reference points installed by the Contractor prior to infiltration layer placement and prior to placement of any overlying material. The Engineer shall check the as-built finished grades and determine the backfilled volume of subgrade based on survey data provided by the Contractor.

**D. Fill Type S6, Waste:**

1. **Basis of Measurement:** By the cubic yard filled. The quantity of the waste fill will be based upon the in-place volume between the top deck area prior to waste placement and the filled surface as determined by survey information collected before and after the erosion layer fill placement. A grid pattern as approved by the Engineer of ground surface elevations in the area shall be surveyed and reference points installed by the Contractor prior to waste placement and prior to placement of any overlying material. The Engineer shall check the as-built finished grades and determine the backfilled volume of subgrade based on survey data provided by the Contractor.

**E. Top Deck Diversion Berm and Other General Site Fill not listed as incidental:**

1. **Basis of Measurement:** By the cubic yard filled. The quantity of the fill will be based upon the in-place volume between the bottom of the in-place fill and the finished surface as determined by survey information collected before and after the fill placement.

## 1.4 References

**A. American Society for Testing and Materials (ASTM) standards:**

1. ASTM D422 - Standard test Method for Particle-Size Analysis of Soils (Grain Size with Hydrometer).
2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
3. ASTM D1556 – Standard Test Method for Density of Soil In Place by the Sand-Cone Method.
4. ASTM D2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
5. ASTM D2487 – Standard Practices for Classification of Soil for Engineering Purposes (Unified Soil Classification System).
6. ASTM D2937 - Standard Test Method for Density of Soil in place by the Drive-Cylinder Method.
7. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
8. ASTM D6938 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

## 1.5 Submittals

- A. N/A**



## 2.0 Products

### 2.1 Fill Materials

#### A. Fill Type S1, Structural Fill:

1. Structural fill is defined as compacted fill for surface water control systems, roadways, or other systems not intended to function as a migration barrier.
2. Natural soil material from designated on-site borrow areas and/or stockpiles. Any fill material containing landfill waste shall not be considered as Type S1 Fill.
3. Structural fill shall be classified as SP, SM, SW, SC, SW-SM, SW-SC, SP-SM, CL or CH soils according to the Unified Soil Classification System (ASTM D2487).
4. Free of topsoil, organic material, roots, stumps, brush, rocks larger than 4 inches, subsoil, debris, vegetation, and other foreign matter.
5. All material clods will be broken down with tillers and/or discs to provide a homogeneous soil that is free of clods greater than 4 inches in diameter with no more than 15% retained on the No. 4 sieve.

#### B. Fill Type S2, Infiltration Layer

1. Infiltration layer is defined as fill placed to achieve proposed cover system elevations for the infiltration layer.
2. Natural soil material from designated on-site borrow areas and/or stockpiles. Any fill material containing landfill waste shall not be considered as Type S2 Fill.
3. Structural fill shall be classified as SP, SM, SW, SC, SW-SM, SW-SC, SP-SM, SC-SM, ML, MH, CL, CH or CL-ML soils according to the Unified Soil Classification System (ASTM D2487).
4. Free of topsoil, organic material, roots, stumps, brush, rocks larger than 4 inches, subsoil, debris, vegetation, and other foreign matter.
5. All material clods will be broken down with tillers and/or discs to provide a homogeneous soil that is free of clods greater than 4 inches in diameter with no more than 15% retained on the No. 4 sieve.

#### C. Fill Type S5, Topsoil/Vegetative Soil:

1. Topsoil/vegetative soil is defined as fill placed to support vegetation establishment placed above the Infiltration Layer (Fill Type S2).
2. Excavated and reused materials from designated on-site or off-site borrow areas and/or stockpiles. Also includes existing vegetative layer stripped and stockpiled during construction.
3. Shall be classified as SM, SC, SW-SM, SW-SC, SP-SM, SP-SC, ML, MH, CL or CL-ML soils according to the Unified Soil Classification System (ASTM D2487).
4. Free of roots, stumps, brush, rocks larger than 2 inches, debris, and other foreign matter.
5. All material clods will be broken down with tillers and/or discs to provide a homogeneous soil that is free of clods greater than 2 inches in diameter with no more than 15% retained on the No. 4 sieve.



**D. Fill Type S6, Waste:**

1. Waste is defined as POZ-O-TEC, bottom ash, or soil mixed with any amount of waste that cannot be separated.
2. Waste excavation will be required at the base of the landfill haul road.
3. Waste excavation may be required in other areas of the landfill to achieve proposed site preparation grades.

## 3.0 Execution

### 3.1 Examination

- A.** The Owner and Owner's Representative will assist the Earthwork Contractor in the determination of Structural Fill and non-select material during excavation operations. The Earthwork Contractor will be responsible for excavating, transporting, stockpiling, placing and compacting all materials as needed.

### 3.2 Preparation – Type S1 fill only

- A.** Preparation for S2 fill placement can be found in Sections 02672 and 02675.
- B.** S5 fill placement can occur following completion of S2 fill placement in accordance with these specifications.
- C.** Proof roll subgrade to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.
- D.** Cut out soft areas of subgrade not capable of compaction in place. Backfill with Type S1 fill (as specified by the Engineer) and compact to density equal to or greater than requirements for subsequent fill material.
- E.** Scarify subgrade surface to depth of 6 inches.

### 3.3 Preparation – Type S6 fill only

- A.** S6 fill placement can occur only in top deck area as noted throughout the project documents.
- B.** The existing top of waste surface in the top deck prior to waste placement shall be prepared by the landfill operations team and left for the Contractor in a smooth drum rolled condition.
- C.** Multiple lifts of waste material placed by the closure Contractor shall be prepared for additional placement in accordance with the backfilling recommendations in this report.

### 3.4 Backfilling

- A.** Begin backfilling after Owner's Representative's acceptance of the appropriate survey for underlying surface.
- B.** Backfill areas to contours and elevations as shown on Drawings with unfrozen materials.
- C.** Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.



- D. Fill Type S1 and S6: Place and compact material in loose lifts not exceeding 8 inches in thickness with a minimum 10,000 lb smooth drum or sheepsfoot vibratory roller, depending on material type.
- E. Fill Type S2: Place material as specified in CQC Plan.
- F. Fill Type S5: Place material as specified in CQC Plan.
- G. Employ placement method that does not disturb or damage other work.
- H. Backfill against supported structures. Do not backfill against unsupported structures. Backfill simultaneously on each side of unsupported structures until supports are in place.
- I. Protect incomplete backfill areas from desiccation, crusting, or cracking.
- J. Make gradual grade changes. Blend slope into level areas.
- K. Remove surplus backfill materials from site unless authorized by Owner to dispose of on-site in an Owner designated location.
- L. Leave fill material stockpile areas free of excess fill materials.
- M. Provide survey information before and after placement of structural fill.

### 3.5 Tolerances

- A. Top Surface Type S1 fill shall be plus or minus 2 inches from required elevations provided minimum thicknesses are achieved. Top surface of Type S2 fill shall be 0 to +2 inches from required thicknesses. Top surface of S5 fill shall be 0 to +2 inches from required thicknesses.
- B. Top surface of S6 fill shall exceed the minimum slopes and be less than the maximum slopes specified in the drawings for the top deck of the landfill. The waste shall be placed in consistent, horizontal lifts and spread evenly across the top deck area.
- C. Constructed thickness of Type S1, S2 and S5 fills in excess of 10% greater than required shall be excluded from payment.

### 3.6 Field Quality Control

- A. Laboratory Testing:
  - 1. Perform laboratory material tests in accordance with ASTM D422, ASTM D698, ASTM D2216, and ASTM D4318.
  - 2. Fill Type S1– Soil Materials test at a frequency of:
    - a. 10,000 cubic yards of material placed;
    - b. When materials used for structural fill change; and/or
    - c. when directed by the Engineer.
    - d. Sample size shall be 50-lb.
- B. In Place Compaction and Natural Moisture Content Tests
  - 1. Perform in place compaction tests in accordance with ASTM D1556, ASTM D6938, or ASTM D2937.
  - 2. Perform in place natural moisture content test in accordance with ASTM D4959 or ASTM D6938.



3. Fill Type S1 – Structural Fill: frequency of compaction/natural moisture content tests for structural fill at a minimum frequency of 1 test per 1,000 in-place cubic yards or as otherwise indicated in these Specifications.
4. Fill Type S2 and S3 – Infiltration Layer and Erosion Layer: no compaction or natural moisture content tests are required, see CQC Plan for additional information.
5. Fill Type S6 – no compaction or natural moisture content tests are required. Finished surface shall be proofrolled and any soft, wet or weak areas excavated and remediated.
6. Compaction criteria:
  - a. Type S1 fill shall be compacted to minimum 98 percent of its Standard Proctor (ASTM D 698) maximum dry density.
  - b. Compacted moisture content shall be within 2 percent of optimum moisture content for all fill placed, or as otherwise approved by Engineer.
- C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

### 3.7 Protection of Work

- A. Reshape and re-compact fills subjected to vehicular traffic.
- B. Protect completed fill areas from precipitation or by drying by smooth drum rolling all areas where no further work is immediately planned.
- C. Contractor is responsible for repairs required as a result of erosion of the placed fill soils, until satisfactory vegetative cover has been established.

**END OF SECTION**



**Technical Specification 02324 - Trenching**  
**East Bend Station, East Landfill Final Cover Modifications**  
Boone County, Kentucky  
S&ME Project No. 7217-17-004K

**April 2021**

Reference: **Technical Specification 02324 - Trenching**  
**East Bend Station, East Landfill Final Cover Modifications**  
Boone County, Kentucky  
S&ME Project No. 7217-17-004K



## Section 02324 Trenching

### 1.0 General (Part 1)

#### 1.1 Summary

**A.** Section Includes:

1. Trenching for buried pipe.
2. Liner system anchor trench.

**B.** Related Sections:

1. Section 02320 – Backfill
2. Section 02400 - Fabriform
3. Section 02500 – HDPE Pipe
4. Section 02672 – LLDPE Geomembrane
5. Section 2680 – Closure Turf

#### 1.2 Unit Price – Measurement and Payment

**A.** Trenching for buried piping:

1. Included with Section 02500

**B.** Anchor Trench

1. Included with Sections 02672 and Section 02680.

#### 1.3 References

**A.** American Society for Testing and Materials (ASTM) standards:

2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
3. ASTM D2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
4. ASTM D2487 – Standard Practices for Classification of Soil for Engineering Purposes (Unified Soil Classification System).
5. ASTM D2937 - Standard Test Method for Density of Soil in place by the Drive-Cylinder Method.
6. ASTM D6938 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).



## 1.4 Submittals

- A. N/A

## 2.0 Products

### 2.1 Fill Materials

- A. Structural Fill for pipe backfill: Type S1 as specified in Section 02320.
- B. Structural Fill for Anchor Trench Backfill: Type S1 as specified in Section 02320

## 3.0 Execution

### 3.1 Location of Trenches

- A. Location and approximate depths of proposed pipe trenches are shown on Drawings.
- B. Engineer or Owner reserves right to make changes in lines, grades, and depths of pipe lines and structures when changes are required for Project conditions.
- C. Location and minimum depths of proposed geosynthetic anchor trenches are as shown or noted on the Drawings.
- D. Additional locations and anchor trench geometry shall be as noted in the approved installation plan provided by the geosynthetic installer.

### 3.2 Trenching

- A. Cut trenches sufficiently wide to enable installation and allow inspection. Remove water or materials that interfere with Work.
- B. Protect all trenches from heavy precipitation events that would fill them with water and damage the subgrade surface from over-topping of the anchor trenches. Contractor is responsible for protection of anchor trenches and repair of the damaged caused by lack of protection between initial excavation and completion of backfill.
- C. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for pipe.
- D. Do not disturb subgrade soils within a 45 degree zone of influence with depth of foundations, if applicable.
- E. When Project conditions permit, slope side walls of excavation starting 2 feet above top of pipe. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this Section.
- F. When required, perform excavations and provide temporary bracing, shoring, and/or benching in accordance with applicable Federal, State, and local excavation safety standards.





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- G. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Engineer until suitable material is encountered. Backfill in accordance with this Specification 02324.
- H. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Fill Type S1 and compact to density equal to or greater than requirements for subsequent backfill material.
- I. Hand trim excavation. Remove loose matter.
- J. Correct over excavated areas with compacted backfill as specified in Section 02320 (Fill Type S1). Corrections for over excavation shall be conducted at no cost to the Owner.
- K. Stockpile excavated material in area designated on site and remove excess material not being used from site unless authorized by Owner to dispose of on-site in an Owner designated location.
- L. All materials that are excavated and are inter-mixed with waste must be hauled to and disposed of in the landfill active area, as designated by the Owner.

### 3.3 Backfilling

- A. Begin backfilling after the Owner's Representative has accepted the appropriate survey for pipe or anchor trench.
- B. Trenches with Piping:
  - 1. Cover pipe with Fill Type S1 in loose 8 inch or thinner lifts with unfrozen fill materials, compacted uniformly to a minimum of 95 percent of its Standard Proctor maximum dry density (ASTM D698, ASTM D1557).
  - 2. Employ placement method that does not disturb or damage utilities in trench.
- C. Anchor Trench:
  - 1. The anchor trench will be backfilled with Fill Type S1 in a single, 24-inch lift with unfrozen fill materials. The top of the anchor trench shall be compacted uniformly, to a minimum of 95 percent of its Standard Proctor maximum dry density (AASHTO T180, ASTM D698, ASTM D1557).
  - 2. The time schedule for excavation and backfilling of the anchor trench is to be approved by the Engineer so that desiccation of trench soils does not occur prior to backfilling.
  - 3. The Contractor shall be responsible for keeping the anchor trenches from accumulating ponding surface water. This may be accomplished by supplying temporary drainage outlets along the outside edge of the anchor trench. Backfill of any temporary drainage measures is to be completed by the Contractor for no charge to the Owner.
- D. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Protect open trench to prevent danger to the contractor's workers, Owner's personnel and public.

### 3.4 Field Quality Control

- A. Perform laboratory material tests as described in Sections 02320.



- B.** Perform in place compaction tests in accordance with the following:
  - 1.** Density Tests: ASTM D1556, ASTM D2937, ASTM D6938.
  - 2.** The time schedule for excavation and backfilling of the anchor trench is to be approved by the Engineer.
  - 3.** Moisture Tests: ASTM D2216, ASTM D6938.
- C.** When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.
- D.** Frequency of Tests: At discretion of the Owner's Representative or Engineer. No minimum frequency of backfill testing is required.

### 3.5 Protection of Installed Construction

- A.** Reshape and re-compact fills subjected to vehicular traffic during construction.
- B.** General construction traffic shall be limited to areas designated by the Engineer that have been protected by at least 24 inches of compacted fill material.

**END OF SECTION**



**Technical Specification 02500 – HDPE Pipe**  
**East Bend Station, East Landfill Final Cover Modifications**  
Boone County, Kentucky  
S&ME Project No. 7217-17-004F

**May 2021**

Reference: **Technical Specification 02500 – HDPE Pipe**  
**East Bend Station, East Landfill Final Cover Modifications**  
Boone County, Kentucky  
S&ME Project No. 7217-17-004F



## Section 02500 HDPE Piping

### 1.0 General

#### 1.1 Summary

**A.** Section Includes:

1. Materials, placement, and installation of solid and perforated HDPE pipe and appurtenances for bench drains, slope drains, ditch drains and underdrains.
2. Furnishing all labor, equipment, and materials necessary to install precast concrete headwalls at underdrain outlets in accordance with the KYTC Section 610 and the Kentucky Standard Drawings RDP-10-09.

**B.** Related Sections:

1. Section 02060 - Aggregate
2. Section 02320 – Backfill – Structural
3. Section 02324 – Trenching

#### 1.2 Unit Price – Measurement and Payment

**A.** Bench Drains:

1. Basis of Measurement: By the linear foot of PE 4710 HDPE Pipe, DR-17, 6-inch IPS bench drain pipe installed.
  - a. Includes all materials and workmanship to construct bench drains, including the following:
    - Manufacturing pipe perforations.
    - KYTC Aggregate #57 stone around the pipe.
    - Geocomposite Drainage Net (GDN) wrap around the pipe.
    - Fusion welding of butt joints at pipe segments.
    - T-sections, 45-degree and 90-degree fittings at each underdrain connection, as applicable.

**B.** Slope Drains:

1. By the linear foot of PE 4710 HDPE Pipe, DR-17, 6-inch IPS slope drain pipe installed.
  - a. Includes all materials and workmanship to construct the slope drains, including the following:



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- Manufacturing pipe perforations.
- Geocomposite Drainage Net (GDN) wrap around the pipe.
- Fusion welding of butt joints at pipe segments.
- Fitting and appurtenances as needed to terminate slope drain into bench drain(s) as shown on the drawings.

**C. Ditch Drains:**

1. By the linear foot of PE 4710 HDPE Pipe, DR-17, 6-inch IPS ditch drain pipe installed.
  - a. Includes all materials and workmanship to construct the ditch drains, including the following:
    - Manufacturing pipe perforations.
    - Geocomposite Drainage Net (GDN) wrap around the pipe.
    - Fusion welding of butt joints at pipe segments.
    - Fitting and appurtenances as needed to terminate ditch drains at riprap stilling basins, including boot penetration through closure turf geomembrane as shown on the drawings.

**D. Underdrains:**

1. Basis of Measurement: By the linear foot of PE 4710 HDPE Pipe, DR-17, 6-inch IPS underdrain pipe installed.
  - a. Includes all materials and workmanship to construct underdrains from bench drain to outlet, including the following:
    - Non-Perforated HDPE pipe between bench drain and headwall.
    - Backfill of trench in accordance with Section 02320.

**E. Subsurface Drains:**

1. Basis of Measurement: By the linear foot of PE 4710 HDPE Pipe, DR-11, 4-inch IPS subsurface drain pipe installed.
  - a. Includes all materials and workmanship to construct subsurface drains along haul road at STA 4+00, 8+00, 12+00, 15+40 and 17+60, including the following:
    - Manufacturing pipe perforations.
    - Excavating for subsurface drain installation.
    - Backfill of trench in accordance with Section 02320.



**F. Headwalls**

1. Basis of Measurement: Measurement of concrete structures to be paid per each item and shall be a count of the installed and approved structures.
  - a. Includes all materials and workmanship to construct headwalls per these specifications and the drawings including:
    - Subgrade preparation
    - KYTC Perforated Pipe Headwall, with Animal Guard.
    - KYTC #2 Stone outlet protection with geotextile bedding.
    - Non-shrink grout (KYTC 835.19) as needed for fill voids at headwall and pipe connection.

**1.3 References**

**A. American Society for Testing and Materials (ASTM) standards:**

1. ASTM D638 - Standard Test Method for Tensile Properties of Plastics
2. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics
3. ASTM F714 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
4. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
5. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
6. ASTM D1238 - Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
7. ASTM F1473 - Standard Test Method for Notch Tensile Test to Measure the Resistance to Slow Crack Growth of Polyethylene Pipes and Resins
8. ASTM D1505 - Standard Test Method for Density of Plastics by the Density-Gradient Technique
9. ASTM D1603 - Standard Test Method for Carbon Black Content in Olefin Plastics
10. ASTM D2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
11. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
12. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings
13. ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

**B. Duke Energy Standard Procedure:**

Quality Assurance and Quality Control of HDPE Butt Fusion Joints; Procedure No. CCP-ENGSTD-NA-QA-004, Rev. No. 3, 7/09/2019 (Provided in Bid Specification, Appendix 9).

**1.4 Submittals**

**A. HDPE Pipe**



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1. **Product Data:** The Contractor or Supplier shall submit a complete description of and data indicating pipe material used, and pipe accessories and fittings proposed for use to the Engineer for approval at least two weeks prior to installation. Pipe data shall conform to the standards set in Table 02500-A found in this specification. The submittal shall include documentation that quality control measures are taken during manufacturing.
2. **Manufacturer's Certificates:**
  - Certification of the analysis for the HDPE resin.
  - Certify products meet or exceed specified requirements specified in Table 02500-A found in this 02500 specification.
  - Certifications must be submitted to Engineer for approval at least two weeks prior to installation.
- B. Manufacturer's Installation Instructions:** Indicate special procedures required to store and install products specified.
- C. Concrete Headwall –** Provide shop drawing for concrete headwall to be used, including identification of headwall pipe inlet diameter. Provide qualifications of precast manufacturer.
- D. Qualifications**
  1. The pipe, fittings and joints shall be provided by manufacturers who are specialists in the manufacture of piping systems. Each manufacturer shall have a minimum of five (5) years of experience, and shall show evidence of at least five (5) satisfactory installations for similar application.
- E. Quality Control Certificates**
  1. Prior to the installation of the leachate collection system piping, the manufacturer shall provide the Owners Representative the following information:
    - Certification of the analysis for the HDPE resin.
    - Certify products meet or exceed specified requirements specified in Table 02500-A found in this Specification.
  2. The Owners Representative shall verify that:
    - The property values certified by the piping system manufacturer meet the design specifications.
    - The measurements of properties by the piping system manufacturer are properly documented, and that the test methods used are acceptable.
- F. Fusion welding records**
  1. The fusion welding records shall be logged by the Contractor on a datalogger in accordance with Duke Energy, Coal Combustion Products, Quality Assurance and Quality Control of HDPE Pipe



Butt Fusion Joints, Procedure Number CCP-ENGSTD-NA-QA-004, which is included as an attachment to this Specification. Welding records shall be provided on a not more than weekly basis by the Contractor. The Contractor is responsible for repair of any welds that require repair, based on the data indicating a weld is outside the specification requirements.

## 1.5 Closeout Submittals

- A. Project Record Documents: Record location of bench drains, slope drains, ditch drains and underdrains and submit survey information to Engineer. Bench drain, slope drain and ditch drain points shall be obtained at each bend and at no time exceed 100 feet between points. The location of all fittings shall be surveyed in addition to the underdrain outlet point and one location between the outlet and the connection to the bench drain.

## 2.0 Products

### 2.1 Pipe

- A. HDPE Pipe
  1. Listed pipes shall be "PE 4710 HDPE Pipe, DR 17." All pipes are 6-inch IPS. The pipes shall be perforated or non-perforated as notated on the drawings.
- B. Base Resin (HDPE Material)
  1. HDPE material used for the manufacture of HDPE pipe and fittings under this specification shall be produced from approved pipe material base resin that is high density, high molecular weight polyethylene (HDPE) pipe grade resin with the nominal physical properties:
    - Equivalent to Type III, Category 5, Class C, Grade PE 4710 in accordance with ASTM D3350.
    - Equivalent to cell classification PE445574C in accordance with ASTM D3350.
    - As outlined in Table 02500-1 below.
  2. The material shall be listed by PPI (Plastics Pipe Institute, a division of the Society of the Plastics Industry) in PPI TR-4 with a 73°F hydrostatic design basis of 1,600 psi and a 140°F hydrostatic design basis of 800 psi. The PPI listing shall be in the name of the pipe manufacturer and shall be based on ASTM D 2837 testing.
  3. The resin shall contain not less than 97% of the base polymer and not less than 2% carbon black as defined in ASTM D3350, Class C to impart maximum weather resistance.
  4. The pipe material shall contain no more than 3% carbon black, anti-oxidants, and heat stabilizers combined, and no other additives, fillers or extenders.
  5. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same raw material, including both the base resin and the co-extruded resin.





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**C. Physical Appearance**

1. All pipes shall have good appearance qualities.
2. The pipe shall be homogeneous throughout and the surfaces shall be smooth and uniform with no visible defects.
3. The pipes shall be free of visible cracks, holes, voids, nicks, cuts, gouges, scratches, blisters, gels, undispersed ingredients, any signs of contamination by foreign inclusions, or other defects that may affect the wall integrity or the pipe's serviceability.

**D. Physical Properties**

1. Pipe and fitting dimensions, workmanship, standard dimension ratio (SDR) and corresponding pressure rating shall be in accordance with the requirements of ASTM F714.
2. HDPE piping shall have a Standard Dimension Ratio (SDR) as specified on the Drawings.
3. The chemical and corrosion resistance of the PE pipe and all fittings shall be in keeping with typical properties of high quality polyethylene products currently available through commercial sources and equal to or greater than that of the 60 mil HDPE geomembrane specified.
4. All mechanical fasteners or fittings shall be stainless steel.
5. At a minimum, the pipe material shall meet the properties presented in Table 02500-1.



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**Table 02500-A: Required Pipe and Base Resin Physical Properties**

PROPERTY	TEST METHOD	UNIT	REQUIRED VALUE
Material Designation	PPI-TR4		PE 4710
Cell Classification	ASTM D3350		445574C
Material Classification	ASTM D3350		Type III, Category 5, Class C
Density	ASTM D1505		≥0.945 g/cm <sup>3</sup>
Melt Index	ASTM D1238 (Condition E)	g/10min	<0.1
Carbon Black Content/Color; UV Stabilizer	ASTM D1603	% range	2 to 3
Flexural Modulus	ASTM D790 2% Secant	psi	>115,000
Tensile Strength @Yield	ASTM D638 (Type IV, 2 ipm) 1	psi	>3,400
Elongation @ Break	ASTM D638 (Type IV, 2 ipm) 1	%	>500
Ultimate Elongation @ Break	ASTM D638	%	>400
Slow-Crack-Growth (SCG) Resistance	ASTM F1473 (PENT) 80 °C	hrs	>500
Compressive Strength at Yield	ASTM D695	psi	>1,000
Slow Crack Resistance (SCG) (PENT test)	ASTM F1473	hours	>100
Hydrostatic Design Basis @ 73.4°F (23°C) 140°F (60°C)	ASTM D2837	psi	≥1,600 ≥1,000
Low Temperature Brittleness	ASTM D746	°F(°C)	< -103 (-75)
Linear Thermal Expansion Coefficient	ASTM D696	in/in/°F	1.0 x 10 <sup>-4</sup>

Notes:

(1) Dumb-bell tested at a rate of strain of 2 inches/minute (ipm)



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**E. Fittings**

1. All fittings specified on the Drawings, or otherwise, needed to make pipe connections (ex: 90° elbow) shall be in accordance with ASTM D2513 and ASTM D3261 and shall be manufactured by injection molding, a combination of extrusion and machining, or fabrication from HDPE pipe conforming to this specification.
2. The fittings shall be fully pressure rated and provide a working pressure equal to that of the pipe.
3. The fittings shall be manufactured from the same base resin type and cell classification as the pipe itself as specified in this Specification.
4. The fittings shall be homogeneous throughout and free from cracks, scratches, holes, foreign inclusions, voids, or other injurious defects.
5. Molded socket fittings shall not be used.
6. Pre-fabricated fittings:
  - Shall not be permitted unless molded fittings are not available from the pipe Manufacturer, and only after obtaining specific approval from the Engineer.
  - Shall be made using pipe segments meeting all base resin, physical, and property requirements presented in this Specification.
  - All pipe segments in a pre-fabricated fitting shall be pressure rated to exceed by 20% the highest pipe pressure rating to which they are intended to be connected.

**F. Joints**

1. The method of joining for high density polyethylene pipe shall be the heat butt fusion method. Pipe joints shall conform to the recommendations of the pipe manufacturer and the requirements of Duke Energy, Coal Combustion Products, Quality Assurance and Quality Control of HDPE Pipe Butt Fusion Joints, Procedure Number CCP-ENGSTD-NA-QA-004. In the event of conflicting requirements between the manufacturer recommendations and the Duke Energy procedures, the conflict shall be brought to the attention of the Engineer prior to fusion of the joints.

**G. Perforations**

1. The perforations shall be pre-fabricated by the Manufacturer. The HDPE pipe sections shall be perforated as shown on the Drawings. Perforations shall be cleanly cut, identical in geometry and evenly spaced. Perforations shall be drilled along entire pipe length.

## **2.2 Headwall**

**A. Headwall**

1. Precast concrete headwall, Kentucky Standard Drawings RDP-10-09 and as shown on the approved drawings.



## 3.0 Execution

### 3.1 Pipe

#### 3.1.1 Labeling

- A. The following shall be continuously indent printed on the pipe, or spaced at intervals not exceeding 5 feet:
- Name and/or trademark of the pipe manufacturer.
  - Pipe series designation.
  - Nominal pipe size.
  - Standard dimension ratio (SDR).
  - The letters PE followed by the polyethylene grade per ASTM D3350, followed by the Hydrostatic Design basis in 100's of psi (e.g. PE 4710).
  - Manufacturing Standard Reference (e.g. ASTM F714-1).
  - A production code from which the date and place of manufacture can be determined.

#### 3.1.2 Handling and Placement

- A. The Contractor shall handle and place piping materials in accordance with manufacturer's instructions and in such a manner so as to minimize damage.
- B. The Contractor shall inspect the interior of all pipe segments and fittings, and completely remove all dirt, gravel, sand, debris, or other foreign material prior to placement.
- C. If bracing of the piping is required to facilitate burial of the pipe with bedding stone or drainage layer, bracing shall be accomplished by means of weights, ropes, or other suitable means which will not damage either the piping or liner system. The use of driven stakes or other means which could penetrate the liner, is strictly prohibited.
- D. Fused segments of pipe shall be handled so as to avoid damage to the pipe.
- E. Chains or cable type chokers must be avoided when lifting fused sections of pipe. Nylon slings are preferred.
- F. Spreader bars are recommended when lifting long fused sections.
- G. Pipe shall be fused in lengths not to exceed that which can be moved and placed easily and safely, causing no damage to the fused pipe or weld.

#### 3.1.3 Joints

- A. All joints shall be made in accordance with the manufacturer's instructions and these Specifications.
1. The method of joining for HDPE DR17 pipe shall be the heat butt fusion method of high density polyethylene pipe. Joining shall be performed in strict accordance with the pipe manufacturer's recommendations and Duke Energy Coal Combustion Products, Quality Assurance and Quality Control of HDPE Pipe Butt Fusion Joints, Procedure Number CCP-ENGSTD-NA-QA-004. Revision Number 3 (7-08-2019) of this document is attached to this Specification. In the event heat fusion



is not applicable to a specific joint, electrofusion fittings may be used. Extrusion welding or hot gas welding of HDPE shall not be used for pressure pipe applications or fabrications where shear or structural strength is important, as determined by the Engineer. Mechanical joint adapters, flanges, unions, grooved-couplers, transition fittings, and some mechanical couplings may be used to mechanically connect HDPE pipe with approval by the Engineer. Refer to the manufacturer's recommendations.

### 3.1.4 *Equipment Traffic*

- A. Equipment used for the installation of the HDPE pipes and underdrains shall conform to the requirements for equipment traffic for Geosynthetic Liner installation and/or soil placement above the geosynthetics included in the CQC Plan.

### 3.1.5 *Quality Control*

- A. Delivered piping system materials shall be examined by the Contractor who will verify that the materials are not broken, cracked, or contain otherwise damaged or unsatisfactory material.
- B. Quality control by the Owners Representative will include testing, monitoring and/or inspecting:
  - The HDPE pipe and fittings for correct size, SDR rating; workmanship, and fabrication.
  - Damage during installation.
  - The installation, alignment and welding of all pipe, and fittings.
  - Review of all welding records for the pipe, as provided in accordance with Duke Energy specification CCP-ENGSTD-NA-QA-004.
  - Backfilling of the pipe.
- C. Any deviation shall be noted by the Owners Representative and reported to the Owner. HDPE pipes and other miscellaneous items shall be subject or rejection on account of failure to conform to these specifications.

## 3.2 **Headwall**

### 3.2.1 *Handling and Placement*

- A. Per KYTC Section 610 and KYTC Standard Drawings.

### 3.2.2 *Foundation Preparation and Backfill*

- A. Prepare subgrade to satisfaction of Engineer. Subgrade should be smooth and firm and free of any ruts, erosion or deleterious materials.

## 3.3 **Protection of Installed Construction**

- A. Protect pipe from damage or displacement until backfilling operation is complete.



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- B.** Subsurface drain pipes along haul road are not designed to withstand loading from heavy truck traffic. Contractor shall install subsurface drain pipes at the end of construction, or is required to replace crushed pipes if damaged during construction.

**END OF SECTION**



**Technical Specification 02672 – LLDPE Geomembrane**  
**East Bend Station, East Landfill Final Cover Modifications**  
Boone County, Kentucky  
S&ME Project No. 7217-17-004E

**August 2019, Rev. July 2020**

Reference: **Technical Specification 02672 – LLDPE Geomembrane**  
**East Bend Station, East Landfill Final Cover Modifications**  
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## Section 02672 Linear Low Density Polyethylene (LLDPE) Geomembrane

### 1.0 General

#### 1.1 Summary

**A.** Section Includes:

1. Linear Low Density Polyethylene (LLDPE) Geomembrane for the cover system.

**B.** Related Sections:

1. Section 02320 - Backfill - Structural.
2. Section 02675 – Geocomposite Drainage Layer
3. Section 02679 – LLDPE Structured Geomembrane

#### 1.2 Unit Price – Measurement

**A.** LLDPE geomembrane:

1. Basis of Measurement: By square foot of geomembrane installed, in-place, excluding scrap and overlap.
  - a. Includes furnishing geomembrane, storage, installation, labor, supervision, transportation, equipment, and incidental items as required to complete the geomembrane installation to temporary or permanent termination limits, as specified on Drawings and in accordance with CQC Plan.
  - b. Measurement will be made based on the total two-dimensional (plan view) surface area in square feet based on as-built conditions. No allowance will be made for geomembrane in anchor and drainage trenches or waste, overlap, repairs, or materials used for the convenience of the Contractor.

#### 1.3 References

**A.** Construction Quality Control (CQC) Plan

**B.** American Society for Testing and Materials (ASTM) standards:

1. ASTM D792 Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
2. ASTM D1004 Standard Test Method of Initial Tear Resistance of Plastic Film and Sheeting.



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3. ASTM D1204 Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.
  4. ASTM D1505 Standard Test Method for Density of Plastics by the Density-Gradient Technique.
  5. ASTM D1603 Standard Test Method for Carbon Black in Olefin Plastics.
  6. ASTM D3895 Test Method for Oxidative Induction Time of Polyolefins by Differential Scanning Calorimetry.
  7. ASTM D4218 Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Method.
  8. ASTM D4354 Standard Practice for Sampling of Geosynthetics for Testing.
  9. ASTM D4759 Standard Practice for Determining the Specification Conformance of Geosynthetics.
  10. ASTM D4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
  11. ASTM D5199 Standard Test Method for Measuring Nominal Thickness of Geosynthetics.
  12. ASTM D5321 Standard Test Method for Determining the Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear..
  13. ASTM D5397, Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test.
  14. ASTM D5596 Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.
  15. ASTM D5641 Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.
  16. ASTM D5721 Standard Practice for Air-Oven Aging of Polyolefin Geomembranes.
  17. ASTM D5885 Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry.
  18. ASTM D5994 Standard Test Method for Measuring the Core Thickness of Textured Geomembranes.
  19. ASTM D6392 Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
  20. ASTM D6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes.
  21. ASTM D7238 Standard Test Method for Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent UV Condensation Apparatus.
  22. ASTM D7466 Standard Test Method for Measuring the Asperity Height of Textured Geomembrane.
- C. Geosynthetic Research Institute (GRI) Standards:
1. GM6 Pressurized Air Channel Test for Dual Seamed Geomembranes.
  2. GM10 Specification for the Stress Crack Resistance of Geomembrane Sheet.
  3. GM12 Measurement of the Asperity Height of Textured Geomembrane Using a Depth Gage.
  4. GM17 Test Properties, Testing Frequency and Recommended Warranty for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembrane.
  5. GM19 Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes.



**D.** U.S. Environmental Protection Agency (EPA), Technical Guidance Document:

- 1.** "The Fabrication of Polyethylene FML Field Seams" EPA/530/SW-89/069, (1193).

## **1.4 Submittals**

- A.** The Geosynthetic Installer shall submit proposed geomembrane panel layout, including anchor trenches and connections to any inlet/outlet structures, to the Engineer at least 14 days prior to mobilization of crews. Once the panel layout is approved, the Geosynthetic Installer may not change the layout without permission of the Engineer.
- B.** Manufacturer's Product Information
  - 1.** At least five (5) working days prior to shipment, the Geosynthetic Contractor shall furnish the Engineer with pre-shipping product data sheets and test data for each geomembrane type. At a minimum, the Manufacturer will perform the tests at the frequencies given in Tables 02672-A found in this Section on the LLDPE sheet prior to shipping LLDPE material to the site. These tests shall conform to the standards set in Table 02672-B also found in this Section. The information supplied shall be in the form of a factory quality control certificate for each geomembrane roll and shall include the following:
    - a.** Roll and lot numbers and identification.
    - b.** Length and width of each roll.
    - c.** Date each roll was manufactured.
    - d.** Sampling procedures.
    - e.** Results of quality control tests that are to include those presented in Tables 02672-A found in this Section and description of test methods used. The results of these tests must meet the minimum required physical properties for LLDPE geomembrane specified in Table 02672-B found in this Section.
- C.** A written certificate from the geomembrane manufacturer stating that the resin and geomembrane materials supplied are in compliance with this Section 02672.
- D.** Manufacturer's Installation Instructions: Submit special procedures for geomembrane installation.
- E.** The Geosynthetics Installer shall adopt and use the quality assurance forms prepared by the Owner's Representative, or other forms approved by the Owner's Representative, during all applicable phases of geomembrane installation, inspection and testing. The Geosynthetics Installer can request to use his forms. The forms must be submitted to the Owner's Representative at least two weeks prior to geomembrane installation for review and approval.
- F.** A resume of the proposed Superintendent of the Geosynthetics Installer must be submitted to the Engineer for final approval two weeks prior to geomembrane installation.
- G.** The Contractor is responsible for his own Health and Safety Plan, but must abide by any safety procedures dictated by the Owner.



## 1.5 Closeout Submittals

- A. Forms by the Owner's Representative:
  - 1. Owner's Representative Daily Field Report
  - 2. Field Inventory Control, Storage Inspection, and Cross-Reference Roll Numbers
  - 3. Subgrade Certification
  - 4. Geomembrane Trial Seam Log
  - 5. Geomembrane Deployment Report
  - 6. Geomembrane Seam Log
  - 7. Geomembrane Defect Log
  - 8. Geomembrane Repair Testing Log
  - 9. Geomembrane Laboratory Destructive Test Results
- B. The Contractor is responsible for providing an as-built drawing of the geomembrane installation. The as-built drawing shall include panel corners, transitions in panel geometry, repair locations, the inside bottom corner of the anchor trench, and other significant features.
- C. The Geosynthetics Installer's supervisor shall observe and check all phases of the geomembrane installation. When the geomembrane is accepted by the Owner, the Geosynthetics Installer shall submit a Letter of Acceptance to the Owner that the installation conforms to the requirements of the Manufacturer.

## 1.6 Quality Assurance

- A. Perform Work in accordance with these Specifications and the CQC Plan.
- B. Friction Angle Requirements and Testing
  - 1. The effective interface shear strength envelope at the interface between the geomembrane and the materials in direct contact with the geomembrane (i.e., interim cover soil, waste and geocomposite drainage layer) shall be verified by the CQA Officer by performing interface friction testing on representative materials to be used for construction of the liner system.
  - 2. The minimum effective friction angle shall be 28.7 degrees at a confining stress of 250 psf.
  - 3. The interface frictional resistance shall be determined by direct shear tests in general accordance with ASTM D5321.
  - 4. The interfaces and/or soil shall be tested saturated with water.
- C. The Manufacturer shall sample and test the LLDPE geomembrane material, at minimum frequencies specified in Table 02672-A. General manufacturing procedures shall be performed in accordance with the Manufacturer's internal quality control guide and/or documents.
- D. All geomembrane sheets shall be continuously spark tested during manufacturing.
  - 1. The spark tester shall be capable of detecting defects or pinholes less than 10 mils in diameter.
  - 2. All necessary repairs to the geomembrane shall be made by the manufacturer at the factory before shipment.



3. The manufacturer shall provide written certification to the Owner and/or Engineer that all the geomembrane rolls delivered to the project were continuously spark tested and do not contain pinhole defects.

**E. Conformance Testing:**

1. Conformance testing shall be performed by an independent laboratory at a frequency of at least 1 per 100,000 square feet of geomembrane manufactured for this project. Conformance testing shall consist of the following tests:

- a. Thickness (ASTM D5199 and/or ASTM D5994).
- b. Density (ASTM D1505 and/or ASTM D792).
- c. Asperity Height (ASTM D7466 or GRI GM 12)
- d. Carbon black content (ASTM D1603).
- e. Tensile properties including break strength and break elongation (ASTM D6693).
- f. Tear resistance (ASTM D1004)
- g. Other tests as required by Engineer.

2. Sampling for conformance testing shall be performed at the manufacturing facility whenever possible, and in accordance with the CQC Plan.

- F. The Engineer shall examine the rolls upon delivery to the site and report any deviations from these Specifications to the Contractor.
- G. If a geomembrane sample fails to meet the quality control requirements of this Section, the Contractor and/or Engineer shall require that the Geomembrane Manufacturer sample and test each roll manufactured in the same lot or batch, or at the same time, as the failing roll. Additional sampling and testing shall be completed at no additional cost to the Owner. Sampling and testing of rolls shall continue until a pattern of acceptable test results is established.
- H. Any geomembrane sample that does not comply with this Section shall result in rejection of the roll from which the sample was obtained. The Contractor shall replace any rejected rolls at no additional cost to Owner. At the Geomembrane Manufacturer's discretion and expense, additional testing of individual rolls may be performed to more closely identify noncomplying rolls and to qualify individual rolls.

## 1.7 Qualifications

**A. Geosynthetic Contractor Equipment and Personnel**

1. Quality Control Foreman (QCF)

- a. The Geosynthetics Installer shall provide an individual whose title is "Quality Control Foreman" (QCF) who shall be experienced in all phases of quality control testing and procedures.



- b. The QCF will be dedicated to performing or directing the Geosynthetics Installer’s quality control activities, (i.e. air pressure, vacuum box and spark non-destructive testing and field destructive testing).
        - c. The QCF and the Superintendent may be the same person if approved by the Engineer.
- 2. Equipment
  - a. Geosynthetic Contractor shall supply and maintain at least three extrusion welders and three double hot wedge fusion welders, at least one of which must be available at the working space at all times.
  - b. At least one extra generator shall be supplied and maintained by the Geosynthetic Contractor to be used as a spare.

## 2.0 Products

### 2.1 Linear Low Density Polyethylene (LLDPE) Geomembrane

- A. Materials:
  - 1. Textured geomembrane shall be made of unreinforced linear low density polyethylene (LLDPE) that has a nominal thickness as noted on the Drawings and designed and manufactured specifically for the purpose of liquid containment.
  - 2. The geomembrane used shall meet, at a minimum, the standards specified in Table 02672-B found in this Section.
  - 3. At least one side of the geomembrane shall be white. The white side shall be installed facing upwards.
  - 4. The chemical resistance of the geomembrane shall be in keeping with typical properties of high quality polyethylene products currently available through commercial sources.
  - 5. Up to 5 percent (by weight) clean, uncontaminated regrind material (that is, material that has been previously processed by the same manufacturer, but has never seen previous service) shall be allowed in the Geomembrane sheet if approved by the Engineer.
  - 6. Regrind material made of the same resin as the geomembrane from sheet failing the physical properties of the geomembrane or resin as specified herein shall not be allowed under any circumstances.
  - 7. Edge trim and sheet failed for thickness or cosmetic reasons may be considered for regrind.
  - 8. LLDPE geomembrane shall be supplied in rolled sheets having a minimum width of 22 feet and a minimum length of 400 feet. Variances for shorter roll lengths may be allowed at the discretion of the Owner’s Representative.



**Table 02672-A**  
**Required Pre-Shipping Sheet Testing of Geomembrane Liner - Textured**

Property	Test Method	Frequency
<b>Thickness</b>	ASTM D5994	Each Roll
<b>Asperity Height mils</b>	ASTM D7466	Every 2 <sup>nd</sup> roll (1)
<b>Density</b>	ASTM D1505 ASTM D792	Every 200,000 lb.
<b>Tensile Properties (2)</b> ♦ Break Strength ♦ Break Elongation	ASTM D6693 TYPE IV	Every 20,000 lb.
<b>2% Modulus</b>	ASTM D5323	Per each formulation
<b>Tear Resistance</b>	ASTM D1004	Every 45,000 lb.
<b>Puncture Resistance</b>	ASTM D4833	Every 45,000 lb.
<b>Axi-Symmetric Break Resistance Strain (min.)</b>	ASTM D5617	Per each formulation
<b>Carbon Black Content</b>	ASTM 4218 (3)	Every 45,000 lb
<b>Carbon Black Dispersion</b>	ASTM D5596	Every 45,000 lb.
<b>Oxidative Induction Time (OIT) (4)</b>		Every 200,000 lb.
<b>a.</b> Standard OIT (min. ave.) OR	ASTM D3895	
<b>b.</b> High Pressure OIT (min. ave.)	ASTM D5885	
<b>Oven Aging at 85°C</b>	ASTM D5721	Per each formulation
<b>a.</b> Standard OIT (min. ave.) - % retained after 90 days OR	ASTM D3895	
<b>b.</b> High Pressures OIT (min. ave.) - % retained after 90 days	ASTM D5885	
<b>UV Resistance (5)</b>	ASTM D7238	
<b>b.</b> High Pressure OIT (min. ave.) - % retained after 1600 hrs	ASTM D5885	Per each formulation

- (1) Alternate the measurement side for double sided textured sheet.
- (2) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction. Break elongation is calculated using a gage length of 2.0 inches at 2 inches/minute.
- (3) Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 (muffle furnace) can be established.
- (4) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
- (5) The condition of the test should be 20 hr. UV cycle at 75 °C followed by 4 hr. condensation at 60°C. UV resistance is based on percent retained value regardless of the original value.



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**Table 02672-B**  
**Required Physical Properties of LLDPE Geomembrane - Textured**

Property	Test Method	Required Value
<b>Liner Thickness (Normal)</b>		40 mil
<b>Thickness (min. ave.)</b>	ASTM D5994	38 mils
◆ lowest individual for 8 out of 10 values		36 mils
◆ lowest individual for any of the 10 values		34 mils
<b>Asperity Height mils (min. ave.)</b>	ASTM D7466	16 mils
<b>Density (max.)</b>	ASTM D1505/ ASTM D792	0.939 g/cc
<b>Tensile Properties (min. ave.)</b>	ASTM D6693, Type IV	60 lb./in.
◆ Break Strength		250%
◆ Break Elongation		
<b>2 % Modulus (max.)</b>	ASTM D5323	2,400 lb./in.
<b>Tear Resistance (min. ave.)</b>	ASTM D1004	22 lb.
<b>Puncture Resistance (min. ave.)</b>	ASTM D4833	44 lb.
<b>Axi-Symmetric Break Resistance Strain</b>	ASTM D5617	30%
<b>Carbon Black Content (range)</b>	ASTM 4218	2.0 – 3.0%
<b>Carbon Black Dispersion</b>	ASTM D5596	9 in Categories 1 or 2 and 1 in Category 3
<b>Oxidative Induction Time (OIT)</b>		
a. Standard OIT (min. ave.) OR	ASTM D3895	100 minutes
b. High Pressure OIT (min. ave.)	ASTM D5885	400 minutes
<b>Oven Aging at 85°C</b>	ASTM D5721	
a. Standard OIT (min. ave.) - % retained after 90 days Or	ASTM D3895	35%
b. High Pressures OIT (min. ave.) - % retained after 90 days	ASTM D5885	60%
<b>UV Resistance</b>	ASTM D7238	
◆ High Pressure OIT (min. ave.) - % retained after 1600 hrs	ASTM D5885	35%
<b>Seam Strengths (1)(2)</b>		
1. Shear Strength Hot Wedge Seam Extrusion Fillet Seam	ASTM D6392	60 lb(in (min.) 60 lb(in (min.)
2. Peel Strength Hot Wedge Seam Extrusion Fillet Seam	ASTM D6392	50 lb(in (min.) 40 lb(in (min.)
3. Peel Separation Hot Wedge Seam Extrusion Fillet Seam	ASTM D6392	25% 25%
<b>Non-Destructive Testing</b>		
1. Extrusion Fillet Seam (Single Weld)	Continuous Vacuum Box	Maintain vacuum of at least 5 psi for at least 15 seconds





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2. Hot Wedge Seam (Double Weld)	Air Testing	Maintain 30 psi for at least 5 minutes, with a drop in pressure not greater than 3 psi
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- (1.) Value listed for shear and peel strengths are for 4 out of 5 test specimens; the 5<sup>th</sup> specimen can be as low as 80% of the listed values.
- (2.) When welding to a geomembrane with a different thickness, seam strength requirements shall meet or exceed the requirements for the thinner roll.

### 3.0 Execution

The Geosynthetics Installer shall furnish all labor, materials, supervision and equipment to complete the Geomembrane Liner for the project including, but not limited to, geomembrane layout, seaming, patching, and all necessary and incidental items required to complete the work, in accordance with the Drawings and these Specifications.

#### 3.1 Delivery, Storage and Handling

- A. Geomembrane liner shall be shipped:
  - 1. Rolled and labeled with roll number and manufacturer's batch number.
  - 2. Manufacturer's quality control documentation shall be included with each roll.
- B. Transport and handle geomembrane with equipment designed to protect geomembrane from damage. The Contractor shall be responsible for unloading and storage of geomembrane in a manner that prevents damage to the geomembrane.
- C. On-site storage shall be as needed to protect the geomembrane rolls from excessive accumulations of soil on the geomembrane surfaces, water, heat, mechanical abrasion, puncture and vehicular traffic.
- D. The geomembrane rolls shall not be stacked more than three rolls high, or as otherwise recommended by the Manufacturer.

#### 3.2 Daily Pre-Installation Meetings

- A. At the beginning of each work day the Earthwork Contractor's Superintendent, the Geosynthetic Contractor's Superintendent, and the Owner's Representative will meet to discuss the upcoming work plan for all parties to promote cooperation, communication and understanding. Care shall be taken to provide as much notice as possible when scheduling geomembrane as-built survey. Operations shall be planned and implemented so as not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

#### 3.3 Preparation

- A. The geomembrane is to cover the landfill interim cover or waste in accordance with the Drawings
- B. Ensure acceptance of underlying layers before installing overlying layers.
- C. Prepare ballast loading that shall be used for anchoring down the geomembrane during installation.



1. Ballast loading may consist of sand bags or Portland cement bags.
2. Bags used for containing sand or cement shall be resistant to degradation by ultraviolet rays and by the weather in general.

**D. Surface Water Control and Base Maintenance**

1. The base shall be maintained well-drained and dry prior to and during geomembrane installation.
2. The Geosynthetics Installer shall be responsible for surface water control during geomembrane installation as needed to maintain all work areas well-drained and dry during construction, preclude ponding, and prevent uplift of the geomembrane after installation.
3. The Geosynthetics Installer's proposed dewatering method(s) shall be submitted to the Owner's Representative at least one week prior to implementation.

### **3.4 Installation**

Installation of the geomembrane shall be in compliance with this Specification and with the Manufacturer's standard guidelines and specifications for geomembrane installation, subject to approval by the Owner's Representative, including, but not limited to: (i) handling and site storage requirements; (ii) unrolling and laying of geomembrane sheets; (iii) field seaming or welding techniques; and (iv) anchor trench and ballast details.

**A. Liner Handling and Placement**

1. Appropriate handling equipment shall be used when loading or moving rolled geomembrane sheets from one place to another. Appropriate equipment includes spreader and roll bars for deployment, and cloth chokers with a spreader bar for off-loading.
2. Do not use materials damaged during storage or handling. If the geomembrane is not packaged and a roll is damaged during shipment, it shall be rejected. If only the outermost surface of the roll is affected, it shall be peeled back, cut, and wasted (i.e., it shall be treated as if it were the protective packaging for the remainder of the roll).
3. The geomembrane shall be installed at the locations and to the lines, grades and dimensions shown on the Drawings, or as otherwise directed by the Engineer.
4. Liner deployment shall not be performed when precipitation is occurring, when excessive moisture or wet conditions exist, or when high winds or other adverse climatologic conditions exist.
5. The geomembrane sheets shall be unrolled and deployed in a manner which minimizes wrinkles and prevents the occurrence of folds and creases.
6. Unroll only those sections that are to be seamed together in one day.
7. Adjoining geomembrane panels shall be overlapped as recommended by the manufacturer, but not less than 4 inches, by adequately lapping the edges of the sheets. The overlap shall not exceed 6 inches for double-wedge fusion welds.
8. For stormwater drainage purposes, the upstream panel should be overlapped on top of the downstream panel to form a shingle effect.



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9. Panel layout and deployment shall be such that the seams run down the slopes and are oriented perpendicular to the top of slope. The seam orientation shall be maintained for a distance of 10 feet from the toe of slope or as shown on the Drawings.
10. Cross seams will be allowed on slopes provided that the cross seams are cut at 45 degrees and adjacent cross seams are staggered. Cross seams must be kept to the lower half of the slope and only one cross seam is allowed per panel slope length.
11. Unroll several panels and allow the geomembrane to "relax" before beginning field seaming. The purpose of this is to make the edges that are to be bonded as smooth and free of wrinkles as possible.
12. In corners and odd shaped geometric locations, the number of field seams should be minimized.
13. After panels are initially in place, remove wrinkles as directed by the Engineer.
14. All geomembrane sheets shall have good appearance qualities. Texturing on the surface of the textured sheets shall be uniform and homogeneously distributed. The geomembrane shall be free of pinholes, holes, blisters, gels, undispersed ingredients, any signs of contamination by foreign matter, or any defect that may affect serviceability. The edges of geomembrane sheets shall be straight and free from nicks and cuts.
15. Once panels are in place and smooth, commence field seaming operations.

**B. Field Seaming**

1. Field seaming shall be in accordance with U.S. E.P.A. Technical Guidance document: "The Fabrication of Polyethylene FML Field Seams" EPA/530/SW-89/069 and/or according to this Section 02672.
2. Field seaming shall be conducted in the dry, on a compacted smooth surface. Surfaces to receive geomembrane installation should be relatively smooth and even, and free of voids, protrusions, and deleterious material.
3. All geomembrane sheets must be continuously and tightly bonded using continuous extrusion fillet welds or double wedge fusion welds and automated welding equipment approved by the Engineer. The Engineer reserves the right to reject any proposed seaming method it believes unacceptable. Double hot wedge fusion welding shall be the predominant seaming method. Additional concepts and requirements of proper field seaming include the following:
  - a. All geomembrane shall be seamed the same day that the geomembrane is deployed.
  - b. All geomembrane shall be ballasted immediately after deployment to prevent uplift by winds.
  - c. A moveable protective layer of plastic or approved material may be placed directly below each overlap of geomembrane that is to be seamed. This is to prevent any moisture build-up between the sheets to be welded. The protective layer must be removed after welding.
  - d. All foreign matter (dirt, moisture, oil, etc.) shall be removed from the edges to be bonded. For extrusion welds, the bonding surfaces must be thoroughly cleaned by mechanical abrasion or alternate methods approved by the Engineer to remove surface cure and prepare the surfaces for bonding. No solvents shall be used to clean the geomembrane.
  - e. Grinding:



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- (1) All abrasive buffing shall be performed using No. 80 grit or finer sandpaper.
  - (2) The grinding shall be performed so that any and all grind marks are perpendicular to the edge of sheet.
  - (3) No grinding greater than 1/4 inch outside the welds is permitted or the Engineer can require patching.
- f. As much as practical, field seaming shall start from the top of the slope down. This will minimize large wrinkles from becoming trapped that require cutting and patching.
  - g. Seaming of the bottom geomembrane to the sidewall geomembrane (toe seam) shall be conducted when conditions minimize thermal expansion effects.
  - h. Tack welds (if used for temporary conditions) shall use heat only; no double sided tape, glue or other method will be permitted.
  - i. The geomembrane should be seamed completely to the ends of all panels to minimize the potential of tear propagation along the seam.
  - j. Seaming will extend to the outside edge of panels to be placed in anchor trenches. If required, a firm substrata should be provided by using a flat board, or similar hard surface directly under the seam overlap to achieve proper support across the anchor trench.
  - k. The completed geomembrane shall not exhibit any "trampolining" during late morning to early evening hours. All areas exhibiting trampolining must be repaired as directed by the Engineer. Additional slack (i.e.: 1-3%) shall be allowed on the side slopes to reduce the potential for trampolining.
  - l. All field seams must be uniform in appearance, width and properties, and shall not exhibit warping due to overheating from welding.
  - m. The peel and shear strengths of the welded seams must comply with the strength criteria stated in Table 02672-B of this Section.
  - n. Ambient Weather Conditions:
    - (1) Ambient temperature is measured 18 inches above the geomembrane surface.
    - (2) The Geosynthetics Installer shall supply instrumentation for measurement of ambient temperature.
    - (3) Welding of field seams shall not take place except during suitable ambient weather conditions, as confirmed by field trial test welds.
    - (4) No seaming should be attempted above 40°C (104°F) ambient air temperature
    - (5) Below 5°C (41°F) ambient air temperature, preheating of the geomembrane will be required, unless it is demonstrated that this is not necessary (i.e., acceptable test (start-up) seams that duplicate, as closely as possible, actual field conditions can be achieved). Preheating may be achieved by natural and/or artificial means (shelters and heating devices).
  - o. Seams at the panel corners of 3 or 4 sheets shall be completed with a circular patch approximately 12 inches in diameter, extrusion welded to the parent sheets, or with a "T" weld at suitable locations.



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**C. Pipe Penetrations**

1. Pipe penetrations in the geomembrane shall be sealed using polyethylene pipe boots (sleeves and skirts), gaskets, banding straps, or other material as shown on the Drawings.
2. Surfaces where pipe boots are to be attached (including pipe) shall be cleaned to remove dirt, oil, debris, or other deleterious materials.
3. Prior to attaching and/or seaming pipe boots, the Owner's Representative shall visually inspect all prepared surface to verify that the proper preparation techniques have been followed.

**D. Temporary Ballast Loading**

1. Adequate temporary ballast loading that will not damage the geomembrane shall be placed by the Geosynthetics Installer over the geomembrane during installation as needed to prevent uplift by wind and by rapid changes in barometric pressure.
2. Temporary ballast loading shall be in addition to the anchor trenches.
3. If high winds are expected, boards along the edge of unseamed panels, with weighted sandbags on top, may be used to anchor the geomembrane on the subgrade.
4. Staples, U-shaped rods or other penetrating anchors shall not be used to secure the geomembrane on the side slopes, on the floor or anywhere else in the construction area.
5. Any damage to the geomembrane including damage due to construction activities or wind, rain, hail, or other weather shall be the sole responsibility of the Geosynthetics Installer.
6. All temporary ballast loading shall be removed by the Geosynthetics Installer prior to demobilizing from the site unless otherwise approved by the Owner.

**3.5 Field Quality Control**

- A. The Geosynthetics Installer shall adopt and use the quality assurance forms prepared by the Owner's Representative or other forms approved by the Owner's Representative, during all applicable phases of geomembrane installation, inspection and testing. The Geosynthetics Installer can request to use his forms. The forms must be submitted to the Owner's Representative at least two weeks prior to geomembrane installation for review and approval.
- B. All aspects of the geomembrane installation will be inspected on a full-time basis by the Owner's Representative.
  1. The Owner's Representative will conduct his own observations and perform quality control tests in addition to those performed by the Geosynthetics Installer.
  2. Testing of the seams and repairs will be conducted by the Geosynthetics Installer under observation by the Owner's Representative.
  3. The Owner's Representative or a designated, independent geosynthetics laboratory may perform additional testing, as required by these detailed Specifications or as required in the judgment of the Owner's Representative to verify that the LLDPE sheet and seams meet these Specifications.
  4. Quality control by the Owner's Representative will include monitoring:



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- a. Liner handling and panel deployment
  - b. Field seaming or welding of geomembrane sheets and non-destructive testing of field seams or welds
  - c. Placement and maintenance of temporary ballast loading
- C. Trial Seams
  1. The Installer shall maintain and use equipment and personnel at the site to perform testing of trial seams.
  2. Frequency:
    - a. Trial seams will be made in the morning and afternoon, after any interruption in power, after any prolonged idle period during the day, when changes in storing equipment occur, and at the request of the Engineer at any other time during the day.
  3. Each seamer/welder shall prepare a test strip using the welding apparatus assigned to him.
  4. Trial seams will be made on fragment pieces of geomembrane to verify that seaming conditions are adequate. A trial seam shall be made for each texture contact type to be seamed by that welder during the working increment.
  5. Requirements for trial seams are as follows:
    - a. The trial seam sample will be at least 5 feet long by 1 foot wide with the seam centered lengthwise.
    - b. Ten adjoining specimens 1-inch wide each will be cut from the trial seam sample.
    - c. These specimens will be tested in the field with a tensiometer and/or manual seam tester for both shear (5 specimens) and peel (5 specimens).
    - d. For dual wedge, both inside and outside welds shall be tested in peel.
    - e. Trial seams will be tested by the Geosynthetics Installer under observation of the Owner's Representative.
    - f. The Geosynthetics Installer shall supply all necessary knowledgeable personnel and all necessary calibrated testing equipment.
    - g. Film Tear Bond (FTB) type failures will be the criterion for qualification of the trial seam. The specimens should not fail in the weld.
    - h. A passing trial seam will be achieved when the criteria presented in Table 02672-B are satisfied. The sample weld shall successfully pass the test requirements before either the welder or welding apparatus are allowed to operate on production welds.
    - i. If a trial seam fails, the entire operation will be repeated.
    - j. If the additional trial seam fails, the seaming apparatus or welding technician will not be accepted and will not be used for seaming until the deficiencies are corrected and two consecutive successful full trial seams are achieved.
    - k. Trial seam failure is defined as failure of any one of the specimens tested in shear or peel.
  6. The Owner's Representative will approve all trial seam procedures and results.



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7. The following shall be logged in the Geomembrane Trial Seam Log by the Owner's Representative: date, hour, ambient temperature, number of seaming unit, name of seamer, and pass or fail description.

**D. Nondestructive Testing**

1. The Geosynthetics Installer shall continuously test every field weld (i.e., 100 percent of the length of all field seams), including field welds around patches, using non-destructive testing techniques. These tests shall be performed in the presence of the Engineer.
2. Single Weld Seams (extrusion welds):
  - a. The Geosynthetics Installer shall maintain and use equipment and personnel at the site to perform continuous vacuum box testing in general accordance with ASTM D5641 under the observation of the Engineer on all single weld production seams except those corner seams where vacuum box testing is impossible.
  - b. The system shall be capable of applying a vacuum of at least 5 psi.
  - c. The vacuum shall be held for a minimum of 15 seconds for each section of seam.
  - d. Once the soap solution is uniformly placed over the weld and suction applied to the seam any bubble formation must be noted and the corresponding defective area identified, marked, and subsequently repaired.
  - e. Where vacuum box testing is not possible, spark testing or an approved alternative by the Engineer will be used.
3. Double-Wedge Fusion Weld Seams:
  - a. The Geosynthetic Contractor shall maintain and use equipment and personnel to perform air pressure testing under the observation of the Engineer of all double-wedge fusion weld seams with a continuous air gap between the two welds and which are greater than 20 ft.
  - b. Double-wedge fusion weld seams less than 20 ft. may be vacuum box tested.
  - c. Pressure Loss Test:
    - (1) Pressure loss tests shall be conducted in accordance with the procedures outlined in "Pressurized Air Channel Test for Dual Seamed Geomembranes," Geosynthetic Research Institute Test Method GM-6.
    - (2) The system shall be capable of applying a pressure of between 25 psi and 30 psi for not less than 5 minutes.
    - (3) Following a 2 minute pressurized stabilization period, pressure losses over a measurement period of 5 minutes shall not exceed 3 psi.
    - (4) After the 5 minute testing period, the opposite end of the seam shall be cut open and pressure loss monitored to verify the entire length of the seam channel is open. If no pressure loss is realized, the location of the blocked channel must be found and the remainder of the seam tested separately.



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- (5) If a non-compliant drop of pressure is noted, pressure testing may be repeated in a step fashion each time halving the length of weld being tested until the extent of the defective weld is determined.
  - (6) Vacuum box testing (ASTM D5641) may also be used to locate a defective area in the top weld or in the top of the air channel.
  - (7) The air pressure test results shall be documented on all applicable CQA forms.
  - d. The length of welded section tested by air pressure shall not exceed 500 feet, without prior approval by the Owner's Representative.
  - e. Once the defect is found, it shall be clearly identified, marked, and repaired. Any defect shall be repaired so that it meets or exceeds the minimum requirements of this Section.
  - f. Double weld seams will also be visually inspected on 100% of the seam. If necessary the outside flap can be pulled back to aid in the visual observation.
- E. Destructive Testing**
- 1. Laboratory Destructive Testing (LDT) is defined as 12"W X 39"L (of seam) samples placed at an average rate of one LDT location per 500 feet of seam for both extrusion and double welded seams.
    - a. Laboratory Destructive Testing (LDT)
      - (1) Sampling:
        - (a) LDT will be performed on an average of every 500 linear feet of production seam. The locations will be selected by the Engineer.
        - (b) Samples will be 12" X 39" in order to provide one sample to the archive, one sample to the Owner's Representative for laboratory testing, and one sample to be retained by the Geosynthetics Installer for possible field and/or additional laboratory testing at the option of the Engineer or Geosynthetics Installer.
        - (c) The name of the sample (e.g. LDT-1), date, time, equipment, seam number, and seaming parameters will be marked on each sample and recorded by the Engineer in the Geomembrane Defect Log.
      - (2) Testing:
        - (a) Tests shall be conducted using a calibrated tensiometer and must meet the qualitative and quantitative criteria outlined criteria listed in Tables 02672-B found in this Section.
        - (b) The peel strength criteria shall apply to both the top and bottom welds of double wedge fusion welds.
        - (c) Testing requirements are as follows:
          - (i) Each sample shall be large enough to test five specimens in peel and five specimens in shear.





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- (ii) The average values of each set of five specimens must meet the specification, and four of the five specimen tests must meet the specifications for the seam as specified in Tables 02672 B to be considered a passing seam.
  - (iii) If the average of the five specimens is adequate, but one of the specimens is failing, values for the failing specimen must be at least 80 percent of the values required for the seam for the sample to pass.
  - (iv) All samples must fail in film tear bond (FTB) and/or the geomembrane must fail before the weld.
- (d) Failing Tests:
- (i) Samples which do not pass the shear and peel tests will be re-sampled from locations at least 10 feet on each side of the original location.
  - (ii) These two re-test samples must pass both shear and peel testing.
  - (iii) If these two samples do not pass, then additional samples will continue to be obtained until two consecutive samples on each side of the original sample pass the field seam criteria and the questionable seam area is defined.
  - (iv) At that point, the extent of the original defect in both directions along the field seam will be considered isolated and the Geosynthetics Installer may then:
    - a.) Either cap, re-weld and re-test the seam up to and including the closest of the two passing samples, and patch and weld the hole of the furthest passing sample; or
    - b.) Cap, re-weld and re-test the entire length of sampling.
    - c.) If approved by the Owner's Representative, double-wedge fusion welds may be repaired by extrusion welding the flap of the top sheet to the bottom sheet if the seam non-compliance is due to a non-FTB failure of the destructive test sample.
    - d.) If the length of the questionable seam area is defined to be excessive by the Engineer, a cap patch may be required over the entire seam with nondestructive testing prior to acceptance of the seam.
2. Each sample area will be clearly marked both on the geomembrane itself (LDT) using the procedures outlined in the marking Section.
3. All areas cut out for testing should be immediately patched by the Geosynthetics Installer and the patches should be tested and approved by the Engineer. Patches shall extend a minimum of 6 inches beyond the cut area.
4. A passing double welded seam will be achieved in peel (ASTM D6392) when:
- a. Failure is by Film Tear Bond (FTB).
  - b. Yield strength for the seam is not less than 72 percent of the minimum tensile strength at yield at as specified in Table 02672-B found in this Section; and
  - c. No greater than 25 percent of the seam width peels (separates) at any point; and







- a. Following the completion of each seam, patch or repair, the welding technician will write, at the end of the seam or in the middle of the patch or repair, the following: the initials of the technician, date welded, time welded, and welder unit number. The markings will be done clearly with a white or red permanent marking pen or pencil.
  - b. Similarly, after each quality control test, the Owner's Representative will record the following immediately adjacent to the area tested: initials of QC Technician performing the test, date of the test, type of test (i.e. VB, SP, AP for vacuum box, spark test and air pressure test respectively) and the words "pass (P)" or "fail (F)". For the air pressure test, the QC Technician must also define the limits or zone of the test as well as the amount of pressure loss observed. Again, a permanent white or red marking pen is required. If the test fails and the necessary repair is made, the technician will cross out the previous markings and mark appropriately for the new test results.
  - c. Destructive test samples will be clearly circled and marked in permanent marker with the words "LDT" as defined in the specifications. The Owner's Representative will mark the words "pass" or "fail" as appropriate. Similarly, any other area needing repair will be clearly marked in permanent marking to identify where the repair is required to be made.
  - d. The Owner's Representative will mark areas in need of repair using white marking pens (red for white surfaced geomembrane).
- H. All geomembrane sheet, seams and patches will be tested and evaluated prior to acceptance. In general, testing of the sheet will be conducted by the Geosynthetics Installer according to the standards specified in Table 02672-B found this Section. All areas failing nondestructive test procedures shall be clearly marked both on the geomembrane itself and on all applicable CQA forms.

### 3.6 Protection of Work

- A. Protect installed geomembrane according to geomembrane manufacturer's instructions. Repair or replace areas of geomembrane damaged by scuffing, punctures, traffic, rough subgrade, or other unacceptable conditions.
- B. No support equipment, tools, or personnel that can readily cause damage to the LLDPE geomembrane shall be allowed on the geomembrane during and after installation unless approved by the Engineer. Personnel working on the geomembrane shall not smoke, wear damaging shoes, bring glass of any kind onto geomembrane, dispose of trash or other debris, or engage in any activity that could damage the geomembrane.
- C. The passage of construction equipment, other than light rubber-tired equipment approved by the Engineer, over any exposed LLDPE geomembrane surface is strictly prohibited. Light rubber-tired equipment exerting a contact stress less than 5 psi will be allowed provided proper care is taken when operating the vehicle to avoid pulling, displacing or damaging the geomembrane.
- D. Between construction of partial sections of the geomembrane, leading edges of the geomembrane may be exposed or buried for extended periods of time prior to their joining to adjacent, subsequent geomembrane sections. The combined action of abrasive soil and equipment impact stresses may "etch" unprotected geomembrane surfaces sufficiently to affect seam strengths. Therefore, it is necessary to protect leading edges in high activity areas with sacrificial layers of geotextile and LLDPE sheet until they



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are ready for final seaming. As a minimum, each leading edge to be seamed that must be buried or which must be exposed for periods of one month or longer shall be continuously covered by a layer of LLDPE sheet. The geotextile shall be nonwoven and have a minimum weight of 8 oz per square yard. The sacrificial LLDPE sheet shall have a minimum thickness equal to that of the geomembrane to be protected. Both protective layers shall have a minimum width of 2 feet. The protective cover sheets shall be either covered with soil or weighted with sand bags to prevent displacement by wind. The edge of the sheet to be protected shall be approximately centered beneath the overlying protective layers prior to burial or weighing with sandbags. Leading edges located in areas expected to receive direct traffic from construction equipment shall be buried under a minimum thickness of one foot of buffer soil.

- E.** Fuel and Oil Spill Clean-Up
  - 1.** All spills or leaks of fuels and oils from equipment and vehicles on the surface of the geomembrane shall be thoroughly cleaned with soap and water, or, at the discretion of the Engineer, the affected geomembrane shall be cut, removed and replaced with new geomembrane material.
  - 2.** Subgrade materials contaminated with fuel or oil shall be excavated and replaced to the extent designated by the Owner.
  - 3.** Contaminated material shall be properly disposed of off-site by the Contractor at no expense to the Owner.
  
- F.** Any damage to the geomembrane shall be reported to the Engineer, and repaired by the Geosynthetic Contractor at no expense to the Owner.

**END OF SECTION**



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**April 2021**

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## Section 02673 High Density Polyethylene (HDPE) Geomembrane

### 1.0 General

#### 1.1 Summary

**A.** Section Includes:

1. High Density Polyethylene (HDPE) Geomembrane for the perimeter ditch.

**B.** Related Sections:

1. Section 02060 - Aggregate
2. Section 02320 - Backfill - Structural.

#### 1.2 Unit Price – Measurement

**A.** HDPE geomembrane:

1. Basis of Measurement: By square foot of geomembrane installed, in-place, excluding scrap and overlap.
  - a. Includes furnishing geomembrane, storage, installation, labor, supervision, transportation, equipment, and incidental items as required to complete the geomembrane installation to temporary or permanent termination limits, as specified on Drawings and in accordance with CQC Plan.
  - b. Measurement will be made based on the total two-dimensional (plan view) surface area in square feet based on as-built conditions. No allowance will be made for geomembrane in anchor and drainage trenches or waste, overlap, repairs, or materials used for the convenience of the Contractor.

#### 1.3 References

**A.** Construction Quality Control (CQC) Plan

**B.** American Society for Testing and Materials (ASTM) standards:

1. ASTM D792 Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
2. ASTM D1004 Standard Test Method of Initial Tear Resistance of Plastic Film and Sheeting.
3. ASTM D1505 Standard Test Method for Density of Plastics by the Density-Gradient Technique.



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4. ASTM D1603 Standard Test Method for Carbon Black in Olefin Plastics.
  5. ASTM D3895 Test Method for Oxidative Induction Time of Polyolefins by Differential Scanning Calorimetry.
  6. ASTM D4218 Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Method.
  7. ASTM D4354 Standard Practice for Sampling of Geosynthetics for Testing.
  8. ASTM D4759 Standard Practice for Determining the Specification Conformance of Geosynthetics.
  9. ASTM D4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
  10. ASTM D5199 Standard Test Method for Measuring Nominal Thickness of Geosynthetics.
  11. ASTM D5321 Standard Test Method for Determining the Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear..
  12. ASTM D5397, Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test.
  13. ASTM D5596 Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.
  14. ASTM D5641 Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.
  15. ASTM D5721 Standard Practice for Air-Oven Aging of Polyolefin Geomembranes.
  16. ASTM D5885 Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry.
  17. ASTM D5994 Standard Test Method for Measuring the Core Thickness of Textured Geomembranes.
  18. ASTM D6392 Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
  19. ASTM D6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes.
  20. ASTM D7238 Standard Test Method for Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent UV Condensation Apparatus.
  21. ASTM D7466 Standard Test Method for Measuring the Asperity Height of Textured Geomembrane.
- C. Geosynthetic Research Institute (GRI) Standards:**
1. GM6 Pressurized Air Channel Test for Dual Seamed Geomembranes.
  2. GM10 Specification for the Stress Crack Resistance of Geomembrane Sheet.
  3. GM12 Measurement of the Asperity Height of Textured Geomembrane Using a Depth Gage.
  4. GM13 Test Methods, Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes.
  5. GM19 Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes.
- D. U.S. Environmental Protection Agency (EPA), Technical Guidance Document:**





1. "The Fabrication of Polyethylene FML Field Seams" EPA/530/SW-89/069, (1193).

## 1.4 Submittals

- A. The Geosynthetic Installer shall submit proposed geomembrane panel layout, including anchor trenches and connections to any inlet/outlet structures, to the Engineer at least 14 days prior to mobilization of crews. Once the panel layout is approved, the Geosynthetic Installer may not change the layout without permission of the Engineer.
- B. Manufacturer's Product Information
  1. At least five (5) working days prior to shipment, the Geosynthetic Contractor shall furnish the Engineer with pre-shipping product data sheets and test data for each geomembrane type. At a minimum, the Manufacturer will perform the tests at the frequencies given in Tables 02673-A found in this Section on the HDPE sheet prior to shipping HDPE material to the site. These tests shall conform to the standards set in Table 02673-B also found in this Section. The information supplied shall be in the form of a factory quality control certificate for each geomembrane roll and shall include the following:
    - a. Roll and lot numbers and identification.
    - b. Length and width of each roll.
    - c. Date each roll was manufactured.
    - d. Sampling procedures.
    - e. Results of quality control tests that are to include those presented in Tables 02673-A found in this Section and description of test methods used. The results of these tests must meet the minimum required physical properties for HDPE geomembrane specified in Table 02673-B found in this Section.
- C. A written certificate from the geomembrane manufacturer stating that the resin and geomembrane materials supplied are in compliance with this Section 02673.
- D. Manufacturer's Installation Instructions: Submit special procedures for geomembrane installation.
- E. The Geosynthetics Installer shall adopt and use the quality assurance forms prepared by the Owner's Representative, or other forms approved by the Owner's Representative, during all applicable phases of geomembrane installation, inspection and testing. The Geosynthetics Installer can request to use his forms. The forms must be submitted to the Owner's Representative at least two weeks prior to geomembrane installation for review and approval.
- F. A resume of the proposed Superintendent of the Geosynthetics Installer must be submitted to the Engineer for final approval two weeks prior to geomembrane installation.
- G. The Contractor is responsible for his own Health and Safety Plan, but must abide by any safety procedures dictated by the Owner.

## 1.5 Closeout Submittals

- A. Forms by the Owner's Representative:



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1. Owner's Representative Daily Field Report
  2. Field Inventory Control, Storage Inspection, and Cross-Reference Roll Numbers
  3. Subgrade Certification
  4. Geomembrane Trial Seam Log
  5. Geomembrane Deployment Report
  6. Geomembrane Seam Log
  7. Geomembrane Defect Log
  8. Geomembrane Repair Testing Log
  9. Geomembrane Laboratory Destructive Test Results
- B.** The Contractor is responsible for providing an as-built drawing of the geomembrane installation. The as-built drawing shall include panel corners, transitions in panel geometry, repair locations, the inside bottom corner of the anchor trench, and other significant features.
- C.** The Geosynthetics Installer's supervisor shall observe and check all phases of the geomembrane installation. When the geomembrane is accepted by the Owner, the Geosynthetics Installer shall submit a Letter of Acceptance to the Owner that the installation conforms to the requirements of the Manufacturer.

## 1.6 Quality Assurance

- A.** Perform Work in accordance with these Specifications and the CQC Plan.
- B.** The Manufacturer shall sample and test the HDPE geomembrane material, at minimum frequencies specified in Table 02673-A. General manufacturing procedures shall be performed in accordance with the Manufacturer's internal quality control guide and/or documents.
- C.** All geomembrane sheets shall be continuously spark tested during manufacturing.
1. The spark tester shall be capable of detecting defects or pinholes less than 10 mils in diameter.
  2. All necessary repairs to the geomembrane shall be made by the manufacturer at the factory before shipment.
  3. The manufacturer shall provide written certification to the Owner and/or Engineer that all the geomembrane rolls delivered to the project were continuously spark tested and do not contain pinhole defects.
- D.** Conformance Testing:
1. Conformance testing shall be performed by an independent laboratory at a frequency of at least 1 per 100,000 square feet of geomembrane manufactured for this project. Conformance testing shall consist of the following tests:
    - a. Thickness (ASTM D5199 and/or ASTM D5994).
    - b. Asperity Height (ASTM D7466 or GRI GM 12)
    - c. Tensile properties including yield strength/yield elongation and break strength/break elongation (ASTM D6693).





## 2.0 Products

### 2.1 High Density Polyethylene (HDPE) Geomembrane

#### A. Materials:

1. Textured geomembrane shall be made of unreinforced high density polyethylene (HDPE) that has a nominal thickness as noted on the Drawings and designed and manufactured specifically for the purpose of liquid containment.
2. The geomembrane used shall meet, at a minimum, the standards specified in Table 02673-B found in this Section.
3. At least one side of the geomembrane shall be white. The white side shall be installed facing upwards.
4. The chemical resistance of the geomembrane shall be in keeping with typical properties of high quality polyethylene products currently available through commercial sources.
5. Up to 5 percent (by weight) clean, uncontaminated regrind material (that is, material that has been previously processed by the same manufacturer, but has never seen previous service) shall be allowed in the Geomembrane sheet if approved by the Engineer.
6. Regrind material made of the same resin as the geomembrane from sheet failing the physical properties of the geomembrane or resin as specified herein shall not be allowed under any circumstances.
7. Edge trim and sheet failed for thickness or cosmetic reasons may be considered for regrind.
8. HDPE geomembrane shall be supplied in rolled sheets having a minimum width of 22 feet and a minimum length of 400 feet. Variances for shorter roll lengths may be allowed at the discretion of the Owner's Representative.



**Table 02673-A**  
**Required Pre-Shipping Sheet Testing of Geomembrane Liner - Textured**

Property	Test Method	Frequency
<b>Density (resin)</b>	ASTM D1505 ASTM D792	One Per Resin Batch.
<b>Melt Flow Index (resin)</b>	ASTM D1238	One Per Resin Batch
<b>Thickness</b>	ASTM D5994	Each Roll
<b>Asperity Height (mils)</b>	ASTM D7466	Every 2 <sup>nd</sup> roll (1)
<b>Density (roll)</b>	ASTM D1505 ASTM D792, Method B	Every 200,000 lb.
<b>Tensile Properties (2)</b> <ul style="list-style-type: none"> <li>◆ Yield Strength</li> <li>◆ Yield Elongation</li> <li>◆ Break Strength</li> <li>◆ Break Elongation</li> </ul>	ASTM D6693 TYPE IV	Every 20,000 lb.
<b>Tear Resistance</b>	ASTM D1004	Every 45,000 lb.
<b>Puncture Resistance</b>	ASTM D4833	Every 45,000 lb.
<b>Carbon Black Content (3)</b>	ASTM 4218	Every 20,000 lb
<b>Carbon Black Dispersion</b>	ASTM D5596	Every 45,000 lb.
<b>Stress Crack Resistance (SP-NCTL)</b>	ASTM D5397	Every 200,000 lb
<b>Oxidative Induction Time (OIT) (4)</b>		Every 200,000 lb
<b>a.</b> Standard OIT (min. ave.) OR	ASTM D8117	
<b>b.</b> High Pressure OIT (min. ave.)	ASTM D5885	
<b>Oven Aging at 85°C</b>	ASTM D5721	Per each formulation
<b>a.</b> Standard OIT (min. ave.) - % retained after 90 days OR	ASTM D8117	
<b>b.</b> High Pressures OIT (min. ave.) - % retained after 90 days	ASTM D5885	
<b>UV Resistance (5)</b>	ASTM D7238	Per each formulation
<b>b.</b> High Pressure OIT (min. ave.) - % retained after 1600 hrs	ASTM D5885	

- (1) Alternate the measurement side for double sided textured sheet.
- (2) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction. Break elongation is calculated using a gage length of 2.0 inches at 2 inches/minute.
- (3) For white surface geomembranes, specimen should be prepared in accordance with GSI White Paper #36 using the 'shaving' technique. GSI White Paper #36 is published by the Geosynthetics Research Institute and is available on their website at [www.geosynthetic-institute.org](http://www.geosynthetic-institute.org).
- (4) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
- (5) The condition of the test should be 20 hr. UV cycle at 75 °C followed by 4 hr. condensation at 60°C. UV resistance is based on percent retained value regardless of the original value.



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**Table 02673-B**  
**Required Physical Properties of HDPE Geomembrane - Textured**

Property	Test Method	Required Value
<b>Density (resin)</b>	ASTM D1505 / ASTM D792	0.932 g/cm <sup>3</sup>
<b>Melt Flow Index (resin)</b>	ASTM D1238	1.0 g/10min. (maximum)
<b>Liner Thickness (Normal)</b>		60 mil
<b>Thickness (min. ave.)</b> ♦ lowest individual for 8 out of 10 values ♦ lowest individual for any of the 10 values	ASTM D5994	57 mils 54 mils 51 mils
<b>Asperity Height mils (min. ave.)</b>	ASTM D7466	16 mils
<b>Density (roll)</b>	ASTM D1505/ ASTM D792	0.940 g/cm <sup>3</sup>
<b>Tensile Properties (min. ave.)</b> ♦ Yield Strength ♦ Break Strength ♦ Yield Elongation (%) ♦ Break Elongation (%)	ASTM D6693, Type IV	126 lb /in 90 lb / in. 12% 100%
<b>Tear Resistance (min. ave.)</b>	ASTM D1004	42 lb.
<b>Puncture Resistance (min. ave.)</b>	ASTM D4833	90 lb.
<b>Carbon Black Content (range)</b>	ASTM 4218	2.0 – 3.0%
<b>Carbon Black Dispersion</b>	ASTM D5596	9 in Categories 1 or 2 and 1 in Category 3
<b>Stress Crack Resistance (SP-NCTL), hrs</b>	ASTM D5397 Appendix	500
<b>Oxidative Induction Time (OIT)</b>		
<b>a.</b> Standard OIT (min. ave.) OR	ASTM D3895	100 minutes
<b>b.</b> High Pressure OIT (min. ave.)	ASTM D5885	400 minutes
<b>Oven Aging at 85°C</b>	ASTM D5721	
<b>a.</b> Standard OIT (min. ave.) - % retained after 90 days Or	ASTM D3895	55%
<b>b.</b> High Pressures OIT (min. ave.) - % retained after 90 days	ASTM D5885	80%
<b>UV Resistance</b>	ASTM D7238	
♦ High Pressure OIT (min. ave.) - % retained after 1600 hrs	ASTM D5885	50%
<b>Seam Strengths (1)</b>		
<b>1.</b> Shear Strength Hot Wedge Seam Extrusion Fillet Seam	ASTM D6392	120 lb(in (min.) 120 lb(in (min.)
<b>2.</b> Peel Strength Hot Wedge Seam Extrusion Fillet Seam	ASTM D6392	91 lb(in (min.) 78 lb(in (min.)
<b>3.</b> Peel Separation Hot Wedge Seam Extrusion Fillet Seam	ASTM D6392	25% 25%



<b>Non-Destructive Testing</b>		
<b>1.</b> Extrusion Fillet Seam (Single Weld)	Continuous Vacuum Box	Maintain vacuum of at least 5 psi for at least 15 seconds
<b>2.</b> Hot Wedge Seam (Double Weld)	Air Testing	Maintain 30 psi for at least 5 minutes, with a drop in pressure not greater than 3 psi

(1.) Value listed for shear and peel strengths are for 4 out of 5 test specimens; the 5<sup>th</sup> specimen can be as low as 80% of the listed values.

### 3.0 Execution

The Geosynthetics Installer shall furnish all labor, materials, supervision and equipment to complete the Geomembrane Liner for the project including, but not limited to, geomembrane layout, seaming, patching, and all necessary and incidental items required to complete the work, in accordance with the Drawings and these Specifications.

#### 3.1 Delivery, Storage and Handling

- A.** Geomembrane liner shall be shipped:
  - 1.** Rolled and labeled with roll number and manufacturer's batch number.
  - 2.** Manufacturer's quality control documentation shall be included with each roll.
- B.** Transport and handle geomembrane with equipment designed to protect geomembrane from damage. The Contractor shall be responsible for unloading and storage of geomembrane in a manner that prevents damage to the geomembrane.
- C.** On-site storage shall be as needed to protect the geomembrane rolls from excessive accumulations of soil on the geomembrane surfaces, water, heat, mechanical abrasion, puncture and vehicular traffic.
- D.** The geomembrane rolls shall not be stacked more than three rolls high, or as otherwise recommended by the Manufacturer.

#### 3.2 Daily Pre-Installation Meetings

- A.** At the beginning of each work day the Earthwork Contractor's Superintendent, the Geosynthetic Contractor's Superintendent, and the Owner's Representative will meet to discuss the upcoming work plan for all parties to promote cooperation, communication and understanding. Care shall be taken to provide as much notice as possible when scheduling geomembrane as-built survey. Operations shall be planned and implemented so as not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

#### 3.3 Preparation

- A.** The geomembrane is to cover the landfill interim cover or waste in accordance with the Drawings
- B.** Ensure acceptance of underlying layers before installing overlying layers.



- C. Prepare ballast loading that shall be used for anchoring down the geomembrane during installation.
  - 1. Ballast loading may consist of sand bags or Portland cement bags.
  - 2. Bags used for containing sand or cement shall be resistant to degradation by ultraviolet rays and by the weather in general.
- D. Surface Water Control and Base Maintenance
  - 1. The base shall be maintained well-drained and dry prior to and during geomembrane installation.
  - 2. The Geosynthetics Installer shall be responsible for surface water control during geomembrane installation as needed to maintain all work areas well-drained and dry during construction, preclude ponding, and prevent uplift of the geomembrane after installation.
  - 3. The Geosynthetics Installer's proposed dewatering method(s) shall be submitted to the Owner's Representative at least one week prior to implementation.

### 3.4 Installation

Installation of the geomembrane shall be in compliance with this Specification and with the Manufacturer's standard guidelines and specifications for geomembrane installation, subject to approval by the Owner's Representative, including, but not limited to: (i) handling and site storage requirements; (ii) unrolling and laying of geomembrane sheets; (iii) field seaming or welding techniques; and (iv) anchor trench and ballast details.

- A. Liner Handling and Placement
  - 1. Appropriate handling equipment shall be used when loading or moving rolled geomembrane sheets from one place to another. Appropriate equipment includes spreader and roll bars for deployment, and cloth chokers with a spreader bar for off-loading.
  - 2. Do not use materials damaged during storage or handling. If the geomembrane is not packaged and a roll is damaged during shipment, it shall be rejected. If only the outermost surface of the roll is affected, it shall be peeled back, cut, and wasted (i.e., it shall be treated as if it were the protective packaging for the remainder of the roll).
  - 3. The geomembrane shall be installed at the locations and to the lines, grades and dimensions shown on the Drawings, or as otherwise directed by the Engineer.
  - 4. Liner deployment shall not be performed when precipitation is occurring, when excessive moisture or wet conditions exist, or when high winds or other adverse climatologic conditions exist.
  - 5. The geomembrane sheets shall be unrolled and deployed in a manner which minimizes wrinkles and prevents the occurrence of folds and creases.
  - 6. Unroll only those sections that are to be seamed together in one day.
  - 7. Adjoining geomembrane panels shall be overlapped as recommended by the manufacturer, but not less than 4 inches, by adequately lapping the edges of the sheets. The overlap shall not exceed 6 inches for double-wedge fusion welds.





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8. For stormwater drainage purposes, the upstream panel should be overlapped on top of the downstream panel to form a shingle effect.
9. Panel layout and deployment shall be such that the seams run down the slopes and are oriented perpendicular to the top of slope. The seam orientation shall be maintained for a distance of 10 feet from the toe of slope or as shown on the Drawings.
10. Cross seams will be allowed on slopes provided that the cross seams are cut at 45 degrees and adjacent cross seams are staggered. Cross seams must be kept to the lower half of the slope and only one cross seam is allowed per panel slope length.
11. Unroll several panels and allow the geomembrane to "relax" before beginning field seaming. The purpose of this is to make the edges that are to be bonded as smooth and free of wrinkles as possible.
12. In corners and odd shaped geometric locations, the number of field seams should be minimized.
13. After panels are initially in place, remove wrinkles as directed by the Engineer.
14. All geomembrane sheets shall have good appearance qualities. Texturing on the surface of the textured sheets shall be uniform and homogeneously distributed. The geomembrane shall be free of pinholes, holes, blisters, gels, undispersed ingredients, any signs of contamination by foreign matter, or any defect that may affect serviceability. The edges of geomembrane sheets shall be straight and free from nicks and cuts.
15. Once panels are in place and smooth, commence field seaming operations.

**B. Field Seaming**

1. Field seaming shall be in accordance with U.S. E.P.A. Technical Guidance document: "The Fabrication of Polyethylene FML Field Seams" EPA/530/SW-89/069 and/or according to this Section 02673.
2. Field seaming shall be conducted in the dry, on a compacted smooth surface. Surfaces to receive geomembrane installation should be relatively smooth and even, and free of voids, protrusions, and deleterious material.
3. All geomembrane sheets must be continuously and tightly bonded using continuous extrusion fillet welds or double wedge fusion welds and automated welding equipment approved by the Engineer. The Engineer reserves the right to reject any proposed seaming method it believes unacceptable. Double hot wedge fusion welding shall be the predominant seaming method. Additional concepts and requirements of proper field seaming include the following:
  - a. All geomembrane shall be seamed the same day that the geomembrane is deployed.
  - b. All geomembrane shall be ballasted immediately after deployment to prevent uplift by winds.
  - c. A moveable protective layer of plastic or approved material may be placed directly below each overlap of geomembrane that is to be seamed. This is to prevent any moisture build-up between the sheets to be welded. The protective layer must be removed after welding.
  - d. All foreign matter (dirt, moisture, oil, etc.) shall be removed from the edges to be bonded. For extrusion welds, the bonding surfaces must be thoroughly cleaned by mechanical abrasion or alternate methods approved by the Engineer to remove surface cure and prepare the surfaces for bonding. No solvents shall be used to clean the geomembrane.



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- e. Grinding:
  - (1) All abrasive buffing shall be performed using No. 80 grit or finer sandpaper.
  - (2) The grinding shall be performed so that any and all grind marks are perpendicular to the edge of sheet.
  - (3) No grinding greater than 1/4 inch outside the welds is permitted or the Engineer can require patching.
  
- f. As much as practical, field seaming shall start from the top of the slope down. This will minimize large wrinkles from becoming trapped that require cutting and patching.
- g. Seaming of the bottom geomembrane to the sidewall geomembrane (toe seam) shall be conducted when conditions minimize thermal expansion effects.
- h. Tack welds (if used for temporary conditions) shall use heat only; no double sided tape, glue or other method will be permitted.
- i. The geomembrane should be seamed completely to the ends of all panels to minimize the potential of tear propagation along the seam.
- j. Seaming will extend to the outside edge of panels to be placed in anchor trenches. If required, a firm substrata should be provided by using a flat board, or similar hard surface directly under the seam overlap to achieve proper support across the anchor trench.
- k. The completed geomembrane shall not exhibit any "trampolining" during late morning to early evening hours. All areas exhibiting trampolining must be repaired as directed by the Engineer. Additional slack (i.e.: 1-3%) shall be allowed on the side slopes to reduce the potential for trampolining.
- l. All field seams must be uniform in appearance, width and properties, and shall not exhibit warping due to overheating from welding.
- m. The peel and shear strengths of the welded seams must comply with the strength criteria stated in Table 02673-B of this Section.
- n. Ambient Weather Conditions:
  - (1) Ambient temperature is measured 18 inches above the geomembrane surface.
  - (2) The Geosynthetics Installer shall supply instrumentation for measurement of ambient temperature.
  - (3) Welding of field seams shall not take place except during suitable ambient weather conditions, as confirmed by field trial test welds.
  - (4) No seaming should be attempted above 40°C (104°F) ambient air temperature
  - (5) Below 5°C (41°F) ambient air temperature, preheating of the geomembrane will be required, unless it is demonstrated that this is not necessary (i.e., acceptable test (start-up) seams that duplicate, as closely as possible, actual field conditions can be achieved). Preheating may be achieved by natural and/or artificial means (shelters and heating devices).



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- o. Seams at the panel corners of 3 or 4 sheets shall be completed with a circular patch approximately 12 inches in diameter, extrusion welded to the parent sheets, or with a "T" weld at suitable locations.

**C. Pipe Penetrations**

1. Pipe penetrations in the geomembrane shall be sealed using polyethylene pipe boots (sleeves and skirts), gaskets, banding straps, or other material as shown on the Drawings.
2. Surfaces where pipe boots are to be attached (including pipe) shall be cleaned to remove dirt, oil, debris, or other deleterious materials.
3. Prior to attaching and/or seaming pipe boots, the Owner's Representative shall visually inspect all prepared surface to verify that the proper preparation techniques have been followed.

**D. Temporary Ballast Loading**

1. Adequate temporary ballast loading that will not damage the geomembrane shall be placed by the Geosynthetics Installer over the geomembrane during installation as needed to prevent uplift by wind and by rapid changes in barometric pressure.
2. Temporary ballast loading shall be in addition to the anchor trenches.
3. If high winds are expected, boards along the edge of unseamed panels, with weighted sandbags on top, may be used to anchor the geomembrane on the subgrade.
4. Staples, U-shaped rods or other penetrating anchors shall not be used to secure the geomembrane on the side slopes, on the floor or anywhere else in the construction area.
5. Any damage to the geomembrane including damage due to construction activities or wind, rain, hail, or other weather shall be the sole responsibility of the Geosynthetics Installer.
6. All temporary ballast loading shall be removed by the Geosynthetics Installer prior to demobilizing from the site unless otherwise approved by the Owner.

### 3.5 Field Quality Control

- A. The Geosynthetics Installer shall adopt and use the quality assurance forms prepared by the Owner's Representative or other forms approved by the Owner's Representative, during all applicable phases of geomembrane installation, inspection and testing. The Geosynthetics Installer can request to use his forms. The forms must be submitted to the Owner's Representative at least two weeks prior to geomembrane installation for review and approval.
- B. All aspects of the geomembrane installation will be inspected on a full-time basis by the Owner's Representative.
  1. The Owner's Representative will conduct his own observations and perform quality control tests in addition to those performed by the Geosynthetics Installer.
  2. Testing of the seams and repairs will be conducted by the Geosynthetics Installer under observation by the Owner's Representative.



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3. The Owner's Representative or a designated, independent geosynthetics laboratory may perform additional testing, as required by these detailed Specifications or as required in the judgment of the Owner's Representative to verify that the HDPE sheet and seams meet these Specifications.
4. Quality control by the Owner's Representative will include monitoring:
  - a. Liner handling and panel deployment
  - b. Field seaming or welding of geomembrane sheets and non-destructive testing of field seams or welds
  - c. Placement and maintenance of temporary ballast loading

**C. Trial Seams**

1. The Installer shall maintain and use equipment and personnel at the site to perform testing of trial seams.
2. Frequency:
  - a. Trial seams will be made in the morning and afternoon, after any interruption in power, after any prolonged idle period during the day, when changes in storing equipment occur, and at the request of the Engineer at any other time during the day.
3. Each seamer/welder shall prepare a test strip using the welding apparatus assigned to him.
4. Trial seams will be made on fragment pieces of geomembrane to verify that seaming conditions are adequate. A trial seam shall be made for each texture contact type to be seamed by that welder during the working increment.
5. Requirements for trial seams are as follows:
  - a. The trial seam sample will be at least 5 feet long by 1 foot wide with the seam centered lengthwise.
  - b. Ten adjoining specimens 1-inch wide each will be cut from the trial seam sample.
  - c. These specimens will be tested in the field with a tensiometer and/or manual seam tester for both shear (5 specimens) and peel (5 specimens).
  - d. For dual wedge, both inside and outside welds shall be tested in peel.
  - e. Trial seams will be tested by the Geosynthetics Installer under observation of the Owner's Representative.
  - f. The Geosynthetics Installer shall supply all necessary knowledgeable personnel and all necessary calibrated testing equipment.
  - g. Film Tear Bond (FTB) type failures will be the criterion for qualification of the trial seam. The specimens should not fail in the weld.
  - h. A passing trial seam will be achieved when the criteria presented in Table 02673-B are satisfied. The sample weld shall successfully pass the test requirements before either the welder or welding apparatus are allowed to operate on production welds.
  - i. If a trial seam fails, the entire operation will be repeated.





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- (3) Following a 2 minute pressurized stabilization period, pressure losses over a measurement period of 5 minutes shall not exceed 3 psi.
  - (4) After the 5 minute testing period, the opposite end of the seam shall be cut open and pressure loss monitored to verify the entire length of the seam channel is open. If no pressure loss is realized, the location of the blocked channel must be found and the remainder of the seam tested separately.
  - (5) If a non-compliant drop of pressure is noted, pressure testing may be repeated in a step fashion each time halving the length of weld being tested until the extent of the defective weld is determined.
  - (6) Vacuum box testing (ASTM D5641) may also be used to locate a defective area in the top weld or in the top of the air channel.
  - (7) The air pressure test results shall be documented on all applicable CQA forms.
- d. The length of welded section tested by air pressure shall not exceed 500 feet, without prior approval by the Owner's Representative.
  - e. Once the defect is found, it shall be clearly identified, marked, and repaired. Any defect shall be repaired so that it meets or exceeds the minimum requirements of this Section.
  - f. Double weld seams will also be visually inspected on 100% of the seam. If necessary the outside flap can be pulled back to aid in the visual observation.

**E. Destructive Testing**

- 1. Laboratory Destructive Testing (LDT) is defined as 12"W X 39"L (of seam) samples placed at an average rate of one LDT location per 500 feet of seam for both extrusion and double welded seams.
  - a. Laboratory Destructive Testing (LDT)
    - (1) Sampling:
      - (a) LDT will be performed on an average of every 500 linear feet of production seam. The locations will be selected by the Engineer.
      - (b) Samples will be 12" X 39" in order to provide one sample to the archive, one sample to the Owner's Representative for laboratory testing, and one sample to be retained by the Geosynthetics Installer for possible field and/or additional laboratory testing at the option of the Engineer or Geosynthetics Installer.
      - (c) The name of the sample (e.g. LDT-1), date, time, equipment, seam number, and seaming parameters will be marked on each sample and recorded by the Engineer in the Geomembrane Defect Log.
    - (2) Testing:



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- (a) Tests shall be conducted using a calibrated tensiometer and must meet the qualitative and quantitative criteria outlined criteria listed in Tables 02673-B found in this Section.
  - (b) The peel strength criteria shall apply to both the top and bottom welds of double wedge fusion welds.
  - (c) Testing requirements are as follows:
    - (i) Each sample shall be large enough to test five specimens in peel and five specimens in shear.
    - (ii) The average values of each set of five specimens must meet the specification, and four of the five specimen tests must meet the specifications for the seam as specified in Tables 02673 B to be considered a passing seam.
    - (iii) If the average of the five specimens is adequate, but one of the specimens is failing, values for the failing specimen must be at least 80 percent of the values required for the seam for the sample to pass.
    - (iv) All samples must fail in film tear bond (FTB) and/or the geomembrane must fail before the weld.
  - (d) Failing Tests:
    - (i) Samples which do not pass the shear and peel tests will be re-sampled from locations at least 10 feet on each side of the original location.
    - (ii) These two re-test samples must pass both shear and peel testing.
    - (iii) If these two samples do not pass, then additional samples will continue to be obtained until two consecutive samples on each side of the original sample pass the field seam criteria and the questionable seam area is defined.
    - (iv) At that point, the extent of the original defect in both directions along the field seam will be considered isolated and the Geosynthetics Installer may then:
      - a.) Either cap, re-weld and re-test the seam up to and including the closest of the two passing samples, and patch and weld the hole of the furthest passing sample; or
      - b.) Cap, re-weld and re-test the entire length of sampling.
      - c.) If approved by the Owner's Representative, double-wedge fusion welds may be repaired by extrusion welding the flap of the top sheet to the bottom sheet if the seam non-compliance is due to a non-FTB failure of the destructive test sample.
      - d.) If the length of the questionable seam area is defined to be excessive by the Engineer, a cap patch may be required over the entire seam with nondestructive testing prior to acceptance of the seam.
2. Each sample area will be clearly marked both on the geomembrane itself (LDT) using the procedures outlined in the marking Section.



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3. All areas cut out for testing should be immediately patched by the Geosynthetics Installer and the patches should be tested and approved by the Engineer. Patches shall extend a minimum of 6 inches beyond the cut area.
  4. A passing double welded seam will be achieved in peel (ASTM D6392) when:
    - a. Failure is by Film Tear Bond (FTB).
    - b. Yield strength for the seam is not less than 72 percent of the minimum tensile strength at yield at as specified in Table 02673-B found in this Section; and
    - c. No greater than 25 percent of the seam width peels (separates) at any point; and
    - d. The failed sheet exhibits elongation, prior to failure.
  5. Both sides of the double welded seam must be tested and must meet all of the criteria listed above for peel.
  6. A passing double welded seam will be achieved in shear (ASTM D6392) when:
    - a. Failure is by FTB; and
    - b. Yield strength for the seam is not less than 95 percent of the minimum tensile strength at yield at as specified in Table 02673-B found in this Section.
  7. A passing extrusion welded seam will be achieved in peel (ASTM D6392) when:
    - a. Failure is by FTB; and
    - b. Yield strength for the seam is not less than 62 percent of the minimum tensile strength at yield at as specified in Table 02673-B; and
    - c. No greater than 25% separation occurs from the edge of the sheet at any point; and
    - d. The failed sheet exhibits ductility prior to failure.
  8. A passing extrusion welded seam will be achieved in shear (ASTM D6392 modified) when:
    - a. Failure is by FTB; and
    - b. Yield strength for the seam is not less than 95 percent of the minimum tensile strength at yield at as specified in Table 02673-B.
- F. Repair:**
1. The Geosynthetics Installer shall visually inspect the entire geomembrane surface for any defects including, but not limited to, seam imperfections, badly scuffed areas, scratches, blisters, tears, rips, holes, pinholes, and punctures. He shall identify, mark, and repair all noted defects, as well as defects designated by the Engineer.
  2. Damaged and Sampled Area





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- a. All geomembrane defects (scratches, blisters, rips, punctures, tears, holes, pinholes, creases, folds, etc.) and holes created by removal of samples or coupons for destructive testing shall be marked and repaired.
  - b. Damaged and sample coupon areas of geomembrane shall be repaired by the Geosynthetics Installer by completely covering the defect or hole with an oval-shaped piece of the corresponding HDPE geomembrane material, and continuously welding the patch to the geomembrane sheet using an extrusion weld construction.
    - (1) Patches shall extend a minimum of 6 inches beyond the damaged or cut area.
    - (2) No repairs shall be made to seams by application of an extrusion bead to a seam edge previously welded by fusion or extrusion methods.
  - c. All geomembrane repairs shall be documented including date, geomembrane panel identification number, repair location, type of defect, cause of defect and details of repairs made.
  - d. Repaired areas will be tested for seam integrity as specified in this Section.
  - e. Damaged materials are the property of the Geosynthetics Installer and will be removed from the site at Geosynthetics Installer's expense unless authorized by the Owner to dispose of on-site.
  - f. The Geosynthetics Installer will retain all ownership and responsibility for the geomembrane until acceptance by the Engineer.
  - g. The Engineer shall accept the geomembrane after the installation and repair are complete, and after the Engineer has received all necessary documentation for the installation in accordance with these specifications.
- 3. Seams at Panel Corners**
- a. Seams at the panel corners of 3 sheets shall be completed with a circular patch approximately 12 inches in diameter, extrusion welded to the parent sheet, or with a "T" weld at suitable locations.
  - b. If the Geosynthetics Installer wishes to use a different method, samples must be submitted to the Engineer and tested accordingly.
- G. Marking on Liner by the Geosynthetics Installer**
- 1. The Geosynthetics Installer will mark directly on the geomembrane as described herein for the purpose of readily identifying panels, seams, repairs and destructive test locations.
  - 2. Panel Identification
    - a. Each panel indicated on the pre-construction panel layout drawings will be numbered sequentially using the format P1, P2, etc.
    - b. Panels in the field must be numbered in the order in which the panels are actually laid regardless of preconstruction numbering.





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- B.** No support equipment, tools, or personnel that can readily cause damage to the HDPE geomembrane shall be allowed on the geomembrane during and after installation unless approved by the Engineer. Personnel working on the geomembrane shall not smoke, wear damaging shoes, bring glass of any kind onto geomembrane, dispose of trash or other debris, or engage in any activity that could damage the geomembrane.
- C.** The passage of construction equipment, other than light rubber-tired equipment approved by the Engineer, over any exposed HDPE geomembrane surface is strictly prohibited. Light rubber-tired equipment exerting a contact stress less than 5 psi will be allowed provided proper care is taken when operating the vehicle to avoid pulling, displacing or damaging the geomembrane.
- D.** Between construction of partial sections of the geomembrane, leading edges of the geomembrane may be exposed or buried for extended periods of time prior to their joining to adjacent, subsequent geomembrane sections. The combined action of abrasive soil and equipment impact stresses may "etch" unprotected geomembrane surfaces sufficiently to affect seam strengths. Therefore, it is necessary to protect leading edges in high activity areas with sacrificial layers of geotextile and HDPE sheet until they are ready for final seaming. As a minimum, each leading edge to be seamed that must be buried or which must be exposed for periods of one month or longer shall be continuously covered by a layer of HDPE sheet. The geotextile shall be nonwoven and have a minimum weight of 8 oz per square yard. The sacrificial HDPE sheet shall have a minimum thickness equal to that of the geomembrane to be protected. Both protective layers shall have a minimum width of 2 feet. The protective cover sheets shall be either covered with soil or weighted with sand bags to prevent displacement by wind. The edge of the sheet to be protected shall be approximately centered beneath the overlying protective layers prior to burial or weighing with sandbags. Leading edges located in areas expected to receive direct traffic from construction equipment shall be buried under a minimum thickness of one foot of buffer soil.
- E.** Fuel and Oil Spill Clean-Up
  - 1.** All spills or leaks of fuels and oils from equipment and vehicles on the surface of the geomembrane shall be thoroughly cleaned with soap and water, or, at the discretion of the Engineer, the affected geomembrane shall be cut, removed and replaced with new geomembrane material.
  - 2.** Subgrade materials contaminated with fuel or oil shall be excavated and replaced to the extent designated by the Owner.
  - 3.** Contaminated material shall be properly disposed of off-site by the Contractor at no expense to the Owner.
- F.** Any damage to the geomembrane shall be reported to the Engineer, and repaired by the Geosynthetic Contractor at no expense to the Owner.

**END OF SECTION**



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## Section 02674 Nonwoven Geotextiles

### 1.0 General

#### 1.1 Summary

- A. Section includes all labor, tools, geotextile material, placement, supervision, transportation, installation, equipment, binding, repairs, and all incidentals necessary to complete the work as specified on the Drawings and in these Specifications.
  - 1. Nonwoven geotextile for:
    - a. Geotextile at haul road ditch terminations.
    - b. Geotextile separator for haul road construction beneath granular base.
    - c. Geotextile beneath aggregate at underdrain outlet.
- B. Related Sections:
  - 1. Section 2020 – Aggregate.
  - 2. Section 02320 – Backfill - Structural.
  - 3. Section 02500 – HDPE Pipe

#### 1.2 Unit Price – Measurement

- A. Geotextile
  - 1. Basis of Measurement: Where installed, geotextile is incidental to the other items as noted below:
    - a. Geotextile installed for haul road ditch terminations is incidental the rip-rap basin bedding stone.
    - b. Geotextile specified for haul road construction is considered incidental to the granular base placement.
    - c. Geotextile installed at the underdrain outlets is incidental to the underdrain outlet headwall and is not a separate pay item.

#### 1.3 References

- A. Kentucky Transportation Cabinet
  - 1. *Standard Specifications for Road and Bridge Construction*, Edition of 2019, Approved for June 1, 2019, Published by the Kentucky Transportation Cabinet.



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- B.** American Association of State Highway Transportation Officials
  - 2. AASHTO M 288, 2017 Edition, 2017 - Standard Specification for Geosynthetic Specification for Highway Applications
- C.** American Society for Testing and Materials (ASTM) standards:
  - 1. ASTM D4354 Practice for Sampling of Geosynthetics for Testing.
  - 2. ASTM D4355 Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
  - 3. ASTM D4491 Standard Test Method for Water Permeability of Geotextiles by Permittivity.
  - 4. ASTM D4751 Standard Test Method for Determining Apparent Opening Size of a Geotextile.
  - 5. ASTM D4533 Test Method for Trapezoidal Tearing Strength of Geotextiles.
  - 6. ASTM D4632 Test Method for Grab Breaking Load and Elongation of Geotextiles.
  - 7. ASTM D4716, Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
  - 8. ASTM D4873 Guide for Identification, Storage and Handling of Geotextiles.
  - 9. ASTM D5261 Test Method for Measuring Mass per Unit Area of Geotextiles.
  - 10. ASTM D6241 Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.

## 1.4 Submittals

- A.** Manufacturer's Product Information
  - 1. As part of their submittal, the Contractor shall provide the following information for the geotextile to be used:
    - a. Name of manufacturer.
    - b. Product name.
    - c. Style number.
    - d. Chemical composition of the filaments and yarns.
    - e. Product data sheets.
    - f. Manufacturer's installation instructions.
  - 2. The manufacturer shall have a quality control program that includes an on-site laboratory accredited by the Geosynthetic Accreditation Institute, Laboratory Accreditation Program (GAI-LAP) to perform the required test methods.
  - 3. Submit the results of factory testing to the Owner's Representative prior to initiating field work.
  - 4. At a minimum, the Manufacturer will perform the tests at the frequencies given in Table 02674-A found in this Section 02674 on the geotextile prior to shipping the material to the site.



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5. A written certificate from the Geotextile Manufacturer stating that the materials supplied are in compliance with this Specification:
  - a. The manufacturer's certificate shall state that the finished geotextile meets minimum average roll value (MARV) requirements as noted below (5), except as otherwise specified, as evaluated under the manufacturer's quality control program.
  - b. The information supplied shall be in the form of a factory quality control certificate for each roll and shall include the following:
    - (1) Lot, batch, or roll numbers and identification.
    - (2) Length and width of each roll.
    - (3) Date each roll was manufactured.
    - (4) Sampling procedures.
    - (5) Results of quality control tests that are to include those presented in Table 02674-A found in this Section 02674 and description of test methods used. The results of these tests must meet the minimum required physical properties for each geotextile type listed in the referenced AASHTO M288 specification for the specific class specified herein.
  - c. A person having legal authority to bind the manufacturer shall attest to the certificate.
6. Either mislabeling or misrepresentation of materials shall be reason to reject those geotextile products.

## 1.5 Quality Assurance

- A. Perform Work in accordance with these Specifications.
- B. The Manufacturer shall sample and test the geotextile material, at minimum frequencies specified in Table 02674-A, with at least one test performed on each geotextile type proposed for use.
- C. Any geotextile sample that does not comply with this Section 02674 shall result in rejection of the roll from which the sample was obtained. The Contractor shall replace any rejected rolls at no additional cost to Owner.
- D. If a geotextile sample fails to meet the quality control requirements of this Section 02674, the Contractor shall require that the Geotextile Manufacturer sample and test each roll manufactured in the same lot or batch, or at the same time, as the failing roll. Sampling and testing of rolls shall continue until a pattern of acceptable test results, as approved by the Owner, is established.
- E. General manufacturing procedures shall be performed in accordance with the manufacturer's internal quality control guide and/or documents.
- F. The Manufacturer shall be a well-established firm with more than five years experience in the manufacture of geotextiles.
- G. The Installer shall be trained and qualified to install geotextiles.



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- H. The Owner's Representative shall monitor the geotextile rolls upon delivery to the site and report any deviations from project specifications to the contractor.

## 1.6 Delivery, Storage and Handling

- A. Geotextile labeling, shipment, and storage shall follow ASTM D 4873.
- B. Product labels shall clearly show:
  - 1. Manufacturer or supplier name.
  - 2. Product identification.
  - 3. Lot or batch number.
  - 4. Roll number.
  - 5. Roll dimensions (length and width).
- C. If any special handling is required, it shall be so marked on the geotextile itself; e.g., "This Side Up" or "This Side Against Soil to be Retained."
- D. Each shipping document shall include a notation certifying that the material is in accordance with the manufacturer's certificate.
- E. Each geotextile roll shall be wrapped with a material that will protect the geotextile, including the ends of the roll, from damage due to shipment, water, ultraviolet sunlight, mud, dust, puncture, and other damaging deleterious conditions. The protective wrapping shall be maintained during periods of shipment and storage.
- F. During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, temperatures in excess of 160°F (71°C), and any other environmental condition that may damage the property values of the geotextile.
- G. Transport and handle geotextile with equipment designed to protect it from damage. Equipment used to unload, stack or transport geotextile shall not damage protective wrap or geotextile.
- H. Upon delivery at the job site, the contractor shall ensure that the geotextile rolls are handled and stored in accordance with the manufacturer's instructions as to prevent damage.
- I. The geotextile rolls shall not be stacked more than three rolls high or as otherwise recommended by the Manufacturer.
- J. Do not use materials damaged during storage or handling. If the geotextile is not packaged and a roll is damaged during shipment, the roll shall be rejected.
- K. If only the outermost surface of the roll is affected, it may be peeled back, cut, and wasted if approved by the Owner's Representative (i.e., it shall be treated as if it were the protective packaging for the remainder of the roll).
- L. The geotextile shall be relatively free of holes or any sign of contamination by foreign matter. The Engineer may reject all or portions of units (or rolls) of the geotextile if in his opinion significant quantities of production flaws are observed.
- M. Responsibility





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**1. Contractor**

- a.** The Contractor shall provide the services of a Geotextile Manufacturer, and Installer, who shall meet the following qualifications. The Contractor shall, however, accept and retain full responsibility for all materials and installation and shall be held responsible for any defects in the completed system.
- b.** Unloading of geotextile from delivery vehicle.
- c.** The Contractor shall be liable for all damages to the geotextile materials incurred during and after unloading them at the site.

**2. Manufacturer of Geotextiles**

- a.** The Geotextile Manufacturer shall be responsible for the production and delivery of geotextile rolls.
- b.** The Manufacturer shall submit to the Engineer:
  - (1)** Those items listed in Part 1.4 of this Section 02674.
  - (2)** Production capacity available and projected delivery dates for this project.

**3. Geosynthetic Installer (may be same as Contractor)**

- a.** The Installer shall be responsible for field handling, storing, deploying, seaming or connecting, temporary restraining (against wind), anchoring, and other site aspects of the geotextiles.
- N.** The Installer shall take any necessary precautions to prevent damage to other portions of the Work during placement of the geotextile.

**1.7 Field Measurements**

- A.** Verify field measurements prior to fabrication.



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## 2.0 Products

### 2.1 Geotextile

- A. Nonwoven geotextile shall conform to AASHTO M288 section on subsurface drainage requirements with the minimum Class designations from Table 1 (AASHTO M288) specified as follows:
  - 1. Geotextile at haul road ditch terminations: Class 2.
  - 2. Geotextile separator for haul road construction beneath granular base: Class 1.
  - 3. Geotextile beneath aggregate at underdrain outlet headwalls: Class 3.
- B. The Contractor shall test the in-situ soils for gradation to determine geotextile requirements in accordance with Table 2 (AASHTO M288).
- C. Unless otherwise noted on the Drawings, geotextile suppliers shall furnish materials whose Minimum Average Roll Values meet or exceed the criteria specified in AASHTO M288. The Manufacturer shall provide test results for these procedures, as well as a certification that the material properties meet or exceed the specified values.
  - 1. Minimum Average Roll Value (MARV) shall be based on Manufacturer's data and shall be calculated as the mean value of the property of interest plus or minus two standard deviations, as appropriate.
  - 2. Where material properties vary among the machine and cross-machine directions, the MARV shall apply to the direction providing the lowest value (when a minimum is specified) or the highest value (when a maximum value is specified).
- D. The geotextiles provided by the supplier shall be stock products.
- E. The geotextile shall be:
  - 1. Nonwoven, needlepunched, continuous filament polyester material; or
  - 2. Nonwoven, needlepunched, continuous filament polypropylene material; or
  - 3. Nonwoven, needlepunched, polypropylene staple or continuous fiber material.
- F. The geotextile shall be manufactured from first quality virgin polymer.
- G. The supplier shall not furnish products specifically manufactured to meet the specifications of this project unless authorized by the Owner and Engineer.
- H. In addition to the property values listed in AASHTO M288, the geotextiles shall:
  - 1. Retain its structure during handling, placement, and long-term service.
  - 2. Be capable of withstanding outdoor exposure for a minimum of 30 days with no measurable deterioration.



**Table 02674-A  
Geotextile Required Physical Pre-Shipping Testing and Frequencies**

Property	Test Method	Frequency
Mass Per Unit	ASTM D5261	Every 100,000 ft <sup>2</sup>
Grab Tensile Strength	ASTM D4632	Every 100,000 ft <sup>2</sup>
Grab Tensile Elongation	ASTM D4632	Every 100,000 ft <sup>2</sup>
Trapezoid Tear Strength	ASTM D4533	Every 100,000 ft <sup>2</sup>
Puncture Strength	ASTM D6241	Every 100,000 ft <sup>2</sup>
Apparent Opening Size (AOS)	ASTM D4751	1 per production lot
Permittivity	ASTM D4491	1 per production lot
UV Resistance	ASTM D4355	1 per formulation

## 2.2 Accessories

- A. Sewing materials: Types recommended by manufacturer for sewing seams in geotextile.

## 3.0 Execution

### 3.1 Examination

- A. Prior to implementing any geotextile work, the Geosynthetic Installer shall carefully inspect the subgrade and verify that all work is complete to the point where the installation of the geotextile may properly commence without adverse impact.
- B. If the Contractor has any concerns regarding the installed work, the Engineer and/or Owner shall be notified in writing within 48-hours of his site inspection. Failure to inform the Engineer and/or Owner in writing or installation of the geotextile will be construed as Contractor's acceptance of all prior related work.
- C. Any geotextile that does not comply with Table 1 in AASHTO M288 for the tests listed in Table 02674-A shall be rejected and replaced with new material in accordance with the Specifications, at no additional cost to Owner.

### 3.2 Preparation

- A. Prior to implementing any of the work described in this Section 02674, the Geosynthetic Installer shall become thoroughly familiar with all portions of the work within this Section 02674 or related work, as necessary for successful completion of the Work.

### 3.3 Installation

- A. The Geosynthetic Installer shall handle all geotextile in such a manner as to ensure they are not damaged in any way.



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- B.** The Geosynthetic Installer shall take any necessary precautions to prevent damage to underlying layers during placement of the geotextile.
- C.** In the presence of wind, all geotextiles shall be weighted by sandbags or approved equivalent. Such anchors shall be installed during placement and shall remain in place until replaced with cover material.
- D.** After unwrapping the geotextile from its opaque cover, the geotextile shall not be left exposed for a period in excess of 30 days unless a longer exposure period is approved by the Engineer based on a formal demonstration from the CONTRACTOR that the geotextile is stabilized against UV degradation for the proposed period of exposure.
- E.** The Contractor shall take care not to entrap stones, excessive dust, or moisture in the geotextile during placement.
- F.** Nonwoven geotextile shall be continuously sewn at their seams. Geotextiles shall be overlapped a minimum of 6 inches, or as otherwise noted in the Specifications.

### **3.4 Field Quality Control**

- A.** The Contractor shall be aware of the activities outlined in this Specification and shall account for these CQC activities in the installation schedule.
- B.** Conformance testing of on-site samples is not required but can be directed by the Engineer at their discretion.
- C.** The finished geotextile shall have good appearance qualities. It shall be free from such defects that would affect the specific properties of the geotextile, or its proper functioning.
- D.** Defects and Repairs:
  - 1.** Any holes or tears in the geotextile shall be repaired with a patch made from the same geotextile. The patch may be lystered (heat bond) in place using a method acceptable to the Owner's Representative. The patch shall maintain a minimum of 12 inches overlap in all directions.
  - 2.** Care shall be taken to remove any soil or other material, which may have penetrated the torn geotextile.
- E.** Before initial placement of overlying materials, inspect underlying system seams and repaired areas to ensure tight, continuously seamed installation. Repair damaged system and re-inspect repaired work.

### **3.5 Protection of Finished Work**

- A.** The Geosynthetic Installer and Contractor shall use all means necessary to protect all prior work and all materials and completed work of other Sections.
- B.** In applying fill material, no equipment can drive directly across the geotextile. The specified fill material shall be placed and spread utilizing vehicles with a low ground pressure in accordance with the requirements of the CQC Plan for protection of geomembrane.



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- C. The geotextile shall be covered as soon as possible after installation and approval. The geotextile shall not be exposed to precipitation prior to being installed and shall not be exposed to direct sun light for more than 30 days after installation.
- D. Placement of Overlying Material:
  - 1. Placement of the overlying material shall proceed immediately following placement and inspection of the geotextile
  - 2. The overlying material shall be placed on the geotextile in such a manner that ensures that:
    - a. The geotextile and underlying geosynthetic materials (if any) are not damaged.
    - b. Minimal slippage occurs between the geotextile and underlying layers.
    - c. Wrinkling of geosynthetics does not occur.
- E. In the event of damage, the Geosynthetic Installer shall immediately make all repairs and replacements necessary at the expense of the responsible party, to the approval of the Engineer.
- F. Protect installed geotextile according to manufacturer's instructions. Repair or replace areas of damaged by scuffing, punctures, traffic, rough subgrade, or other unacceptable conditions.

**END OF SECTION**



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**August 2019, Rev. July 2020**

Reference: **Technical Specification 02675 – Geocomposite Drainage Layer**  
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## Section 02675 Geocomposite Drainage Layer

### 1.0 General

#### 1.1 Summary

**A.** Section Includes:

1. Geocomposite drainage layer (Geocomposite) used for primary drainage layer in final cover system.

**B.** Related Sections:

1. Section 02320 – Backfill - Structural
2. Section 02672 – LLDPE Geomembrane
3. Section 02674 – Nonwoven Geotextile.

#### 1.2 Unit Price – Measurement

**A.** Geocomposite

1. Basis of Measurement: By the square foot installed or as otherwise specified in other Sections of these Specifications.
  - a. Includes all labor, tools, geocomposite material, placement, supervision, transportation, installation, equipment, binding, repairs, and all incidentals necessary to complete the work as specified on the Drawings and in these Specifications and in accordance with the CQC Plan for the installation of the geocomposite.
  - b. Measurement will be made based on the total two-dimensional (plan view) surface area in square feet covered by the geocomposite as shown on the Drawings. Final quantities will be based on as-built conditions. No allowance will be made for geocomposite in anchor and drainage trenches or waste, overlap, repairs, or materials used for the convenience of the Contractor.

#### 1.3 References

**A.** American Society for Testing and Materials (ASTM)

1. ASTM D1238 Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.



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2. ASTM D1505 Standard Test Method for Density of Plastics by the Density-Gradient Technique.
3. ASTM D1603 Standard Test Method for Carbon Black in Olefin Plastics.
4. ASTM D4218 Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.
5. ASTM D4355 Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
6. ASTM D4491 Standard Test Method for Water Permeability of Geotextiles.
7. ASTM D4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
8. ASTM D4716, Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
9. ASTM D4751, Standard Test Method for Determining Apparent Opening Size of Geotextile, Geomembranes, and Related Products.
10. ASTM D4883 Standard Test Method for Density of Polyethylene by the Ultrasound Technique.
11. ASTM 5035 Standard Test Method for Breaking Force and Elongation of Textile Strips (Strip Method)
12. ASTM D5199 Standard Test Method for Measuring Nominal Thickness of Geosynthetics.
13. ASTM D5261 Standard Test Method for Measuring Mass per Unit Area of Geotextiles.
14. ASTM D5321 Standard Test Method for Determining the Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear.
15. ASTM D6241 Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.
16. ASTM D7005 Standard Test Method for Determining the Bond Strength (Ply Adhesion) of Geocomposites.

**B. Geosynthetic Research Institute (GRI) Standards**

1. GC8 Determination of the Allowable Flow Rate of a Drainage Geocomposite

## 1.4 Submittals

**A. Manufacturer's Product Information**

1. At least five (5) working days prior to shipment, the Geosynthetic Installer shall furnish the Engineer with pre-shipping product data sheets and test data for each geocomposite type. At a minimum, the Manufacturer will perform the tests at the frequencies given in Tables 02675-A found in this Section on the geocomposite prior to shipping geocomposite material to the site. These tests shall conform to the standards set in Tables 02675-B and 02675-C, also found in this Section. The information supplied shall be in the form of a factory quality control certificate for each geocomposite roll and shall include the following:





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- a. Lot, batch, or roll numbers and identification.
- b. Length and width of each roll.
- c. Date each roll was manufactured.
- d. Sampling procedures.
- e. Results of quality control tests that are to include those presented in Table 02675-A and description of test methods used. The results of these tests must meet the minimum required physical properties for geocomposite specified in Table 02675-B and Table 02675-C.

- B. The factory QA/QC plan for operating the system.
- C. Manufacturer's Installation Instructions.
- D. A written Certificate from the Geocomposite Manufacturer stating that the resin and/or materials supplied are in compliance with this Specification.
- E. Statement certifying that no more than 2% by weight of factory regrind was used to manufacture the geonet core in the composite used for leachate collection applications. Factory regrind shall have resin documentation.

## 1.5 Closeout Submittals

- A. The Geosynthetics Installer's supervisor shall observe and check all phases of the geocomposite installation. When the geocomposite is accepted by the Owner, the Geosynthetics Installer shall submit a Letter of Acceptance to the Owner that the installation conforms to the requirements of the Manufacturer.

## 1.6 Quality Assurance

- A. Perform Work in accordance with these Specifications.
- B. Liner System - Interface Friction Angle Requirements and Testing
  - 1. The effective interface shear strength envelope at the interface between the geocomposite and the materials in direct in contact with the geocomposite shall be verified by the Owner's Representative by performing interface friction testing on representative materials to be used for construction of the liner system.
  - 2. Interface friction testing shall be conducted by the methods and meeting the criteria defined in Specification Section 02672, LLDPE Geomembrane.
- C. The Manufacturer shall sample and test the geocomposite material, at minimum frequencies specified in Table 02675-A.
- D. Conformance Testing – Material Properties:
  - 1. Conformance testing shall be performed by an independent laboratory at a frequency of at least 1 per 100,000 square feet of geocomposite manufactured for this project. Conformance testing shall consist of the following tests:



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- a. Thickness (ASTM D5199).
  - b. Density (ASTM D1505).
  - c. Ply Adhesion (ASTM D7005).
  - d. Other tests as required by Engineer.
2. Sampling for conformance testing shall be performed at the manufacturing facility whenever possible, and in accordance with the CQC Plan.
- E. Conformance Testing – Performance:
  1. Additional Conformance testing shall be performed on the geocomposite material and shall consist of the following tests:
    - a. Transmissivity (ASTM D4716).
  2. Conformance testing shall be performed by an independent laboratory at a frequency of:
    - a. 1 tests per 1,000,000 square feet of geocomposite placed for transmissivity testing, and
    - b. When directed by the Engineer.
  3. Conformance test results shall be reviewed by the Engineer to determine if the soil/geotextile system is acceptable.
- F. The Engineer shall examine the geocomposite rolls upon delivery to the site and report any deviations from project specifications to the Contractor.
- G. If a geocomposite sample fails to meet the quality control requirements of this Section, the Contractor and/or Engineer shall require that the Liner Manufacturer sample and test each roll manufactured in the same lot or batch, or at the same time, as the failing roll. Additional sampling and testing shall be completed at no additional cost to the Owner. Sampling and testing of rolls shall continue until a pattern of acceptable test results is established.
- H. Any geocomposite sample that does not comply with this Section shall result in rejection of the roll from which the sample was obtained. The Contractor shall replace any rejected rolls at no additional cost to Owner. At the Geocomposite Manufacturer's discretion and expense, additional testing of individual rolls may be performed to more closely identify noncomplying rolls and to qualify individual rolls.

## 1.7 Qualifications

- A. Manufacturer
  1. Manufacturer shall have manufactured a minimum of 10,000,000 square feet of geocomposite material during the last year.



- B. Pre-Qualified Installer: Geosynthetics Installer shall meet the qualifications defined in Section 02672, Part 1.7

## 2.0 Products

### 2.1 Geocomposite

- A. Materials:
  1. Geocomposite shall be a high-flow capacity geocomposite consisting of an HDPE geonet drainage core with nonwoven geotextiles heat bonded to each side.
  2. Geocomposite suppliers shall furnish materials whose values meet or exceed the criteria specified in Table 02675-B and Table 02675-C. The Manufacturer shall provide test results for these procedures, as well as a certification that the material properties meet or exceed the specified values.
  3. The synthetic mesh structure shall consist of solid rib extruded high density polyethylene.
  4. The geocomposite provided by the Supplier shall be stock products. No more than 2% by weight of factory regrind shall be used to manufacture the geonet core used for leachate collection applications. Factory regrind shall have resin documentation.
  5. The Supplier shall not furnish products specifically manufactured to meet the Specifications of this project unless authorized by the Owner and Engineer.
  6. In addition to the property values listed in Table 02675-B and Table 02675-C, the geocomposite shall:
    - a. Retain its structure during handling, placement, and long-term service.
    - b. Be capable of withstanding outdoor exposure for a minimum of 30 days with no measurable deterioration.
  7. The geonet core shall be manufactured by extruding:
    - a. Two crossing strands to form a bi-planar drainage net structure; or
    - b. Three sets of strands to form a tri-planar drainage net structure consisting of a thick vertical rib with diagonally placed top and bottom ribs.

**Table 02674-A**  
**Geotextile Required Physical Pre-Shipping Testing**

Property	Test Method	Frequency
<b>Geonet</b>		
Thickness	ASTM D5199	50,000 ft <sup>2</sup>
Density (geonet)	ASTM D1505	50,000 ft <sup>2</sup>
Carbon Black Content	ASTM D4218	50,000 ft <sup>2</sup>



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<b>Resin</b>		
Polymer Density	ASTM D1505 or ASTM 4883	Once per lot
Melt Flow Index	ASTM D1238	Once per lot
<b>Geotextiles</b>		
Mass per Unit Area	ASTM D5261	100,000 ft <sup>2</sup>
Grab Tensile	ASTM D4632	100,000 ft <sup>2</sup>
CBR Puncture Strength	ASTM D6241	100,000 ft <sup>2</sup>
AOS, US Sieve	ASTM D4751	540,000 ft <sup>2</sup>
Water Flow Rate	ASTM D4491	540,000 ft <sup>2</sup>
UV Resistance	ASTM D4355	Once per resin formulation
<b>Geocomposite</b>		
Ply Adhesion	ASTM D7005	50,000 ft <sup>2</sup>
Transmissivity	ASTM D4716	1,000,000 ft <sup>2</sup>



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**Table 02675-B**  
**Geocomposite Required Physical Properties**

Properties and Requirements <sup>(1,2)</sup>	Test Method	Qualifier <sup>3</sup>	Minimum Average Values
<b>Geonet</b>			
Polymer Composition, %			95% polyethylene by weight
Thickness, mil	ASTM D5199	MAV	SEE TABLE 02675-C
Density, g/cm <sup>3</sup>	ASTM D1505 or ASTM D4883	MAV	0.94
Tensile Strength, lb/in	ASTM D5035	MAV	75
Carbon Black Content, %	ASTM D4218	range	2.0 – 3.0
<b>Resin</b>			
Polymer Density, g/cm <sup>3</sup>	ASTM D1505	MAV	> 0.94
Melt Flow Index, g/10 min	ASTM D1238	MAX	≤ 1.0
<b>Geotextile</b>			
Mass per Unit Area, oz/yd <sup>2</sup>	ASTM D5261	MAV	8
Grab Tensile, lb	ASTM D4632	MAV	200
Puncture Strength, lb	ASTM D6241	MAV	410
AOS, US Sieve (mm)	ASTM D4751	MAV	80 (0.18 mm)
Water Flow Rate, gpm/ft <sup>2</sup>	ASTM D4491	MAV	95
UV Resistance (% retained after 500 hours)	ASTM D4355	MAV	70
<b>Geocomposite</b>			
Transmissivity, m <sup>3</sup> /m/sec (Liner)	ASTM D4716	MAV	SEE TABLE 02675-C
Ply Adhesion, lb/in	ASTM D7005	MAV	1.0
Roll Width, ft	-	MAV	15
Roll Length, ft	-	MAV	160

Notes:

- (1) MAV = Minimum Average Value, MAX = Maximum Value



**Table 02675-C  
Geocomposite Transmissivity Requirements**

Thickness, mil	Slope Angle	Long-Term Required Transmissivity <sup>1,2</sup> m <sup>3</sup> /m/sec
<b>Final Cover System</b>		
As required to achieve transmissivity	3H:1V	≥ 9.1 x 10 <sup>-5</sup>
As required to achieve transmissivity	Flatter than 3H:1V	≥ 2.0 x 10 <sup>-4</sup>

Notes:

- (1) Liner System: Gradient of 0.2. Design normal stress value of 500 psf, between soil and geocomposite drainage layer at seat time of 100 hours.
- (2) Values reported are the required allowable long-term transmissivity. Reduction factors need to be applied to the laboratory test result<sup>(3)</sup> to calculate this value.
- (3) Reduction factors shall be applied to the laboratory permeability to achieve a minimum long-term required transmissivity value as specified in Table 02675-C Reduction factor for creep to be determined in accordance with GRI-GC8 in accordance with ASTM D6364. Other reduction factors shall be as follows: Global Factor of Safety  $RF_D = 2$ ; Chemical Clogging  $RF_{cc} = 1.2$ ; Biological Clogging,  $RF_{BC} = 3.5$ .

## 2.2 Accessories

- A. Geonet Ties: Plastic fasteners recommended by Manufacturer for tying geonet panels together. Metallic ties shall not be used for joining the geonet strips.

## 3.0 Execution

The Geosynthetics Installer shall furnish all labor, materials, supervision and equipment to complete the Geocomposite Liner for the project including, but not limited to, geocomposite layout, seaming, patching, and all necessary and incidental items required to complete the work, in accordance with the Drawings and these Specifications.

### 3.1 Delivery, Storage, and Handling

- A. Geocomposite shall be shipped as follows:
  1. Rolled and labeled with roll number and manufacturer's batch number.
  2. Manufacturer's quality control documentation shall be included with each roll.
- B. If any special handling is required, it shall be labeled on the geocomposite itself; e.g., "This Side Up" or "This Side Against Soil to be Retained."
- C. Each shipping document shall include a notation certifying that the material is in accordance with the Manufacturer's Certificate.
- D. Each geocomposite roll shall be wrapped with a material that will protect the geocomposite, including the ends of the roll, from damage due to shipment, water, sunlight and



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contaminants. The protective wrapping shall be maintained during periods of shipment and storage.

- E.** Transport and handle geocomposite with equipment designed to protect geocomposite from damage. The Contractor shall be responsible for unloading and storage of geocomposite in a manner that prevents damage to the geocomposite.
- F.** On-site storage shall be as needed to protect the geocomposite rolls from excessive accumulations of soil on the geocomposite surfaces, water, heat, mechanical abrasion, puncture and vehicular traffic.
- G.** Preserve integrity and readability of geocomposite roll labels.
- H.** The geocomposite rolls shall not be stacked more than three rolls high, or as otherwise recommended by the Manufacturer.

### **3.2 Daily Pre-Installation Meetings**

- A.** At the beginning of each work day the Contractor's Superintendent, the Geosynthetic Installer's Superintendent, and the Owner's Representative will meet to discuss the upcoming work plan for all parties to promote cooperation, communication and understanding. Operations shall be planned and implemented so as not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

### **3.3 Preparation**

- A.** Ensure acceptance of underlying layers before installing overlying layers.

### **3.4 Installation**

Installation of the geocomposite shall be in compliance with this Specification and with the Manufacturer's standard guidelines and specifications for geocomposite installation, subject to approval by the Owner's Representative, including, but not limited to: (i) handling and site storage requirements; (ii) unrolling and laying of geocomposite sheets; (iii) field seaming or welding techniques; and (iv) anchor trench and ballast details.

- A.** Geocomposite Deployment:
  - 1.** The Geosynthetics Installer shall handle all geocomposite in such a manner as to ensure the material is not damaged in any way.
  - 2.** The geocomposite roll should be installed in the direction of the slope and in the intended direction of flow unless otherwise specified by the Engineer.
  - 3.** Along landfill benches, the geocomposite machine direction shall be installed in the slope direction. The slope direction is the direction perpendicular to the contour lines indicated on the Drawings.



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4. On slopes, secure geocomposite and then roll geocomposite down slope in manner to continually keep geocomposite in tension. If necessary, position geocomposite by hand after unrolling to minimize wrinkles.
  5. Weight geocomposite with sandbags or equivalent in presence of wind. Do not remove weight until replaced with cover material. Handle sandbags with care to prevent rupture or damage of sandbag.
  6. If the project includes an anchor trench at the top of the slopes, the geocomposite shall be properly anchored to resist sliding. Anchor trench compacting equipment shall not come into direct contact with the geocomposite.
  7. Do not weld geocomposite to geomembrane unless otherwise specified in construction plans.
  8. Cut geocomposite using scissors or other cutting tools as specified by the Manufacturer.
  9. Do not damage underlying geosynthetic layers during placement of geocomposite.
  10. During geocomposite deployment, do not entrap dirt, excessive dust that could cause clogging of drainage system, or stones that could damage adjacent geomembrane. If dirt or excessive dust is entrapped in geocomposite, hose clean prior to placement of next layer of material.
- B. Seam and Overlap:** Each component of the geocomposite (i.e., geotextile(s) and geonet) will be secured or seamed to the like component at overlaps.
1. Geonet Components
    - a. Overlap adjacent geonet rolls minimum of 4 in.
    - b. Geonet roll ends (butt seams) shall be overlapped one foot in areas with less than 10 percent slope.
    - c. In areas of greater than 10 percent slope, butt seams shall be overlapped two feet. Two staggered rows of ties shall be applied at 12 inch intervals.
    - d. Tie geonet overlaps with plastic fasteners. Use white or yellow tying devices for easy inspection. Do not use metallic devices.
    - e. Tie every 5 ft along edges, every 6 in. in anchor trench, and every 12 in. along end-to-end seams.
    - f. In corners of side slopes of rectangular landfills, where overlaps between perpendicular geonet strips are required, unroll an extra layer of geonet along slope, on top of previously installed geonet, from top to bottom of slope.
    - g. Stagger joints when more than one layer of geonet is installed.
    - h. When several layers of geonet are stacked, deploy rolls in same direction to prevent strands of one layer from penetrating channels of adjacent layer.
  2. Geotextile Components





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- a. The bottom layer of geotextiles shall be overlapped. The top layer of geotextile shall be continuously sewn. Geotextiles shall be overlapped a minimum of 4 inches prior to seaming.
- b. Polymeric thread, with chemical resistance properties equal to or exceeding those of the geotextile component, shall be used for all sewing. The seams shall be sewn to provide a flat (prayer) seam, "J" seam or "butterfly-folded" seam and shall be a two-thread, double-lock stitch or a double row of single-thread, chain stitch.

### 3.5 Field Quality Control

- A. The Contractor shall be aware of the activities outlined in the CQC Plan and shall account for these CQC activities in the installation schedule.
- B. The finished geocomposite shall have good appearance qualities. It shall be free from such defects that would affect the specific properties of the geocomposite, or its proper functioning.
- C. Defects and Repairs:
  - 1. Repair damage to geocomposite as follows, if hole or tear width across roll is less than 50% of width of roll.
    - a. Place patch extending 2 ft beyond edges of hole or tear.
    - b. Secure patch to original geocomposite by tying every 6 inches. Use approved tying devices specified by Manufacturer.
    - c. The top geotextile component of the patch shall be heat sealed to the top geotextile of the geocomposite needing repair.
  - 2. Repair damage to geocomposite as follows, if hole or tear width across roll is greater than 50% of width of roll.
    - a. On base of landfill, cut out damaged area and replace with new geocomposite.
    - b. On side slopes, remove and replace damaged geocomposite panel.
    - c. Join in the new portions as noted in Part 3.4 B1 above in this Section.
- D. Owner's Representative shall observe repairs and report noncompliance in writing to Owner and Engineer.
- E. Before initial placement of soil cover or other cover, inspect system seams and repaired areas to ensure tight, continuously bonded installation. Repair damaged system and re-inspect repaired work.

### 3.6 Protection of Finished Work

- A. Protect installed geocomposite according to geocomposite manufacturer's instructions. Repair or replace areas of geocomposite damaged by scuffing, punctures, traffic, rough subgrade, or other unacceptable conditions.



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- B.** The Geosynthetics Installer and Contractor shall use all means necessary to protect all prior Work and all materials and completed work of other Sections included in these Specifications.
- C.** In the event of damage, the Geosynthetics Installer and/or Contractor (depending on who damages the geocomposite) shall immediately make all repairs and replacements necessary, to the approval of the Owner's Representative and at no additional cost to Owner.
- D.** Tools shall not be left on, in, or under the geocomposite.

**END OF SECTION**



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## Section 02676 Reinforced Polyethylene (PE-R) Geomembrane

### 1.0 General

#### 1.1 Summary

**A.** Section Includes:

1. Reinforced Polyethylene (PE-R) Geomembrane for the cover system.

**B.** Related Sections:

1. Section 02320 - Backfill - Structural.
2. Section 02675 – Geocomposite Drainage Layer
3. Section 02673 – HDPE Geomembrane

#### 1.2 Unit Price – Measurement

**A.** PE-R geomembrane:

1. Basis of Measurement: By square foot of geomembrane installed, in-place, excluding scrap and overlap.
  - a. Includes furnishing geomembrane, storage, installation, labor, supervision, transportation, equipment, and incidental items as required to complete the geomembrane installation to temporary or permanent termination limits, as specified on Drawings and in accordance with CQC Plan.
  - b. Measurement will be made based on the total two-dimensional (plan view) surface area in square feet based on as-built conditions. No allowance will be made for geomembrane in anchor and drainage trenches or waste, overlap, repairs, or materials used for the convenience of the Contractor.

#### 1.3 References

**A.** American Society for Testing and Materials (ASTM) standards:

1. ASTM D76 Standard Specification for Tensile Testing Machines for Textiles.
2. ASTM D751 Standard Test Method for Coated Fabrics.
3. ASTM D5199 Standard Test Method for Measuring Nominal Thickness of Geosynthetics.



4. ASTM D6392 Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
  5. ASTM D7747 Standard Test Method for Determining Integrity of Seams Produced Using Thermo-Fusion Methods for Reinforced Geomembranes by the Strip Tensile Method.
- B.** Geosynthetic Research Institute (GRI) Standards:
1. GM6 Pressurized Air Channel Test for Dual Seamed Geomembranes.
  2. GM19b Seam Strength and Related Properties of Thermally Bonded Reinforced Polyolefin Geomembranes/Barriers.
  3. GM25 Test Methods, Test Properties and Testing Frequency for Reinforced Linear Low Density Polyethylene (LLDPE-R) Geomembranes.
- C.** U.S. Environmental Protection Agency (EPA), Technical Guidance Document:
1. "The Fabrication of Polyethylene FML Field Seams" EPA/530/SW-89/069, (1193).

## 1.4 Submittals

- A.** The Geosynthetic Installer shall submit proposed geomembrane panel layout, including anchor trenches and connections to any inlet/outlet structures, to the Engineer at least 14 days prior to mobilization of crews. Once the panel layout is approved, the Geosynthetic Installer may not change the layout without permission of the Engineer.
- B.** Manufacturer's Product Information
1. At least five (5) working days prior to shipment, the Geosynthetic Contractor shall furnish the Engineer with pre-shipping product data sheets and test data for each geomembrane type. At a minimum, the Manufacturer will perform the tests at the frequencies given in Tables 02676-A found in this Section on the PE-R sheet prior to shipping PE-R material to the site. These tests shall conform to the standards set in Table 02676-B also found in this Section. The information supplied shall be in the form of a factory quality control certificate for each geomembrane roll and shall include the following:
    - a. Roll and lot numbers and identification.
    - b. Length and width of each roll.
    - c. Date each roll was manufactured.
    - d. Sampling procedures.
    - e. Results of quality control tests that are to include those presented in Tables 02676-A found in this Section and description of test methods used. The results of these tests must meet the minimum required physical properties for PE-R geomembrane specified in Table 02676-B found in this Section.



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- C. A written certificate from the geomembrane manufacturer stating that the resin and geomembrane materials supplied are in compliance with this Section 02676.
- D. Manufacturer's Installation Instructions: Submit special procedures for geomembrane installation.
- E. The Geosynthetics Installer shall adopt and use the quality assurance forms prepared by the Owner's Representative, or other forms approved by the Owner's Representative, during all applicable phases of geomembrane installation, inspection and testing. The Geosynthetics Installer can request to use his forms. The forms must be submitted to the Owner's Representative at least two weeks prior to geomembrane installation for review and approval.
- F. A resume of the proposed Superintendent of the Geosynthetics Installer must be submitted to the Engineer for final approval two weeks prior to geomembrane installation.
- G. The Contractor is responsible for his own Health and Safety Plan, but must abide by any safety procedures dictated by the Owner.

## 1.5 Closeout Submittals

- A. Forms by the Owner's Representative:
  - 1. Owner's Representative Daily Field Report
  - 2. Field Inventory Control, Storage Inspection, and Cross-Reference Roll Numbers
  - 3. Subgrade Certification
  - 4. Geomembrane Trial Seam Log
  - 5. Geomembrane Deployment Report
  - 6. Geomembrane Seam Log
  - 7. Geomembrane Defect Log
  - 8. Geomembrane Repair Testing Log
  - 9. Geomembrane Laboratory Destructive Test Results
- B. The Contractor is responsible for providing an as-built drawing of the geomembrane installation. The as-built drawing shall include panel corners, transitions in panel geometry, repair locations, the inside bottom corner of the anchor trench, and other significant features.
- C. The Geosynthetics Installer's supervisor shall observe and check all phases of the geomembrane installation. When the geomembrane is accepted by the Owner, the Geosynthetics Installer shall submit a Letter of Acceptance to the Owner that the installation conforms to the requirements of the Manufacturer.

## 1.6 Quality Assurance

- A. Perform Work in accordance with these Specifications and the CQC Plan.
- B. The Manufacturer shall sample and test the PE-R geomembrane material, at minimum frequencies specified in Table 02676-A. General manufacturing procedures shall be performed in accordance with the Manufacturer's internal quality control guide and/or documents.
- C. Conformance Testing:



1. No conformance testing is required.
  2. Conformance testing may be assigned by the Owner's Representative at their discretion on-site. Materials not passing conformance testing will then be removed and replaced at the Contractor's expense.
- D.** The Engineer shall examine the rolls upon delivery to the site and report any deviations from these Specifications to the Contractor.
- E.** If a geomembrane sample fails to meet the quality control requirements of this Section, the Contractor and/or Engineer shall require that the Geomembrane Manufacturer sample and test each roll manufactured in the same lot or batch, or at the same time, as the failing roll. Additional sampling and testing shall be completed at no additional cost to the Owner. Sampling and testing of rolls shall continue until a pattern of acceptable test results is established.
- F.** Any geomembrane sample that does not comply with this Section shall result in rejection of the roll from which the sample was obtained. The Contractor shall replace any rejected rolls at no additional cost to Owner. At the Geomembrane Manufacturer's discretion and expense, additional testing of individual rolls may be performed to more closely identify noncomplying rolls and to qualify individual rolls.

## 1.7 Qualifications

- A.** Geosynthetic Contractor Equipment and Personnel
1. Quality Control Foreman (QCF)
    - a. The Geosynthetics Installer shall provide an individual whose title is "Quality Control Foreman" (QCF) who shall be experienced in all phases of quality control testing and procedures.
    - b. The QCF will be dedicated to performing or directing the Geosynthetics Installer's quality control activities, (i.e. air pressure, vacuum box and spark non-destructive testing and field destructive testing).
    - c. The QCF and the Superintendent may be the same person if approved by the Engineer.
  2. Equipment
    - a. Geosynthetic Contractor shall supply and maintain at least three extrusion welders and three double hot wedge fusion welders, at least one of which must be available at the working space at all times.
    - b. At least one extra generator shall be supplied and maintained by the Geosynthetic Contractor to be used as a spare.



## 2.0 Products

### 2.1 Reinforced Polyethylene (PE-R) Geomembrane

**A. Materials:**

1. The geomembrane shall be made of reinforced polyethylene (PE-R) that has a nominal thickness as noted in these specifications and designed and manufactured specifically for the purpose of liquid containment and for long-term UV exposure.
2. The geomembrane used shall meet, at a minimum, the standards specified in Table 02676-B found in this Section.
3. The chemical resistance of the geomembrane shall be in keeping with typical properties of high quality polyethylene products currently available through commercial sources.
4. Up to 5 percent (by weight) clean, uncontaminated regrind material (that is, material that has been previously processed by the same manufacturer, but has never seen previous service) shall be allowed in the Geomembrane sheet if approved by the Engineer.
5. Regrind material made of the same resin as the geomembrane from sheet failing the physical properties of the geomembrane or resin as specified herein shall not be allowed under any circumstances.

**Table 02676-A**  
**Required Pre-Shipping Sheet Testing of PE-R Geomembrane**

Property	Test Method	Frequency
<b>Thickness</b>	ASTM D5199	Each Roll
<b>Weight</b>	ASTM D751	Each Roll
<b>Tongue Tear Strength</b>	ASTM D5884	Every 100,000 s.f.
<b>Grab Tensile at Break</b>	ASTM D7004	Every 100,000 s.f.
<b>Tensile Elongation at Break</b>	ASM D7004	Every 100,000 s.f.
<b>Puncture Resistance</b>	ASTM D4833	Every 100,000 s.f.
<b>High Pressure OIT</b>	ASTM D5885	Per each formulation





**Table 02676-B**  
**Required Physical Properties of PE-R Geomembrane - Textured**

Property	Test Method	Minimum	Typical
<b>Liner Thickness (Nominal)</b>	ASTM D5199	27 mil	30 mil
<b>Weight</b>	ASTM D751	126 lbf/msf	144 lbf/msf
<b>Tongue Tear Strength (3)</b>	ASTM D5884	55 lbf	100 lbf
<b>Grab Tensile at Break (2)</b>	ASTM D7004	200 lbf	280 lbf
<b>Tensile Elongation at Break (2)</b>	ASM D7004	22%	30%
<b>Puncture Resistance</b>	ASTM D4833	75 lbf	100 lbf
<b>Standard OIT or High Pressure OIT</b>	ASTM D3895 ASTM D5885	100 min 400 min	150 min 2400 min
<b>Seam Strengths (1)(2)</b>			
1. Shear Strength Hot Wedge Seam	ASTM D7747	50 lb/in (min.)	
2. Peel Strength Hot Wedge Seam	ASTM D7747	20 lb/in (min.)	

(1.) Value listed for shear and peel strengths are for 4 out of 5 test specimens; the 5<sup>th</sup> specimen can be as low as 80% of the listed values.

(2.) Tests are an average of primary reinforcement directions

(3.) Tests are an average of machine and transverse directions.

### 3.0 Execution

The Geosynthetics Installer shall furnish all labor, materials, supervision and equipment to complete the Geomembrane Liner for the project including, but not limited to, geomembrane layout, seaming, patching, and all necessary and incidental items required to complete the work, in accordance with the Drawings and these Specifications.

#### 3.1 Delivery, Storage and Handling

- A. The delivery, storage and handling shall follow the manufacturer’s guidelines which are to be submitted prior to beginning work.

#### 3.2 Preparation

- A. The geomembrane is to be placed above the 60 mil HDPE or the existing cover soil in the perimeter ditch of the geomembrane.
- B. The geomembrane is to be left exposed and anchored at both edges in accordance with the drawings.
- C. Ensure acceptance of underlying layers before installing overlying layers.
- D. Prepare ballast loading that shall be used for anchoring down the geomembrane during installation.
  - 1. Ballast loading may consist of sand bags or Portland cement bags.



2. Bags used for containing sand or cement shall be resistant to degradation by ultraviolet rays and by the weather in general.
- E. Surface Water Control and Base Maintenance**
1. The base shall be maintained well-drained and dry prior to and during geomembrane installation.
  2. The Geosynthetics Installer shall be responsible for surface water control during geomembrane installation as needed to maintain all work areas well-drained and dry during construction, preclude ponding, and prevent uplift of the geomembrane after installation.
  3. The Geosynthetics Installer's proposed dewatering method(s) shall be submitted to the Owner's Representative at least one week prior to implementation.

### 3.3 Installation

Installation of the geomembrane shall be in compliance with this Specification 02676 and the following documents:

- GRI-GM19b (Geosynthetics Research Institute), and;
- the Manufacturer's standard guidelines and specifications for geomembrane installation, subject to approval by the Owner's Representative, including, but not limited to: (i) handling and site storage requirements; (ii) unrolling and laying of geomembrane sheets; (iii) field seaming or welding techniques; and (iv) anchor trench and ballast details.

The owner's representative will perform QA observations during the installation for the Owner.

- A. Liner Handling and Placement**
1. Contractor shall follow manufacturer's recommendations for placement and handling.
- B. Field Seaming**
1. Field seaming shall be in accordance with U.S. E.P.A. Technical Guidance document: "The Fabrication of Polyethylene FML Field Seams" EPA/530/SW-89/069 and according to this Section 02676 and GRI-GM19b.
  2. Field seaming shall be conducted in the dry, on a compacted smooth surface. Surfaces to receive geomembrane installation should be relatively smooth and even, and free of voids, protrusions, and deleterious material.
  3. Geomembrane welding shall follow manufacturer's recommendations for installation and GRI-GM19b.
- C. Temporary Ballast Loading**



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1. Adequate temporary ballast loading that will not damage the geomembrane shall be placed by the Geosynthetics Installer over the geomembrane during installation as needed to prevent uplift by wind and by rapid changes in barometric pressure.
2. Temporary ballast loading shall be in addition to the anchor trenches.
3. If high winds are expected, boards along the edge of unseamed panels, with weighted sandbags on top, may be used to anchor the geomembrane on the subgrade.
4. Staples, U-shaped rods or other penetrating anchors shall not be used to secure the geomembrane on the side slopes, on the floor or anywhere else in the construction area.
5. Any damage to the geomembrane including damage due to construction activities or wind, rain, hail, or other weather shall be the sole responsibility of the Geosynthetics Installer.
6. All temporary ballast loading shall be removed by the Geosynthetics Installer prior to demobilizing from the site unless otherwise approved by the Owner.

### 3.4 Field Quality Control

- A. The Geosynthetics Installer shall adopt and use the quality assurance forms prepared by the Owner's Representative or other forms approved by the Owner's Representative, during all applicable phases of geomembrane installation, inspection and testing. The Geosynthetics Installer can request to use his forms. The forms must be submitted to the Owner's Representative at least two weeks prior to geomembrane installation for review and approval.
- B. All aspects of the geomembrane installation will be inspected on a full-time basis by the Owner's Representative.
  1. The Owner's Representative will conduct his own observations and perform quality control tests in addition to those performed by the Geosynthetics Installer.
  2. Testing of the seams and repairs will be conducted by the Geosynthetics Installer under observation by the Owner's Representative.
  3. The Owner's Representative or a designated, independent geosynthetics laboratory may perform additional testing, as required by these detailed Specifications or as required in the judgment of the Owner's Representative to verify that the PE-R sheet and seams meet these Specifications.
  4. Quality control by the Owner's Representative will include monitoring:
    - a. Liner handling and panel deployment
    - b. Field seaming or welding of geomembrane sheets and non-destructive testing of field seams or welds
    - c. Placement and maintenance of temporary ballast loading
- C. Trial Seams
  1. The Installer shall maintain and use equipment and personnel at the site to perform testing of trial seams.
  2. Frequency:



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- a. Trial seams will be made in the morning and afternoon, after any interruption in power, after any prolonged idle period during the day, when changes in storing equipment occur, and at the request of the Engineer at any other time during the day.
  3. Each seamer/welder shall prepare a test strip using the welding apparatus assigned to him.
  4. Trial seams will be made on fragment pieces of geomembrane to verify that seaming conditions are adequate. A trial seam shall be made for each texture contact type to be seamed by that welder during the working increment.
  5. Requirements for trial seams are as follows:
    - a. The trial seam sample will be at least 5 feet long by 1 foot wide with the seam centered lengthwise.
    - b. Ten adjoining specimens 1-inch wide each will be cut from the trial seam sample.
    - c. These specimens will be tested in the field with a tensiometer and/or manual seam tester for both shear (5 specimens) and peel (5 specimens).
    - d. Trial seams will be tested by the Geosynthetics Installer under observation of the Owner's Representative.
    - e. The Geosynthetics Installer shall supply all necessary knowledgeable personnel and all necessary calibrated testing equipment.
    - f. Film Tear Bond (FTB) type failures will be the criterion for qualification of the trial seam. The specimens should not fail in the weld.
    - g. A passing trial seam will be achieved when the criteria presented in Table 02676-B are satisfied. The sample weld shall successfully pass the test requirements before either the welder or welding apparatus are allowed to operate on production welds.
    - h. If a trial seam fails, the entire operation will be repeated.
    - i. If the additional trial seam fails, the seaming apparatus or welding technician will not be accepted and will not be used for seaming until the deficiencies are corrected and two consecutive successful full trial seams are achieved.
    - j. Trial seam failure is defined as failure of any one of the specimens tested in shear or peel.
  6. The Owner's Representative will approve all trial seam procedures and results.
  7. The following shall be logged in the Geomembrane Trial Seam Log by the Owner's Representative: date, hour, ambient temperature, number of seaming unit, name of seamer, and pass or fail description.
- D. Nondestructive Testing**
1. Non-destructive testing shall follow the manufacturer's installation guidelines.
- E. Destructive Testing**
1. No third party laboratory destructive tests are required.



### 3.5 Protection of Work

- A. Protect installed geomembrane according to geomembrane manufacturer's instructions. Repair or replace areas of geomembrane damaged by scuffing, punctures, traffic, rough subgrade, or other unacceptable conditions.
- B. No support equipment, tools, or personnel that can readily cause damage to the PE-R geomembrane shall be allowed on the geomembrane during and after installation unless approved by the Engineer. Personnel working on the geomembrane shall not smoke, wear damaging shoes, bring glass of any kind onto geomembrane, dispose of trash or other debris, or engage in any activity that could damage the geomembrane.
- C. The passage of construction equipment over any exposed PE-R geomembrane surface is strictly prohibited.
- D. Between construction of partial sections of the geomembrane, leading edges of the geomembrane may be exposed or buried for extended periods of time prior to their joining to adjacent, subsequent geomembrane sections. The combined action of abrasive soil and equipment impact stresses may "etch" unprotected geomembrane surfaces sufficiently to affect seam strengths. Therefore, it is necessary to protect leading edges in high activity areas with sacrificial layers of geotextile and PE-R sheet until they are ready for final seaming. As a minimum, each leading edge to be seamed that must be buried or which must be exposed for periods of one month or longer shall be continuously covered by a layer of PE-R sheet. The geotextile shall be nonwoven and have a minimum weight of 8 oz per square yard. The sacrificial PE-R sheet shall have a minimum thickness equal to that of the geomembrane to be protected. Both protective layers shall have a minimum width of 2 feet. The protective cover sheets shall be either covered with soil or weighted with sand bags to prevent displacement by wind. The edge of the sheet to be protected shall be approximately centered beneath the overlying protective layers prior to burial or weighing with sandbags. Leading edges located in areas expected to receive direct traffic from construction equipment shall be buried under a minimum thickness of one foot of buffer soil.
- E. Fuel and Oil Spill Clean-Up
  1. All spills or leaks of fuels and oils from equipment and vehicles on the surface of the geomembrane shall be thoroughly cleaned with soap and water, or, at the discretion of the Engineer, the affected geomembrane shall be cut, removed and replaced with new geomembrane material.
  2. Subgrade materials contaminated with fuel or oil shall be excavated and replaced to the extent designated by the Owner.
  3. Contaminated material shall be properly disposed of off-site by the Contractor at no expense to the Owner.
- F. Any damage to the geomembrane shall be reported to the Engineer, and repaired by the Geosynthetic Contractor at no expense to the Owner.

**END OF SECTION**



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**August 2019, Rev. July 2020**

Reference: **Technical Specification 02679 – LLDPE Structured Geomembrane**  
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## Section 02679

### Textured Linear Low Density Polyethylene (LLDPE) Structured Geomembrane with Integral Drainage Layer

#### 1.0 General

##### 1.1 Summary

**A.** Section Includes:

1. Textured LLDPE structured geomembrane with integral drainage layer for the cover system at the downdrains and haul road ditches.

**B.** Related Sections:

1. Section 02320 - Backfill - Structural.
2. Section 02672 – LLDPE Geomembrane
3. Section 02675 – Geocomposite Drainage Layer
4. Section 02680 – ClosureTurf®

##### 1.2 Unit Price – Measurement

**A.** Textured LLDPE structured geomembrane with integral drainage layer:

1. Basis of Measurement: By square foot of geomembrane installed, in-place, excluding scrap and overlap.
  - a. Includes furnishing geomembrane, storage, installation, labor, supervision, transportation, equipment, and incidental items as required to complete the geomembrane installation to temporary or permanent termination limits, as specified on Drawings and in accordance with CQC Plan.
  - b. Measurement will be made based on the total two-dimensional (plan view) surface area in square feet based on as-built conditions. No allowance will be made for geomembrane in anchor and drainage trenches or waste, overlap, repairs, or materials used for the convenience of the Contractor. Pay limits shall be measured to the lower inside corner of exterior anchor trenches and/or to tie-in seams.

##### 1.3 References

- A. Construction Quality Control (CQC) Plan
- B. American Society for Testing and Materials (ASTM) standards:



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1. ASTM D792 Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
  2. ASTM D1004 Standard Test Method of Initial Tear Resistance of Plastic Film and Sheeting.
  3. ASTM D1204 Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.
  4. ASTM D1505 Standard Test Method for Density of Plastics by the Density-Gradient Technique.
  5. ASTM D1603 Standard Test Method for Carbon Black in Olefin Plastics.
  6. ASTM D3895 Test Method for Oxidative Induction Time of Polyolefins by Differential Scanning Calorimetry.
  7. ASTM 4218 Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.
  8. ASTM D4716, Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
  9. ASTM D4759 Standard Practice for Determining the Specification Conformance of Geosynthetics.
  10. ASTM D4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
  11. ASTM D5199 Standard Test Method for Measuring Nominal Thickness of Geosynthetics.
  12. ASTM D5321 Standard Test Method for Determining the Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear.
  13. ASTM D5397, Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test.
  14. ASTM D5596 Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.
  15. ASTM D5641 Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.
  16. ASTM D5721 Standard Practice for Air-Oven Aging of Polyolefin Geomembranes.
  17. ASTM D5885 Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry.
  18. ASTM D5994 Standard Test Method for Measuring the Core Thickness of Textured Geomembranes.
  19. ASTM D6392 Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
  20. ASTM D6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes.
  21. ASTM D7238 Standard Test Method for Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent UV Condensation Apparatus.
  22. ASTM D7466 Standard Test Method for Measuring the Asperity Height of Textured Geomembrane.
- C. Geosynthetic Research Institute (GRI) Standards:





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1. GM6 Pressurized Air Channel Test for Dual Seamed Geomembranes.
2. GM10 Specification for the Stress Crack Resistance of Geomembrane Sheet.
3. GM12 Measurement of the Asperity Height of Textured Geomembrane Using a Depth Gage.
4. GM17 Test Properties, Testing Frequency and Recommended Warranty for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembrane.
5. GM19 Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes.

## 1.4 Submittals

- A. The Geosynthetic Installer shall submit proposed geomembrane panel layout, including anchor trenches and connections to any inlet/outlet structures, to the Engineer at least 14 days prior to mobilization of crews. Once the panel layout is approved, the Geosynthetic Installer may not change the layout without permission of the Engineer.
- B. Manufacturer's Product Information
  1. At least five (5) working days prior to shipment, the Geosynthetic Installer shall furnish the Engineer with pre-shipping product data sheets and test data for each geomembrane type. At a minimum, the Manufacturer will perform the tests at the frequencies given in Table 02679-A found in this Section on the LLDPE structured sheet prior to shipping LLDPE material to the site. These tests shall conform to the standards set in Table 02679-B, also found in this Section. The information supplied shall be in the form of a factory quality control certificate for each geomembrane roll and shall include the following:
    - a. Roll and lot numbers and identification.
    - b. Length and width of each roll.
    - c. Date each roll was manufactured.
    - d. Sampling procedures.
    - e. Results of quality control tests that are to include those presented in Table 02679-A found in this Section and description of test methods used. The results of these tests must meet the minimum required physical properties for LLDPE geomembrane specified in Table 02679-B found in this Section.
- C. A written certificate from the geomembrane manufacturer stating that the resin and geomembrane materials supplied are in compliance with this Section 02679.
- D. Manufacturer's Installation Instructions: Submit special procedures for geomembrane installation.
- E. The Geosynthetics Installer shall adopt and use the quality assurance forms prepared by the Owner's Representative, or other forms approved by the Owner's Representative, during all applicable phases of geomembrane installation, inspection and testing. The Geosynthetics Installer can request to use his forms. The forms must be submitted to the Owner's Representative at least two weeks prior to geomembrane installation for review and approval.



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- F. A resume of the proposed Superintendent of the Geosynthetics Installer must be submitted to the Engineer for final approval two weeks prior to geomembrane installation.
- G. The Contractor is responsible for his own Health and Safety Plan, but must abide by any safety procedures dictated by the Owner.

## 1.5 Closeout Submittals

- A. Forms by the CQAO:
  - 1. Owner's Representative Daily Field Report
  - 2. Field Inventory Control, Storage Inspection, and Cross-Reference Roll Numbers
  - 3. Subgrade Certification
  - 4. Geomembrane Trial Seam Log
  - 5. Geomembrane Deployment Report
  - 6. Geomembrane Seam Log
  - 7. Geomembrane Defect Log
  - 8. Geomembrane Repair Testing Log
  - 9. Geomembrane Laboratory Destructive Test Results
- B. The Contractor is responsible for providing an as-built drawing of the geomembrane installation. The as-built drawing shall include panel corners, transitions in panel geometry, repair locations, the inside bottom corner of the anchor trench, and other significant features.
- C. The Geosynthetics Installer's supervisor shall observe and check all phases of the geomembrane installation. When the geomembrane is accepted by the Owner, the Geosynthetics Installer shall submit a Letter of Acceptance to the Owner that the installation conforms to the requirements of the Manufacturer.

## 1.6 Quality Assurance

- A. Perform Work in accordance with these Specifications and the CQC Plan.
- B. The Manufacturer shall sample and test the LLDPE geomembrane material, at minimum frequencies specified in Table 02679-A. General manufacturing procedures shall be performed in accordance with the Manufacturer's internal quality control guide and/or documents.
- C. All geomembrane sheets shall be continuously spark tested during manufacturing.
  - 1. The spark tester shall be capable of detecting defects or pinholes less than 10 mils in diameter.
  - 2. All necessary repairs to the geomembrane shall be made by the manufacturer at the factory before shipment.



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3. The manufacturer shall provide written certification to the Owner and/or Engineer that all the geomembrane rolls delivered to the project were continuously spark tested and do not contain pinhole defects.
- D. Conformance Testing:
  1. Conformance testing shall be performed by an independent laboratory at a frequency of at least 1 per 100,000 square feet of geomembrane manufactured for this project. Conformance testing shall consist of the following tests:
    - a. Thickness (ASTM D5199 and/or ASTM D5994).
    - b. Density (ASTM D1505 and/or ASTM D792).
    - c. Drainage Stud Height (ASTM D7466)
    - d. Friction Spike Height (ASTM D7466)
    - e. Carbon black content (ASTM D1603).
    - f. Tensile properties including break strength and break elongation (ASTM D6693).
    - g. Tear resistance (ASTM D1004)
    - h. Puncture Resistance (ASTM D4833)
    - i. Other tests as required by Engineer.
  2. Sampling for conformance testing shall be performed at the manufacturing facility whenever possible, and in accordance with the CQC Plan.
- E. The Engineer shall examine the rolls upon delivery to the site and report any deviations from these Specifications to the Contractor.
- F. If a geomembrane sample fails to meet the quality control requirements of this Section, the Contractor and/or Engineer shall require that the Geomembrane Manufacturer sample and test each roll manufactured in the same lot or batch, or at the same time, as the failing roll. Additional sampling and testing shall be completed at no additional cost to the Owner. Sampling and testing of rolls shall continue until a pattern of acceptable test results is established.
- G. Any geomembrane sample that does not comply with this Section shall result in rejection of the roll from which the sample was obtained. The Contractor shall replace any rejected rolls at no additional cost to Owner. At the Geomembrane Manufacturer's discretion and expense, additional testing of individual rolls may be performed to more closely identify noncomplying rolls and to qualify individual rolls.

## 1.7 Qualifications

- A. Geosynthetic Contractor Equipment and Personnel
  1. Quality Control Foreman (QCF)



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- a. The Geosynthetics Installer shall provide an individual whose title is "Quality Control Foreman" (QCF) who shall be experienced in all phases of quality control testing and procedures.
  - b. The QCF will be dedicated to performing or directing the Geosynthetics Installer's quality control activities, (i.e. air pressure, vacuum box and spark non-destructive testing and field destructive testing).
  - c. The QCF and the Superintendent may be the same person if approved by the Engineer.
2. Equipment
- a. Geosynthetic Contractor shall supply and maintain at least three extrusion welders and three double hot wedge fusion welders, at least one of which must be available at the working space at all times.
  - b. At least one extra generator shall be supplied and maintained by the Geosynthetic Contractor to be used as a spare.

## 2.0 Products

### 2.1 Linear Low Density Polyethylene (LLDPE) Geomembrane

**A.** Materials:

1. Geomembrane shall be made of unreinforced linear low density polyethylene (LLDPE) that has a nominal thickness as noted on the Drawings designed and manufactured specifically for the purpose of liquid containment.
2. The geomembrane used shall meet, at a minimum, the standards specified in Table 02679-B found in this Section.
3. The chemical resistance of the geomembrane shall be in keeping with typical properties of high quality polyethylene products currently available through commercial sources.
4. Up to 5 percent (by weight) clean, uncontaminated regrind material (that is, material that has been previously processed by the same manufacturer, but has never seen previous service) shall be allowed in the Geomembrane sheet if approved by the Engineer.
5. Regrind material made of the same resin as the geomembrane from sheet failing the physical properties of the geomembrane or resin as specified herein shall not be allowed under any circumstances.
6. Edge trim and sheet failed for thickness or cosmetic reasons may be considered for regrind.
7. LLDPE geomembrane shall be supplied in rolled sheets having a minimum width of 22 feet and a minimum length of 190 feet. Variances for shorter roll lengths may be allowed at the discretion of the Engineer.



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**Table 02679-A**  
**Required Pre-Shipping Sheet Testing of Geomembrane Liner**

Property	Test Method	Frequency
<b>Thickness</b>	ASTM D5994	Each Roll
<b>Drainage Stud Height</b>	ASTM D7466 or GRI GM 12	Every 2 <sup>nd</sup> roll (1)
<b>Density</b>	ASTM D1505 ASTM D792	Every 200,000 lb.
<b>Tensile Properties (2)</b> ♦ Break Strength ♦ Break Elongation	ASTM D6693 TYPE IV	Every 20,000 lb.
<b>2% Modulus</b>	ASTM D5323	Per each formulation
<b>Tear Resistance</b>	ASTM D1004	Every 45,000 lb.
<b>Puncture Resistance</b>	ASTM D4833	Every 45,000 lb.
<b>Axi-Symmetric Break Resistance Strain (min.)</b>	ASTM D5617	Per each formulation
<b>Carbon Black Content</b>	ASTM 4218 (3)	Every 45,000 lb
<b>Carbon Black Dispersion</b>	ASTM D5596	Every 45,000 lb.
<b>Oxidative Induction Time (OIT) (4)</b>		Every 200,000 lb.
<b>a.</b> Standard OIT (min. ave.) OR	ASTM D3895	
<b>b.</b> High Pressure OIT (min. ave.)	ASTM D5885	
<b>Oven Aging at 85°C</b>	ASTM D5721	Per each formulation
<b>c.</b> Standard OIT (min. ave.) - % retained after 90 days OR	ASTM D3895	
<b>d.</b> High Pressures OIT (min. ave.) - % retained after 90 days	ASTM D5885	
<b>UV Resistance (5)</b>	ASTM D7238	
<b>b.</b> High Pressure OIT (min. ave.) - % retained after 1600 hrs	ASTM D5885	Per each formulation

- (1) Alternate the measurement side for double sided textured sheet.
- (2) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
- (2) Break elongation is calculated using a gage length of 2.0 inches.
- (3) Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 (muffle furnace) can be established.
- (4) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
- (5) The condition of the test should be 20 hr. UV cycle at 75 °C followed by 4 hr. condensation at 60°C. UV resistance is based on percent retained value regardless of the original value.



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Table 02679-B  
Required Physical Properties of LLDPE Geomembrane

Property	Test Method	Required Value
<b>Liner Thickness (Normal)</b>		50 mil
<b>Thickness (min. ave.)</b> ♦ lowest individual for 8 out of 10 values ♦ lowest individual of 10 values	ASTM D5994	47.5 mils 45 mils 42.5 mils
<b>Drainage Stud Height mils (min. ave.)</b>	ASTM D7466	130 mils
<b>Friction Spike Height mils (min. ave.)</b>	ASTM D7466	175 mils
<b>Density (min.)</b>	ASTM D792 (B)	0.939 g/cc
<b>Tensile Properties (min. ave.)</b> ♦ Break Strength ♦ Break Elongation	ASTM D6693, Type IV	105 lb./in. 300%
<b>2 % Modulus (max.)</b>	ASTM D5323	3,000 lb./in.
<b>Tear Resistance (min. ave.)</b>	ASTM D1004	30 lb.
<b>Puncture Resistance (min. ave.)</b>	ASTM D4833	55 lb.
<b>Axi-Symmetric Break Resistance Strain</b>	ASTM D5617	30%
<b>Carbon Black Content (range)</b>	ASTM D4218	2.0 – 3.0%
<b>Carbon Black Dispersion</b>	ASTM D5596	10 in Categories 1 or 2
<b>Oxidative Induction Time (OIT) (4)</b>		
<b>a.</b> Standard OIT (min. ave.) OR	ASTM D3895	100 minutes
<b>b.</b> High Pressure OIT (min. ave.)	ASTM D5885	400 minutes
<b>Oven Aging at 85°C</b>	ASTM D5721	
<b>a.</b> Standard OIT (min. ave.) - % retained after 90 days Or	ASTM D3895	35%
<b>b.</b> High Pressures OIT (min. ave.) - % retained after 90 days	ASTM D5885	60%
<b>UV Resistance</b>	ASTM D7238	
<b>a.</b> High Pressure OIT (min. ave.) - % retained after 1600 hrs	ASTM D5885	35%
<b>Transmissivity<sup>(1)</sup></b>	ASTM D4716	8.60x10 <sup>-4</sup> m <sup>3</sup> /m/sec
<b>Seam Strengths <sup>(2)(3)</sup></b>		
<b>1.</b> Shear Strength Hot Wedge Seam Extrusion Fillet Seam	ASTM D6392	100 lb/in (min.) 100 lb/in (min.)
<b>2.</b> Peel Strength Hot Wedge Seam Extrusion Fillet Seam	ASTM D6392	76 lb/in (min.) 65 lb/in (min.)
<b>3.</b> Peel Separation Hot Wedge Seam Extrusion Fillet Seam	ASTM D6392	25% 25%
<b>Non-Destructive Testing</b>		



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<p>1. Extrusion Fillet Seam (Single Weld)</p>	<p>Continuous Vacuum Box</p>	<p>Maintain vacuum of at least 5 psi for at least 15 seconds</p>
<p>2. Hot Wedge Seam (Double Weld)</p> <p><b>*See notes for Table 02679-B on following page</b></p>	<p>Air Testing</p>	<p>Maintain 30 psi for at least 5 minutes, with a drop in pressure not greater than 3 psi</p>

Notes:

- (1) Manufacturer to provide historical testing to indicate value can be achieved, no project specific conformance testing is required.
- (2) Value listed for shear and peel strengths are for 4 out of 5 test specimens; the 5<sup>th</sup> specimen can be as low as 80% of the listed values.
- (3) Values listed are for welding 50 mil geomembrane to 50 mil geomembrane. When welding 50 mil to 40 mil, the 40 mil seam strength requirements (Technical Specification 02672) shall be referenced for pass/fail results.

### 3.0 Execution

The Geosynthetics Installer shall furnish all labor, materials, supervision and equipment to complete the Geomembrane Liner for the project including, but not limited to, geomembrane layout, seaming, patching, and all necessary and incidental items required to complete the work, in accordance with the Drawings and these Specifications.

#### 3.1 Delivery, Storage and Handling

- A. Geomembrane liner shall be shipped:
  1. Rolled and labeled with roll number and manufacturer's batch number.
  2. Manufacturer's quality control documentation shall be included with each roll.
- B. Transport and handle geomembrane with equipment designed to protect geomembrane from damage. The Contractor shall be responsible for unloading and storage of geomembrane in a manner that prevents damage to the geomembrane.
- C. On-site storage shall be as needed to protect the geomembrane rolls from excessive accumulations of soil on the geomembrane surfaces, water, heat, mechanical abrasion, puncture and vehicular traffic.
- D. The geomembrane rolls shall not be stacked more than three rolls high, or as otherwise recommended by the Manufacturer.



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### 3.2 Daily Pre-Installation Meetings

- A. At the beginning of each work day the Earthwork Contractor's Superintendent, the Geosynthetic Contractor's Superintendent, and the Owner's Representative will meet to discuss the upcoming work plan for all parties to promote cooperation, communication and understanding. Care shall be taken to provide as much notice as possible when scheduling geomembrane as-built survey. Operations shall be planned and implemented so as not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

### 3.3 Preparation

- A. The geomembrane is to cover the landfill interim cover or waste in accordance with the Drawings
- B. Ensure acceptance of underlying layers before installing overlying layers.
- C. Prepare ballast loading that shall be used for anchoring down the geomembrane during installation.
  - 1. Ballast loading may consist of sand bags or Portland cement bags.
  - 2. Bags used for containing sand or cement shall be resistant to degradation by ultraviolet rays and by the weather in general.
- D. Surface Water Control and Base Maintenance
  - 1. The base shall be maintained well-drained and dry prior to and during geomembrane installation.
  - 2. The Geosynthetics Installer shall be responsible for surface water control during geomembrane installation as needed to maintain all work areas well-drained and dry during construction, preclude ponding, and prevent uplift of the geomembrane after installation.
  - 3. The Geosynthetics Installer's proposed dewatering method(s) shall be submitted to the Owner's Representative at least one week prior to implementation.

### 3.4 Installation

Installation of the geomembrane shall be in compliance with this Specification and with the Manufacturer's standard guidelines and specifications for geomembrane installation, subject to approval by the Owner's Representative, including, but not limited to: (i) handling and site storage requirements; (ii) unrolling and laying of geomembrane sheets; (iii) field seaming or welding techniques; and (iv) anchor trench and ballast details.

- A. Liner Handling and Placement





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1. Appropriate handling equipment shall be used when loading or moving rolled geomembrane sheets from one place to another. Appropriate equipment includes spreader and roll bars for deployment, and cloth chokers with a spreader bar for off-loading.
2. Do not use materials damaged during storage or handling. If the geomembrane is not packaged and a roll is damaged during shipment, it shall be rejected. If only the outermost surface of the roll is affected, it shall be peeled back, cut, and wasted (i.e., it shall be treated as if it were the protective packaging for the remainder of the roll).
3. The geomembrane shall be installed at the locations and to the lines, grades and dimensions shown on the Drawings, or as otherwise directed by the Engineer.
4. Liner deployment shall not be performed when precipitation is occurring, when excessive moisture or wet conditions exist, or when high winds or other adverse climatologic conditions exist.
5. The geomembrane sheets shall be unrolled and deployed in a manner which minimizes wrinkles and prevents the occurrence of folds and creases.
6. Unroll only those sections that are to be seamed together in one day.
7. Adjoining geomembrane panels shall be overlapped as recommended by the manufacturer, but not less than 4 inches, by adequately lapping the edges of the sheets. The overlap shall not exceed 6 inches for double-wedge fusion welds.
8. For stormwater drainage purposes, the upstream panel should be overlapped on top of the downstream panel to form a shingle effect.
9. Panel layout and deployment shall be such that the seams run down the slopes and are oriented perpendicular to the top of slope. The seam orientation shall be maintained for a distance of 10 feet from the toe of slope or as shown on the Drawings.
10. Cross seams will be allowed on slopes provided that the cross seams are cut at 45 degrees and adjacent cross seams are staggered. Cross seams must be kept to the lower half of the slope and only one cross seam is allowed per panel slope length.
11. Unroll several panels and allow the geomembrane to "relax" before beginning field seaming. The purpose of this is to make the edges that are to be bonded as smooth and free of wrinkles as possible.
12. In corners and odd shaped geometric locations, the number of field seams should be minimized.
13. After panels are initially in place, remove wrinkles as directed by the Engineer.
14. All geomembrane sheets shall have good appearance qualities. The surface of smooth geomembrane shall be smooth with no visible defects. Texturing on the surface of the textured sheets shall be uniform and homogeneously distributed. The geomembrane shall be free of pinholes, holes, blisters, gels, undispersed ingredients, any signs of contamination by foreign matter, or any defect that may affect serviceability. The edges of geomembrane sheets shall be straight and free from nicks and cuts.
15. Once panels are in place and smooth, commence field seaming operations.

**B. Field Seaming**



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1. Field seaming shall be in accordance with U.S. E.P.A. Technical Guidance document: "The Fabrication of Polyethylene FML Field Seams" EPA/530/SW-89/069 and/or according to this Section 02679.
2. Field seaming shall be conducted in the dry, on a compacted smooth surface. Surfaces to receive geomembrane installation should be relatively smooth and even, and free of voids, protrusions, and deleterious material.
3. All geomembrane sheets must be continuously and tightly bonded using continuous extrusion fillet welds or double wedge fusion welds and automated welding equipment approved by the Engineer. The Engineer reserves the right to reject any proposed seaming method it believes unacceptable. Double hot wedge fusion welding shall be the predominant seaming method. Additional concepts and requirements of proper field seaming include the following:
  - a. All geomembrane shall be seamed the same day that the geomembrane is deployed.
  - b. All geomembrane shall be ballasted immediately after deployment to prevent uplift by winds.
  - c. A moveable protective layer of plastic or approved material may be placed directly below each overlap of geomembrane that is to be seamed. This is to prevent any moisture build-up between the sheets to be welded. The protective layer must be removed after welding.
  - d. All foreign matter (dirt, moisture, oil, etc.) shall be removed from the edges to be bonded. For extrusion welds, the bonding surfaces must be thoroughly cleaned by mechanical abrasion or alternate methods approved by the Engineer to remove surface cure and prepare the surfaces for bonding. No solvents shall be used to clean the geomembrane.
  - e. Grinding:
    - (1) All abrasive buffing shall be performed using No. 80 grit or finer sandpaper.
    - (2) The grinding shall be performed so that any and all grind marks are perpendicular to the edge of sheet.
    - (3) No grinding greater than 1/4 inch outside the welds is permitted or the Engineer can require patching.
  - f. As much as practical, field seaming shall start from the top of the slope down. This will minimize large wrinkles from becoming trapped that require cutting and patching.
  - g. Seaming of the bottom geomembrane to the sidewall geomembrane (toe seam) shall be conducted when conditions minimize thermal expansion effects.
  - h. Tack welds (if used) shall use heat only; no double sided tape, glue or other method will be permitted.
  - i. The geomembrane should be seamed completely to the ends of all panels to minimize the potential of tear propagation along the seam.



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- j. Seaming will extend to the outside edge of panels to be placed in anchor trenches. If required, a firm substrata should be provided by using a flat board, or similar hard surface directly under the seam overlap to achieve proper support across the anchor trench.
- k. The completed geomembrane shall not exhibit any "trampolining" during late morning to early evening hours. All areas exhibiting trampolining must be repaired as directed by the Engineer. Additional slack (i.e.: 1-3%) shall be allowed on the side slopes to reduce the potential for trampolining.
- l. All field seams must be uniform in appearance, width and properties, and shall not exhibit warping due to overheating from welding.
- m. The peel and shear strengths of the welded seams must comply with the strength criteria stated in Table 02679-B of this Section.
- n. Ambient Weather Conditions:
  - (1) Ambient temperature is measured 18 inches above the geomembrane surface.
  - (2) The Geosynthetics Installer shall supply instrumentation for measurement of ambient temperature.
  - (3) Welding of field seams shall not take place except during suitable ambient weather conditions, as confirmed by field trial welds.
  - (4) No seaming should be attempted above 40°C (104°F) ambient air temperature
  - (5) Below 5°C (41°F) ambient air temperature, preheating of the geomembrane will be required, unless it is demonstrated that this is not necessary (i.e., acceptable test (start-up) seams that duplicate, as closely as possible, actual field conditions can be achieved). Preheating may be achieved by natural and/or artificial means (shelters and heating devices).
- o. Seams at the panel corners of 3 or 4 sheets shall be completed with a circular patch approximately 12 inches in diameter, extrusion welded to the parent sheets, or with a "T" weld at suitable locations.

**C.** Pipe Penetrations

- 1. Pipe penetrations in the geomembrane shall be sealed using polyethylene pipe boots (sleeves and skirts), gaskets, banding straps, or other material as shown on the Drawings.
- 2. Surfaces where pipe boots are to be attached (including pipe) shall be cleaned to remove dirt, oil, debris, or other deleterious materials.
- 3. Prior to attaching and/or seaming pipe boots, the Owner's Representative shall visually inspect all prepared surface to verify that the proper preparation techniques have been followed.

**D.** Temporary Ballast Loading



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1. Adequate temporary ballast loading that will not damage the geomembrane shall be placed by the Geosynthetics Installer over the geomembrane during installation as needed to prevent uplift by wind and by rapid changes in barometric pressure.
2. Temporary ballast loading shall be in addition to the anchor trenches.
3. If high winds are expected, boards along the edge of unseamed panels, with weighted sandbags on top, may be used to anchor the geomembrane on the subgrade.
4. Staples, U-shaped rods or other penetrating anchors shall not be used to secure the geomembrane on the side slopes, on the floor or anywhere else in the construction area.
5. Any damage to the geomembrane including damage due to construction activities or wind, rain, hail, or other weather shall be the sole responsibility of the Geosynthetic Contractor.
6. All temporary ballast loading shall be removed by the Geosynthetics Installer prior to demobilizing from the site unless otherwise approved by the Owner.

### 3.5 Field Quality Control

- A. The Geosynthetics Installer shall adopt and use the quality assurance forms prepared by the Owner's Representative, or other forms approved by the Owner's Representative, during all applicable phases of geomembrane installation, inspection and testing. The Geosynthetics Installer can request to use his forms. The forms must be submitted to the Owner's Representative at least two weeks prior to geomembrane installation for review and approval.
- B. All aspects of the geomembrane installation will be inspected on a full-time basis by the Owner's Representative.
  1. The Owner's Representative will conduct his own observations and perform quality control tests in addition to those performed by the Geosynthetics Installer.
  2. Testing of the seams and repairs will be conducted by the Geosynthetics Installer under observation by the Owner's Representative.
  3. The Owner's Representative or a designated, independent geosynthetics laboratory may perform additional testing, as required by these detailed Specifications or as required in the judgment of the Engineer to verify that the LLDPE sheet and seams meet these Specifications.
  4. Quality control by the Engineer will include monitoring:
    - a. Liner handling and panel deployment
    - b. Field seaming or welding of geomembrane sheets and non-destructive testing of field seams or welds
    - c. Placement and maintenance of temporary ballast loading
- C. Trial Seams
  1. The Installer shall maintain and use equipment and personnel at the site to perform testing of trial seams.
  2. Frequency:



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- a. Trial seams will be made in the morning and afternoon, after any interruption in power, after any prolonged idle period during the day, when changes in storing equipment occur, and at the request of the Engineer at any other time during the day.
  3. Each seamer/welder shall prepare a test strip using the welding apparatus assigned to him.
  4. Trial seams will be made on fragment pieces of geomembrane to verify that seaming conditions are adequate. A trial seam shall be made for each texture contact type to be seamed by that welder during the working increment.
  5. Requirements for trial seams are as follows:
    - a. The trial seam sample will be at least 5 feet long by 1 foot wide with the seam centered lengthwise.
    - b. Ten adjoining specimens 1-inch wide each will be cut from the trial seam sample.
    - c. These specimens will be tested in the field with a tensiometer and/or manual seam tester for both shear (5 specimens) and peel (5 specimens).
    - d. For dual wedge, both inside and outside welds shall be tested in peel.
    - e. Trial seams will be tested by the Geosynthetics Installer under observation of the Owner's Representative.
    - f. The Geosynthetics Installer shall supply all necessary knowledgeable personnel and all necessary calibrated testing equipment.
    - g. Film Tear Bond (FTB) type failures will be the criterion for qualification of the trial seam. The specimens should not fail in the weld.
    - h. A passing trial seam will be achieved when the criteria presented in Table 02679-B are satisfied. The sample weld shall successfully pass the test requirements before either the welder or welding apparatus are allowed to operate on production welds.
    - i. If a trial seam fails, the entire operation will be repeated.
    - j. If the additional trial seam fails, the seaming apparatus or welding technician will not be accepted and will not be used for seaming until the deficiencies are corrected and two consecutive successful full trial seams are achieved.
    - k. Trial seam failure is defined as failure of any one of the specimens tested in shear or peel.
  6. The Owner's Representative will approve all trial seam procedures and results.
  7. The following shall be logged in the Geomembrane Trial Seam Log by the Owner's Representative: date, hour, ambient temperature, number of seaming unit, name of seamer, and pass or fail description.
- D. Nondestructive Testing**



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1. The Geosynthetics Installer shall continuously test every field weld (i.e., 100 percent of the length of all field seams), including field welds around patches, using non-destructive testing techniques. These tests shall be performed in the presence of the Engineer.
2. Single Weld Seams (extrusion welds):
  - a. The Geosynthetics Installer shall maintain and use equipment and personnel at the site to perform continuous vacuum box testing in general accordance with ASTM D5641 under the observation of the Engineer on all single weld production seams except those corner seams where vacuum box testing is impossible.
  - b. The system shall be capable of applying a vacuum of at least 5 psi.
  - c. The vacuum shall be held for a minimum of 15 seconds for each section of seam.
  - d. Once the soap solution is uniformly placed over the weld and suction applied to the seam any bubble formation must be noted and the corresponding defective area identified, marked, and subsequently repaired.
  - e. Where vacuum box testing is not possible, spark testing or an approved alternative by the Engineer will be used.
3. Double-Wedge Fusion Weld Seams:
  - a. The Geosynthetic Contractor shall maintain and use equipment and personnel to perform air pressure testing under the observation of the Engineer of all double-wedge fusion weld seams with a continuous air gap between the two welds and which are greater than 20 ft.
  - b. Double-wedge fusion weld seams less than 20 ft. may be vacuum box tested.
  - c. Pressure Loss Test:
    - (1) Pressure loss tests shall be conducted in accordance with the procedures outlined in "Pressurized Air Channel Test for Dual Seamed Geomembranes," Geosynthetic Research Institute Test Method GM-6.
    - (2) The system shall be capable of applying a pressure of between 25 psi and 30 psi for not less than 5 minutes.
    - (3) Following a 2 minute pressurized stabilization period, pressure losses over a measurement period of 5 minutes shall not exceed 3 psi.
    - (4) After the 5 minute testing period, the opposite end of the seam shall be cut open and pressure loss monitored to verify the entire length of the seam channel is open. If no pressure loss is realized, the location of the blocked channel must be found and the remainder of the seam tested separately.
    - (5) If a non-compliant drop of pressure is noted, pressure testing may be repeated in a step fashion each time halving the length of weld being tested until the extent of the defective weld is determined.
    - (6) Vacuum box testing (ASTM D5641) may also be used to locate a defective area in the top weld or in the top of the air channel.
    - (7) The air pressure test results shall be documented on all applicable CQA forms.



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- d. The length of welded section tested by air pressure shall not exceed 500 feet, without prior approval by the Owner's Representative.
- e. Once the defect is found, it shall be clearly identified, marked, and repaired. Any defect shall be repaired so that it meets or exceeds the minimum requirements of this Section.
- f. Double weld seams will also be visually inspected on 100% of the seam. If necessary the outside flap can be pulled back to aid in the visual observation.

**E. Destructive Testing**

- 1. Laboratory Destructive Testing (LDT) is defined as 12"W X 39"L (of seam) samples placed at an average rate of one LDT location per 500 feet of seam for both extrusion and double welded seams.

- a. Laboratory Destructive Testing (LDT)

- (1) Sampling:

- (a) LDT will be performed on an average of every 500 linear feet of production seam. The locations will be selected by the Engineer.
    - (b) Samples will be 12" X 39" in order to provide one sample to the archive, one sample to the Owner's Representative for laboratory testing, and one sample to be retained by the Geosynthetics Installer for possible field and/or additional laboratory testing at the option of the Engineer or Geosynthetics Installer.
    - (c) The name of the sample (e.g. LDT-1), date, time, equipment, seam number, and seaming parameters will be marked on each sample and recorded by the Engineer in the Geomembrane Defect Log.

- (2) Testing:

- (a) Tests shall be conducted using a calibrated tensiometer and must meet the qualitative and quantitative criteria outlined criteria listed in Tables 02679-B found in this Section.
    - (b) The peel strength criteria shall apply to both the top and bottom welds of double wedge fusion welds.
    - (c) Testing requirements are as follows:
      - (i) Each sample shall be large enough to test five specimens in peel and five specimens in shear.
      - (ii) The average values of each set of five specimens must meet the specification, and four of the five specimen tests must meet the specifications for the seam as specified in Tables 02679-B to be considered a passing seam.



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- (iii) If the average of the five specimens is adequate, but one of the specimens is failing, values for the failing specimen must be at least 80 percent of the values required for the seam for the sample to pass.
  - (iv) All samples must fail in film tear bond (FTB) and/or the geomembrane must fail before the weld.
- (d) Failing Tests:
- (i) Samples which do not pass the shear and peel tests will be re-sampled from locations at least 10 feet on each side of the original location.
  - (ii) These two re-test samples must pass both shear and peel testing.
  - (iii) If these two samples do not pass, then additional samples will continue to be obtained until two consecutive samples on each side of the original sample pass the field seam criteria and the questionable seam area is defined.
  - (iv) At that point, the extent of the original defect in both directions along the field seam will be considered isolated and the Geosynthetics Installer may then:
    - a.) Either cap, re-weld and re-test the seam up to and including the closest of the two passing samples, and patch and weld the hole of the furthest passing sample; or
    - b.) Cap, re-weld and re-test the entire length of sampling.
    - c.) If approved by the Owner's Representative, double-wedge fusion welds may be repaired by extrusion welding the flap of the top sheet to the bottom sheet if the seam non-compliance is due to a non-FTB failure of the destructive test sample.
    - d.) If the length of the questionable seam area is defined to be excessive by the Engineer, a cap patch may be required over the entire seam with nondestructive testing prior to acceptance of the seam.
2. Each sample area will be clearly marked both on the geomembrane itself (LDT) using the procedures outlined in the marking Section.
3. All areas cut out for testing should be immediately patched by the Geosynthetics Installer and the patches should be tested and approved by the Engineer. Patches shall extend a minimum of 6 inches beyond the cut area.
4. A passing double welded seam will be achieved in peel (ASTM D6392) when:
- a. Failure is by Film Tear Bond (FTB).
  - b. Yield strength for the seam is not less than 72 percent of the minimum tensile strength at yield at as specified in Table 02679-B found in this Section; and
  - c. No greater than 25 percent of the seam width peels (separates) at any point; and
  - d. The failed sheet exhibits elongation, prior to failure.





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5. Both sides of the double welded seam must be tested and must meet all of the criteria listed above for peel.
  6. A passing double welded seam will be achieved in shear (ASTM D6392) when:
    - a. Failure is by FTB; and
    - b. Yield strength for the seam is not less than 95 percent of the minimum tensile strength at yield at as specified in Table 02679-B found in this Section.
  7. A passing extrusion welded seam will be achieved in peel (ASTM D6392) when:
    - c. Failure is by FTB; and
    - d. Yield strength for the seam is not less than 62 percent of the minimum tensile strength at yield at as specified in Table 02679-B; and
    - e. No greater than 25% separation occurs from the edge of the sheet at any point; and
    - f. The failed sheet exhibits ductility prior to failure.
  8. A passing extrusion welded seam will be achieved in shear (ASTM D6392 modified) when:
    - a. Failure is by FTB; and
    - b. Yield strength for the seam is not less than 95 percent of the minimum tensile strength at yield at as specified in Table 02679-B.
- F. Repair:**
1. The Geosynthetics Installer shall visually inspect the entire geomembrane surface for any defects including, but not limited to, seam imperfections, badly scuffed areas, scratches, blisters, tears, rips, holes, pinholes, and punctures. He shall identify, mark, and repair all noted defects, as well as defects designated by the Engineer.
  2. Damaged and Sampled Area
    - a. All geomembrane defects (scratches, blisters, rips, punctures, tears, holes, pinholes, creases, folds, etc.) and holes created by removal of samples or coupons for destructive testing shall be marked and repaired.
    - b. Damaged and sample coupon areas of geomembrane shall be repaired by the Geosynthetics Installer by completely covering the defect or hole with an oval-shaped piece of the corresponding LLDPE geomembrane material, and continuously welding the patch to the geomembrane sheet using an extrusion weld construction.
      - (1) Patches shall extend a minimum of 6 inches beyond the damaged or cut area.
      - (2) No repairs shall be made to seams by application of an extrusion bead to a seam edge previously welded by fusion or extrusion methods.





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- a. Following the completion of each seam, patch or repair, the welding technician will write, at the end of the seam or in the middle of the patch or repair, the following: the initials of the technician, date welded, time welded, and welder unit number. The markings will be done clearly with a white or red permanent marking pen or pencil.
  - b. Similarly, after each quality control test, the Owner's Representative will record the following immediately adjacent to the area tested: initials of QC Technician performing the test, date of the test, type of test (i.e. VB, SP, AP for vacuum box, spark test and air pressure test respectively) and the words "pass (P)" or "fail (F)". For the air pressure test, the QC Technician must also define the limits or zone of the test as well as the amount of pressure loss observed. Again, a permanent white or red marking pen is required. If the test fails and the necessary repair is made, the technician will cross out the previous markings and mark appropriately for the new test results.
  - c. Destructive test samples will be clearly circled and marked in permanent marker with the words "LDT" as defined in the specifications. The Owner's Representative will mark the words "pass" or "fail" as appropriate. Similarly, any other area needing repair will be clearly marked in permanent marking to identify where the repair is required to be made.
  - d. The Owner's Representative will mark areas in need of repair using white marking pens (red for white surfaced geomembrane).
- H. All geomembrane sheet, seams and patches will be tested and evaluated prior to acceptance. In general, testing of the sheet will be conducted by the Geosynthetics Installer according to the standards specified in Table 02679-B found this Section. All areas failing nondestructive test procedures shall be clearly marked both on the geomembrane itself and on all applicable CQA forms.

### 3.6 Protection of Work

- A. Protect installed geomembrane according to geomembrane manufacturer's instructions. Repair or replace areas of geomembrane damaged by scuffing, punctures, traffic, rough subgrade, or other unacceptable conditions.
- B. No support equipment, tools, or personnel that can readily cause damage to the LLDPE geomembrane shall be allowed on the geomembrane during and after installation unless approved by the Engineer. Personnel working on the geomembrane shall not smoke, wear damaging shoes, bring glass of any kind onto geomembrane, dispose of trash or other debris, or engage in any activity that could damage the geomembrane.
- C. The passage of construction equipment, other than light rubber-tired equipment approved by the Engineer, over any exposed LLDPE geomembrane surface is strictly prohibited. Light rubber-tired equipment exerting a contact stress less than 5 psi will be allowed provided proper care is taken when operating the vehicle to avoid pulling, displacing or damaging the geomembrane.



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- D.** Between construction of partial sections of the geomembrane, leading edges of the geomembrane may be exposed or buried for extended periods of time prior to their joining to adjacent, subsequent geomembrane sections. The combined action of abrasive soil and equipment impact stresses may "etch" unprotected geomembrane surfaces sufficiently to affect seam strengths. Therefore, it is necessary to protect leading edges in high activity areas with sacrificial layers of geotextile and LLDPE sheet until they are ready for final seaming. As a minimum, each leading edge to be seamed that must be buried or which must be exposed for periods of one month or longer shall be continuously covered by a layer of LLDPE sheet. The geotextile shall be nonwoven and have a minimum weight of 8 oz per square yard. The sacrificial LLDPE sheet shall have a minimum thickness equal to that of the geomembrane to be protected. Both protective layers shall have a minimum width of 2 feet. The protective cover sheets shall be either covered with soil or weighted with sand bags to prevent displacement by wind. The edge of the sheet to be protected shall be approximately centered beneath the overlying protective layers prior to burial or weighing with sandbags. Leading edges located in areas expected to receive direct traffic from construction equipment shall be buried under a minimum thickness of one foot of buffer soil.
- E.** Fuel and Oil Spill Clean-Up
- 1.** All spills or leaks of fuels and oils from equipment and vehicles on the surface of the geomembrane shall be thoroughly cleaned with soap and water, or, at the discretion of the Engineer, the affected geomembrane shall be cut, removed and replaced with new geomembrane material.
  - 2.** Subgrade materials contaminated with fuel or oil shall be excavated and replaced to the extent designated by the Owner.
  - 3.** Contaminated material shall be properly disposed of off-site by the Contractor at no expense to the Owner.
- F.** Any damage to the geomembrane shall be reported to the Engineer, and repaired by the Geosynthetic Contractor at no expense to the Owner.

**END OF SECTION**



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**August 2019, Rev. July 2020, Rev. Apr 2021**

Reference: **Technical Specification 02680 –ClosureTurf®**  
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## Section 02680 ClosureTurf®

### 1.0 General

The following technical specification addresses the installation of the engineered turf and sand infill (HydroBinder) components of the ClosureTurf® System. Installation of the MicroDrain® Liner for the closure turf system shall comply with Technical Specification 02679.

For this project, only ClosureTurf® with hydrobinder is to be installed where this product is specified. As a result, the use of the product names HydroTurf® and ClosureTurf® are used interchangeably.

### 1.1 Summary

**A.** Section Includes:

1. Specifications for the installation of the ClosureTurf® System.
2. ClosureTurf® System is to be installed at the downdrains and haul road ditches where indicated on the drawings.

**B.** Related Sections:

1. Section 02679 – LLDPE Structured Geomembrane.

### 1.2 Unit Price – Measurement

**A.** ClosureTurf® System:

1. Basis of Measurement: By square foot of ClosureTurf® installed, in-place, excluding scrap and overlap.
  - a. Includes furnishing engineered turf, storage, installation, labor, supervision, transportation, equipment, and incidental items as required to complete the engineered turf installation to temporary or permanent termination limits, as specified on Drawings and in accordance with CQC Plan.
  - b. Measurement will be made based on the total two-dimensional (plan view) surface area in square feet based on as-built conditions. No allowance will be made for closureturf system in anchor and drainage trenches or waste, overlap, repairs, or materials used for the convenience of the Contractor.

**B.** Hydrobinder Infill:



1. Basis of Measurement: By cubic yard installed, as measured and documented by the pre-hydration thickness measurements. Contractor is to record, document and submit this information for measurement justification.
  - a. Includes furnishing and placement of Hydrobinder® infill to the dimensions and thicknesses shown on the drawings. Includes sand delivery, storage, installation, labor, supervision, transportation, equipment, and incidental items as required to complete the engineered turf installation to temporary or permanent termination limits, as specified on Drawings and in accordance with CQC Plan.

### 1.3 References

- A. Construction Quality Control (CQC) Plan
- B. American Society for Testing and Materials (ASTM) standards:
  1. ASTM D792 Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
  2. ASTM D1004 Standard Test Method of Initial Tear Resistance of Plastic Film and Sheeting.
  3. ASTM D1204 Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.
  4. ASTM D1238 - Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.
  5. ASTM D1505 Standard Test Method for Density of Plastics by the Density-Gradient Technique.
  6. ASTM D1603 Standard Test Method for Carbon Black in Olefin Plastics.
  7. ASTM D1693 - Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.
  8. ASTM D1907 - Standard Test Method for Linear Density of Yarn (Yarn Number) by the Skein Method.
  9. ASTM D2256 - Standard Test Method for Tensile Properties of Yarns by the Single-Strand Method
  10. ASTM D3218 - Standard Specification for Polyolefin Monofilaments
  11. ASTM D3895 Standard Test Method for Oxidative Induction Time of Polyolefins by Differential Scanning Calorimetry.
  12. ASTM 4218 Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.
  13. ASTM D4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
  14. ASTM D5261 - Standard Test Method for Measuring Mass per Unit Area of Geotextiles
  15. ASTM D5321 Standard Test Method for Determining the Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear.



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16. ASTM D5323 – Standard Test Method for Determination of 2% Secant Modulus for Polyethylene Geomembranes
  17. ASTM D5397, Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test.
  18. ASTM D5596 Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.
  19. ASTM D5617 – Standard Test Method for Multi-Axial Tension Test for Geosynthetics
  20. ASTM D5721 Standard Practice for Air-Oven Aging of Polyolefin Geomembranes.
  21. ASTM D5885 Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry.
  22. ASTM D5994 Standard Test Method for Measuring the Core Thickness of Textured Geomembranes.
  23. ASTM D6392 Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
  24. ASTM D6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes.
  25. ASTM D6913 - Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
  26. ASTM D7007 – Standard Practices for Electrical Methods for Locating Leaks in Geomembranes Covered with Water or Earth Materials
  27. ASTM C150 - Standard Specification for Portland Cement
  28. ASTM C387 - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar
  29. ASTM D1335 - Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings
  30. ASTM D1577 - Standard Test Methods for Linear Density of Textile Fibers
  31. ASTM D4595 - Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method
  32. ASTM D5793 - Standard Test Method for Binding Sites per Unit Length or Width of Pile Yarn Floor Coverings
  33. ASTM D5823 - Standard Test Method for Tuft Height of Pile Floor Coverings
  34. ASTM D5848 - Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Coverings
  35. ASTM D6241 - Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe
- C. American Concrete Institute (ACI) Standards:
1. American Concrete Institute (ACI) - 306R-10 Guide to Cold Weather Concreting
- D. Geosynthetic Research Institute (GRI) Standards:
1. GRI-GM11– Accelerated Weathering of Geomembranes Using a Fluorescent UVA Device.





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2. GRI-GM12 –Measurement of the Asperity Height of Textured Geomembranes Using a Depth Gage Specification for the Stress Crack Resistance of Geomembrane Sheet.
3. GRI-GM17 – Test Methods, Test Properties, and Testing Frequency and for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes
4. GRI-GM19 - Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes

#### 1.4 Submittals

- A. The Geosynthetic Installer shall submit proposed ClosureTurf® panel layout, including anchor trenches and connections to any inlet/outlet structures, to the Engineer at least 14 days prior to mobilization of crews. Once the panel layout is approved, the Geosynthetic Installer may not change the layout without permission of the Engineer.
- B. Manufacturer's Product Information
  1. Submit the following to the Owner's Representative prior to ordering of geomembrane component:
    - a. Certificate of Compliance that shows proposed material for this project will meet the project specifications.
    - b. Indicate tentative product order date and manufacturer location.
    - c. Provide representative manufacturer Product Data sheets.
    - d. Provide four (4) representative project product samples.
    - e. Provide manufacturer's quality control program, including test procedures and frequencies for this product.
  2. At least five (5) working days prior to shipment, the Geosynthetic Installer shall furnish the Engineer with pre-shipping product data sheets and test data for ClosureTurf®. At a minimum, the Manufacturer will perform the tests at the frequencies given in Table 02680-A found in this Section for the Engineered Turf. These tests shall conform to the standards set in Table 02680-B, also found in this Technical Specification. The information supplied shall be in the form of a factory quality control certificate for each geomembrane roll and shall include the following:
    - a. A copy of the MQC results.
    - b. Statement that MQC testing has been done in accordance with manufacturer's quality control program.
    - c. Certificate of Compliance including:
      - (1) MQC certifications required by the Contract.
    - d. MQC Certifications will include:



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- (1) Tufting Gauge;
  - (2) Pile Height;
  - (3) Roll length and roll numbers;
  - (4) Total Product Weight
  - (5) CBR Puncture Strength (ASTM D6241);
  - (6) Tensile Strength Product (lbs./ft.) (MARV) (ASTM D 4595)
  - (7) Tensile Strength of Yarn (lbs.) (MARV) (ASTM D2256)
- e. Results of quality control tests that are to include those presented in Table 02680-A found in this Section and description of test methods used. The results of these tests must meet the minimum required physical properties for LLDPE geomembrane specified in Table 02680-B found in this Section.
- C. Manufacturer's Installation Instructions: Submit special procedures for ClosureTurf® installation.
- D. The Geosynthetics Installer shall adopt and use the quality assurance forms prepared by the Owner's Representative, or other forms approved by the Owner's Representative, during all applicable phases of geomembrane installation, inspection and testing. The Geosynthetics Installer can request to use his forms. The forms must be submitted to the Owner's Representative at least two weeks prior to geomembrane installation for review and approval.
- E. A resume of the proposed Superintendent of the Geosynthetics Installer must be submitted to the Engineer for final approval two weeks prior to geomembrane installation.
- F. The Contractor is responsible for his own Health and Safety Plan, but must abide by any safety procedures dictated by the Owner.

## 1.5 Closeout Submittals

- A. Forms by the CQAO:
1. Owner's Representative Daily Field Report
  2. Field Inventory Control, Storage Inspection, and Cross-Reference Roll Numbers
  3. Engineered Turf Deployment Report
  4. Sand Infill (HydroBinder) Placement Tracking Log
- B. Forms by the Geosynthetics Installer:
1. 1-year warranty against defects in workmanship
  2. As-built drawing of the ClosureTurf® panel installation. The as-built drawing shall include panel corners, transitions in panel geometry, repair locations (if applicable), and other significant features as identified by the CQAO on-site.
  3. The Geosynthetics Installer's supervisor shall observe and check all phases of the ClosureTurf® installation. When the ClosureTurf® is accepted by the Owner, the



Geosynthetics Installer shall submit a Letter of Acceptance to the Owner that the installation conforms to the requirements of the Manufacturer.

## 1.6 Quality Assurance

- A. Perform Work in accordance with these Specifications and the CQC Plan.
- B. The Manufacturer shall sample and test the engineered turf material, at minimum frequencies specified in Table 02680-A. General manufacturing procedures shall be performed in accordance with the Manufacturer's internal quality control guide and/or documents.
- C. Engineered Turf Conformance Testing:
  - 1. Conformance testing shall be performed by an independent laboratory at a frequency of at least 1 per 400,000 square feet of engineered turf manufactured for this project. Conformance testing shall consist of the following tests:
    - a. Total Product Weight (ASTM D5261);
    - b. CBR Puncture (ASTM D6241).
    - c. Tensile Strength Product (ASTM D4595)
    - d. Tensile Strength Yarn (ASTM D2256).
    - e. Other tests as required by Engineer.
  - 2. Sampling for conformance testing shall be performed at the manufacturing facility whenever possible, and in accordance with the CQC Plan.
- D. The Engineer or their Representative shall examine the rolls upon delivery to the site and report any deviations from these Specifications to the Contractor.
- E. If an engineered turf sample fails to meet the quality control requirements of this Section, the Contractor and/or Engineer shall require that the engineered turf Manufacturer sample and test each roll manufactured in the same lot or batch, or at the same time, as the failing roll. Additional sampling and testing shall be completed at no additional cost to the Owner. Sampling and testing of rolls shall continue until a pattern of acceptable test results is established.
- F. Any engineered turf sample that does not comply with this Section shall result in rejection of the roll from which the sample was obtained. The Contractor shall replace any rejected rolls at no additional cost to Owner. At the Geomembrane Manufacturer's discretion and expense, additional testing of individual rolls may be performed to more closely identify noncomplying rolls and to qualify individual rolls.



## 1.7 Qualifications

- A. Prior to beginning the installation of the ClosureTurf® System, Geosynthetics Installer shall submit the following to the Owner's Representative as it relates to the Engineered Turf component:
  - a. The company will be an approved ClosureTurf Installer as approved through Watershed Geosynthetics, LLC.
  - b. Installation capabilities, including:
    - (1) Information on seaming, testing and deployment equipment proposed for this project;
    - (2) Average daily production anticipated for this project; and
    - (3) Construction Quality Control (CQC) procedures
- B. Geosynthetic Contractor Equipment and Personnel
  - 1. Quality Control Foreman (QCF)
    - a. The Geosynthetics Installer shall provide an individual whose title is "Quality Control Foreman" (QCF) who shall be experienced in all phases of quality control testing and procedures.
    - b. The QCF will be dedicated to performing or directing the Geosynthetics Installer's quality control activities.
  - 2. Superintendent
    - a. Shall have installed at least 5,000,000 square feet of like geosynthetics components.
    - b. The QCF and the Superintendent may be the same person if approved by the Engineer.
  - 3. Geosynthetic Installer Seaming Personnel
    - a. Shall have installed at least 1,000,000 square feet of like geosynthetics components.
    - b. Personnel who have seamed less than 1,000,000 s.f. of polyethylene geomembrane will be allowed to seam only under the direct supervision of the Superintendent.
- C. HydroBinder Installer
  - a. Installation of HydroBinder infill will only be performed by a Watershed Geosynthetics licensed and approved installer.

## 2.0 Products



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**2.1 ClosureTurf®**

ClosureTurf® is a patented system and is the intellectual property of Watershed Geosynthetics, LLC.

- A.** ClosureTurf® for this project is a 3 component system consisting of a Structured Geomembrane, Engineered Turf, and a specialized HydroBinder® infill.
- B.** Materials:
  - 1.** Structured Geomembrane – shall comply with Technical Specification 02679.
  - 2.** Engineered Turf produced by Shaw Industries, Inc. See Tables 02680-A and 02680-B.
  - 3.** HydroBinder® Infill component of the ClosureTurf® System is a proprietary cementitious grout. See Section 3.4.2(A)
- C.** For this project, ClosureTurf® will always be installed using the hydrobinder infill material. Therefore, the use of the term ClosureTurf or HydroTurf is synonymous.
- D.** The HydroTurf material shall be HydroTurf CS. HydroTurf Z shall not be approved as an equivalent.
- E.** Any reference to ClosureTurf or HydroTurf in these project documents is a reference to the 'CS' material.

**Table 02680-A**  
**Required Pre-Shipping Information for Engineered Turf Component**

Property	Test Method	Frequency
<b>Tufting Gauge</b>	N/A	Each Roll
<b>Pile Height</b>	N/A	Each Roll
<b>Roll Length and Roll Numbers</b>	N/A	Each Roll
<b>Total Product Weight</b>	ASTM D5261	Once per 300,000 sf
<b>CBR Puncture</b>	ASTM D6241	Once per 300,000 sf
<b>Tensile Product (MD/XD)</b>	ASTM D4595	Once per 300,000 sf
<b>Tensile Strength Yarn</b>	ASTM D2256	Once per 300,000 sf



**Table 02680-B**  
**Required Physical Properties of Engineered Turf Component**

Property	Test Method	Required Value
<b>Tufting Gauge</b>	N/A	N/A
<b>Pile Height</b>	N/A	N/A
<b>Roll Length and Roll Numbers</b>	N/A	N/A
<b>Total Product Weight</b>	ASTM D5261	N/A
<b>CBR Puncture</b>	ASTM D6241	800 lb (MARV)
<b>Tensile Strength of Product (MD/XD)</b>	ASTM D4595	1,000 lb/ft min.
<b>Tensile Strength of Yarn</b>	ASTM D2256	15 lbs. (min)
<b>Rainfall Induced Erosion</b>	ASTM D6459	0.04% Infill Loss 6 in/hr
<b>Aerodynamic Evaluation</b>	GTRI Wind Tunnel	120 mph with max. uplift of 0.12 lb/sf
<b>Engineered Turf Fiber Tuft UV Stability</b>	ASTM G147	>60% retained tensile strength at 10 years (projected)
<b>Backing system UV Stability (Exposed)</b>	ASTM G154 Modified Cycle 1, UVA340	110 lb/ft retained tensile strength @ 6500 hrs (projected)
<b>Steady State Hydraulic Overtopping (ClosureTurf with HydroBinder)</b>	ASTMD7277 ASTM D7276	5 ft overtopping resulting in 29 fps velocity & 8.8 psf shear stress for Manning N Value of 0.02
<b>Full Scale Wave Overtopping Test – Cumulative Volume (ClosureTurf® with HydroBinder™)</b>	CSU Wave Simulator	165,000 ft3/ft
<b>Full Scale Wave Overtopping Test – Max. Avg. Wave Overtopping Discharge (ClosureTurf w/ HydroBinder)</b>	CSU Wave Simulator	4.0 ft3/s/ft
<b>Transmissivity w/ underlying structured geomembrane, Normal Stress @ 50 psf &amp; 0.33m2/sec</b>	ASTM D4716	2.5 x 10-3 m2/sec, min.
<b>Internal Friction of combined components</b>	ASTM D5321	35° (min)

### 3.0 Execution

The Geosynthetics Installer shall furnish all labor, materials, supervision and equipment to complete the Engineered Turf and HydroBinder installation for the project including, but not limited to, geomembrane installation (Technical Specification 02679), engineered turf layout, seaming, patching, and all necessary and incidental items required to complete the work, and HydroBinder installation in accordance with the Drawings and these Specifications.



### 3.1 Delivery, Storage and Handling

- A. Engineered Turf shall be shipped:
  - 1. Rolled and labeled with manufacturer name, product identification, lot number, roll number and roll dimensions.
  - 2. Manufacturer's quality control documentation shall be included with each roll.
- B. Transport and handle geomembrane with equipment designed to protect engineered turf from damage. The Contractor shall be responsible for unloading and storage of the engineered turf in a manner that prevents damage to the engineered turf.
- C. Use appropriate handling equipment as recommended by the Manufacturer and approved by the Owner's Representative.
- D. Dragging panels on the ground surface is not permitted.
- E. On-site storage shall be as needed to protect the geomembrane rolls from excessive accumulations of soil on the geomembrane surfaces, water, heat, mechanical abrasion, puncture and vehicular traffic. Store on level prepared surface (not on wooden pallets) graded to drain away from ClosureTurf® components
- F. The geomembrane rolls shall not be stacked more than three rolls high, or as otherwise recommended by the Manufacturer.

### 3.2 Daily Pre-Installation Meetings

- A. At the beginning of each work day the Earthwork Contractor's Superintendent, the Geosynthetic Contractor's Superintendent, and the Owner's Representative will meet to discuss the upcoming work plan for all parties to promote cooperation, communication and understanding. Care shall be taken to provide as much notice as possible when scheduling geomembrane as-built survey. Operations shall be planned and implemented so as not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

### 3.3 Preparation

- A. Ensure acceptance of underlying layers (geomembrane/engineering turf) before installing overlying layers (engineered turf/HydroBinder infill).
- B. Verify ballast loading has been removed in active engineered turf deployment areas. Return appropriate ballast to the top of the engineered turf layer until HydroBinder is installed.
- C. Surface Water Control and Base Maintenance
  - 1. The base shall be maintained well-drained and dry prior to and during geomembrane installation.
  - 2. The Geosynthetics Installer shall be responsible for surface water control during engineered turf installation as needed to maintain all work areas well-drained and dry



during construction, preclude ponding, and prevent uplift of the ClosureTurf® system after installation.

3. The Geosynthetics Installer's proposed dewatering method(s) shall be submitted to the Owner's Representative at least one week prior to implementation.

### 3.4 Installation

#### 3.4.1 Engineered Turf

Installation of the engineered turf shall be in compliance with this Specification and with the Manufacturer's standard guidelines and specifications for engineered turf installation, subject to approval by the Owner's Representative, including, but not limited to: (i) handling and site storage requirements; (ii) unrolling and laying of geomembrane sheets; (iii) field seaming or welding techniques; and (iv) anchor trench and ballast details. Prior to installation the Owner's Representative must observe the following:

1. The geomembrane has been seamed, tested, approved and is released for further component deployment.
2. The supporting surface (i.e. the geomembrane) is substantially free of debris of large scraps, except those required for ballast.

#### A. Turf Handling and Placement

1. Appropriate handling equipment shall be used when loading or moving rolled engineered turf rolls from one place to another. Appropriate equipment is that recommended by the Manufacturer.
2. Do not use materials damaged during storage or handling. If the engineered turf is not packaged and a roll is damaged during shipment, it shall be rejected. If only the outermost surface of the roll is affected, it shall be peeled back, cut, and wasted (i.e., it shall be treated as if it were the protective packaging for the remainder of the roll).
3. The engineered turf shall be installed at the locations and to the lines, grades and dimensions shown on the Drawings, or as otherwise directed by the Engineer.
4. Engineered turf deployment shall not be performed when precipitation is occurring, when excessive moisture or wet conditions exist as determined by the Owner or Owner's Representative, in areas of ponded water, or when high winds (sustained winds greater than 25 mph) or other adverse climatologic conditions exist.
5. The contractor is responsible for any damage resulting to or from windblown Engineered Turf.
6. The turf shall remain free of contaminants such as soil, grease, fuel, etc.
7. Horizontal cross seam/panel extension on slopes will not be more than one aligned side by side (i.e. not adjacent cross seams on slopes).
8. At least on complete panel shall separate any horizontal cross seam/panel extension.





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9. Horizontal cross seam connection will be performed prior to the vertical production seaming.
  10. Once the horizontal cross seam/panel extension is completed, the excess seam overlap on the bottom of the weld or seam shall be cut off.
- B. Engineered Turf Fusion Seaming Method (A)**
1. Techniques for Fusion Seaming Engineered Turf shall be as follows:
    - a. Engineered Turf fusion seaming device will be a DemTech VM20/4/A fusion welder only.
    - b. Fusion seams require a minimum of 5 inches of overlap.
    - c. Frayed or loose geotextile strands will be cut off or removed.
    - d. Prior to starting the production fusion seaming, trial seams must be performed as outlined in Section 3.02.
    - e. Demonstrate the preparation methods and equipment utilized for removal of the selvage from the outside edge of the rolls of turf (i.e. trimming & cutting devices).
    - f. Mechanical or hot knife trimming and cutting devices will be utilized for salvage trimming.
    - g. Demonstrate and control the fraying of geotextile strands when performing the removal of selvage.
    - h. Any damage that occurs due to production seaming will be repaired as outlined in this specification.
    - i. Any defects will be repaired as outlined in this specification.
- C. Engineered Turf Sewn Seam Method (B)**
1. Techniques for using a Sewn Seam Method for Engineered Turf shall be as follows:
    - a. A single stitch prayer type seam is constructed using an American Newlong sewing machine or equivalent.
    - b. The thread will be polyester or equivalent.
    - c. Sewing will occur between the 1<sup>st</sup> and 2<sup>nd</sup> row of tufts from the edge.
- D. Repair:**
1. The Geosynthetics Installer shall visually inspect the entire geomembrane surface for any defects including, but not limited to, seam imperfections, badly scuffed areas, scratches, blisters, tears, rips, holes, and punctures. He shall identify, mark, and repair all noted defects, as well as defects designated by the Engineer.
  2. When repairs and tie-ins of the engineered turf occur, the Owner's Representative must observe the following:



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- a. Repairs to Engineered Turf are completed by using a heat-bonded seam.
- b. All tie-in seams along flatter slopes (i.e. 15% or less) with length greater than 25 feet will use an approved heat bonded seam so as consistent pressure is achieved throughout the seam.
- c. A hand-held heat gun with a pressure wheel will be used in smaller/concentrated areas.
- d. Geosynthetics Installer may also demonstrate techniques and practiced for approval by the Owner, Owner's Representative and Watershed Geosynthetics.

(1) Field demonstration and approval by the Owner's Representative is required before incorporating any alternative technique. All geomembrane repairs shall be documented including date, geomembrane panel identification number, repair location, type of defect, cause of defect and details of repairs made.

**E.** Equipment on Engineered Turf

1. All equipment used to deploy the engineered turf system shall follow the manufacturer recommendations.

3.4.2 *Infill – HydroBinder® Placement*

HydroBinder® is a proprietary cementitious product used as an alternate infill component of the ClosureTurf® system.

**A.** Materials:

1. The infill will be HydroBinder® Cementitious Infill. The infill material may be delivered in either pallet form of 80 lb. bags or 3000 lb. bulk super sacks.
2. Cement, except as otherwise specified herein, will be a brand of Portland Cement, meeting ASTM C 150 and will be Type I or Type II.
3. Only one brand of cement will be used throughout the duration of this Contract.
4. The cementitious infill mix design will conform to the requirements of ASTM C 387 for high strength mortars.
5. The cementitious infill mix will have a minimum 28 day compressive strength of 5000 psi per ASTM C109 / C109M.
  - a. Verification of the compressive strength will be completed by the manufacturer and a certified test report supplied with each batch/lot of Hydrobinder® material delivered to the site.

**B.** Placement by Installer:

1. Manual hand spreading is acceptable when equipment is not practical.
2. Placement shall begin at the bottom and end at the top of each slope section.



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3. Geosynthetics Installer shall explain in detail in the pre-construction meeting the method of HydroBinder® infill deployment.
  4. Installation of HydroBinder® infill will only be performed by a Watershed Geosynthetics licensed and approved installer.
  5. The infill will be worked into the tuft fibers so the tuft fibers are in an upright position with the infill at a measurable 3/4 inch minimum depth. This is achieved with common mechanical turf broom, power broom, shop broom, yard rakes, or greens groomer rakes.
  6. Brushing should be performed in all four directions starting with the direction against the lay of the fibers. Multiple passes may be required.
  7. The HydroBinder® may need to be placed in 2 to 3 lifts with brushing in between lifts to effectively work the material into the tufts and achieve fibers that are upright.
  8. The desired HydroBinder® infill thickness will be achieved prior to the hydration process.
- C. Hydration by Installer**
1. The hydration process will occur on the same day as the HydroBinder® infill placement.
  2. Hydrate the infill thoroughly without causing displacement of the product. This may require another pass after waiting momentarily to allow the initial water application to soak in.
  3. Estimated application rate is approx. 0.12 to 0.20 gallons per square foot of area.
  4. The installer shall not overhydrate the infill so that water begins to runoff and cause loss of cement infill during the process.
  5. To improve curing, the hydrated area may be covered with plastic sheeting.
  6. If freezing temperatures are expected, the hydrated area should be covered with burlap and / or plastic sheeting.
  7. The HydroBinder® infill will harden within 24 hours following hydration.
  8. Personnel access on the HydroBinder® infilled surface will be prohibited for 24-hr following the hydration of the HydroBinder®.
  9. Once hydration is completed and the HydroBinder® has set up, backfill and compaction of the anchor trenches may be performed.

### **3.5 Field Quality Control**

#### **3.5.1 Engineered Turf**

- A.** The Geosynthetics Installer shall adopt and use the quality assurance forms prepared by the Owner's Representative, or other forms approved by the Owner's Representative, during all applicable phases of geomembrane installation, inspection and testing. The Geosynthetics Installer can request to use his forms. The forms must be submitted to the Owner's Representative at least two weeks prior to geomembrane installation for review and approval.



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- B.** All aspects of the geomembrane installation will be inspected on a full-time basis by the Owner's Representative. During deployment, the Onwer's Representative must observe and record the following:
1. Observe the turf as it is deployed and record defects and disposition of the defects (i.e., panel rejected, patch installed, etc.).
  2. That repairs are made in accordance with the specifications.
  3. Equipment used does not damage the turf or underlying geomembrane.
  4. That all panels are deployed from the top of the slope in a way that the Engineered Turf filaments are pointing upslope after deployment is complete.
  5. That the turf is anchored to prevent movement by the wind (the Geosynthetics Installer is responsible for any damage resulting to or from windblown Engineered Turf).
  6. That the turf remains substantially free of contaminants.
  7. That the turf is laid substantially smooth and substantially free of tension, stress, folds, wrinkles, or creases.
  8. That on slopes, the turf is secured with sandbag anchoring at the top of the slope after deployment.
  9. That the first panel deployed has the turf filaments facing upward.
  10. That subsequent panels are deployed turf side down, and on top of the previous panel. (Sewing Method Only)
  11. That after seaming each panel, it is flipped onto the geomembrane component with care to avoid pulling of tufts in the drainage studs. (Sewing Method Only)
  12. A single stitch prayer type seam is constructed using a Newlong sewing machine or equivalent. (Sewing Method Only)
  13. The thread will be 207 Polyester or equivalent.
  14. Sewing will occur between the 1st and 2nd row of tufts on both sides of panel.
  15. The Owner's Representative or a designated, independent geosynthetics laboratory may perform additional testing, as required by these detailed Specifications or as required in the judgment of the Engineer to verify that the engineered turf sheets and seams meet these Specifications.
- C.** Trial Seams
1. Prior to turf component welding, CQA personnel shall observe and document that turf welding apparatus are testing as follows:
    - a. At daily start-up;
    - b. Immediately after any break;
    - c. Anytime the machine is turned off for more than 30 minutes.
  2. If at any time, the CQA Personnel believe that an operator or fusion welding apparatus is not functioning properly, a Field Trial Seam Test must be performed.



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3. Any dispute concerning proper installation techniques or the proper function of fusion welding equipment will be resolved by the Owner's Representative.
4. The trial weld must be allowed to cool to ambient temperature before seam snapping or panel adjustments are applied. Requirements for trial seams are as follows:
  - a. Trial weld samples must comply with "Visual Passing Criteria." Visual passing criteria is verified when a manual peel/pull test is performed and the top turf panel tufts transfer to the bottom turf panel. The transfer of approx. 75% of the tufts constitutes a passing trial weld.
  - b. The trial weld shall fail if less than approximately 75% of the top turf panel tufts transfer to the bottom turf panel.
  - c. If a failing trial weld is observed, two consecutive trial welds must be performed and meet the visual passing criteria before the trial weld is accepted.
  - d. The trial weld sample must be a minimum of 3 feet long and 12 inches wide, with the seam centered lengthwise.
  - e. If a welding apparatus exceeds 5 hours in the second half of the day, another trial seam must be performed.
  - f. Trial seams will be tested by the Geosynthetics Installer under observation of the Owner's Representative.
  - g. The Geosynthetics Installer shall supply all necessary knowledgeable personnel and all necessary calibrated testing equipment.
5. The Owner's Representative will approve all trial seam procedures and results.
6. The following shall be logged in the Geomembrane Trial Seam Log by the Owner's Representative:
  - a. The names of the seaming personnel;
  - b. The name of the fusion seaming technician;
  - c. the welding apparatus number, time and date;
  - d. Ambient air temperature;
  - e. Welding apparatus temperature.

### 3.5.2 Sand Infill (HydroBinder)

1. The HydroBinder® will be installed into the turf while it is in a dry state.
2. The HydroBinder® will be worked into the tufts so the tufts are in an upright position.
3. The HydroBinder® infill layer will be placed to a 3/4 inch minimum thickness not to exceed 1 inch thick.
4. Multiple passes will be required so the tufts can be more readily freed from the weight of the HydroBinder® on each pass before hydration takes place.
5. Engineered Turf Tufts will be free and upright before the hydration process begins.
6. Reduce trapped tufts as much as practical.



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7. HydroBinder® thickness will be checked using a caliper or other approved measuring device.
  - a. Take thickness measurements of the dry HydroBinder® at a rate of 20 samples per acre.
  - b. The desired HydroBinder® infill thickness will be achieved prior to the hydration process.
8. Do not backfill horizontal or vertical anchor trenches until turf has been infilled with HydroBinder® infill.
9. The hydration process must occur the same day as the HydroBinder® infill placement.
  - a. Check to assure HydroBinder® is hydrated thoroughly through the full thickness, without causing excessive runoff using the following methods.
    - (1) Check each completed hydration area for full saturation using a probe before moving on to the next area.
    - (2) Check hydration with probe at a rate of 1 per 100 sq. ft.
    - (3) Check for full hydration by tapping on hydrated surface forcing water to be visually seen pooling at the surface.
  - b. The estimated application rate is 0.20 gallons of water per square foot.
    - (1) Rate may change according to ambient temperature and humidity.
  - c. After 24 hours. :
    - (1) Check the completed Hydrobinder® to ensure the hardening process is taking place.
    - (2) It should be noted that the dustless version of HydroBinder® may take longer than 24 hours to reach an obvious hardness to the touch.
  - d. The 28-day compression strength of the HydroBinder is verified by the manufacturer before the mix is delivered to the site. :
    - (1) Check the completed Hydrobinder® to ensure the hardening process is taking place.
10. Cold Weather Placement and Curing of HydroBinder®. Follow procedure shown in American Concrete Institute (ACI) 306 – Guide to Cold Weather Concreting.
  - a. At the time of HydroBinder® Placement the following methods.



- (1) Both the subgrade and the surface of the Engineered Turf will be at a temperature of at least 36 degrees.
- (2) Ambient temperature will be rising.

### 3.6 Protection of Work

- A. Protect installed ClosureTurf® system according to geomembrane manufacturer's instructions. Repair or replace areas of geomembrane damaged by scuffing, punctures, traffic, rough subgrade, or other unacceptable conditions.
- B. No support equipment, tools, or personnel that can readily cause damage to the ClosureTurf® system shall be allowed on the ClosureTurf® system during and after installation. Ground pressures shall comply with the manufacturer's recommendations.
- C. Fuel and Oil Spill Clean-Up
  1. All spills or leaks of fuels and oils from equipment and vehicles on the surface of the geomembrane shall be thoroughly cleaned with soap and water, or, at the discretion of the Engineer, the affected geomembrane shall be cut, removed and replaced with new geomembrane material.
  2. Subgrade materials contaminated with fuel or oil shall be excavated and replaced to the extent designated by the Owner.
  3. Contaminated material shall be properly disposed of off-site by the Contractor at no expense to the Owner.
- D. Any damage to the ClosureTurf® system shall be reported to the Engineer, and repaired by the Geosynthetic Contractor at no expense to the Owner.

**END OF SECTION**



**Technical Specification 02900 – Erosion and Sediment Control**  
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## Section 02900 Erosion and Sediment Control

### 1.0 General

The following technical specification addresses erosion and sediment control requirements for the project.

#### 1.1 Section Includes:

This item of work includes furnishing all labor, equipment, and material necessary for minimization of erosion and control of sediment resulting from earth disturbing activities. The work includes but is not necessarily limited to:

- A. Development of a Storm Water Pollution Prevention Plan (SWPPP) including selection of type and location of Erosion and Sediment (E&S) control measures in conformance with KYTC Section 212 "Erosion Control" and Section 213 "Water Pollution Control."
- B. Implementation of the SWPPP including installation of E&S control measures. .
- C. Inspection of E&S control measures, including preparation of required documentation.
- D. Maintenance of E&S control measures including but not limited to, sediment removal and replacement of defective or inadequate devices throughout the contract period.
- E. Removal of and off-site disposal of E&S control measures at the completion of the contract period.

#### 1.2 Related Sections:

- 1. Section 02000 - Mobilization
- 2. Section 02924 – Seeding and Mulching

#### 1.3 Unit Price – Measurement

- A. Erosion and Sediment Control
  - 1. Measurement for purpose of payment shall be based the percent complete of the overall construction schedule.

#### 1.4 References

- A. Kentucky Division of Water – most recent edition of Best Management Practices for Storm Water Control Manual.
- B. Owner provided Erosion and Sediment Control details in construction drawings.
- C. Contractor prepared Storm Water Pollution Prevention Plan.



**Technical Specification 02900 – Erosion and Sediment Control  
East Bend Station, East Landfill Final Cover Modifications**

Boone County, Kentucky  
S&ME Project No. 7217-17-004K

- D. Best Management Practices, Pollution Prevention Plan, Duke Energy, East Bend Station.

## 1.5 Definitions

Erosion and sedimentation control includes installation of temporary control measures, maintenance and replacement of those measures as needed, and removal of those measures at the completion of work. Erosion and sedimentation control also includes establishment of temporary vegetative cover for overwintering of project, extended delays in work, or any area that will not be graded or re-worked for 21 days or greater. Temporary seeding requirements are included on the Erosion and Sediment Control plan sheets included on the Construction Drawings. Erosion and sedimentation control does not include establishment of permanent vegetative cover or installation of permanent erosion control measures. Permanent vegetative cover is included in Technical Specification 02000, Mobilization and Technical Specification 02924, Seeding and Mulching.

## 1.6 Submittals

- A. Contractor shall submit the Erosion and Sediment Control Plan to the Owner for review and comment prior to the pre-construction meeting.
- B. Contractor shall review, sign, and return to Owner the Erosion and Sediment Control Plan not less than 30 days prior to initiation of earth disturbing activities.
- C. Contractor shall submit a detailed plan for removal of downdrain B and installation of hydroturf at Outfall 017. The plan shall be submitted at least 30 days prior to the beginning of the concrete removal. Plan should include the erosion control measures that will be implemented and the remedial measures in-place should if an unforeseen rain event were to occur prior to installation of hydroturf.

## 1.7 Materials

As identified in:

- A. Owner provided Erosion and Sedimentation Control Drawings, and/or;
- B. Contractor developed/modified Erosion and Sedimentation Control Drawings, and/or;
- C. Contractor provided SWPPP.

## 1.8 Existing Controls

- A. The existing lined retention basin on the south side of the East Landfill may be used as an E&S control measure. Contractor is not required to perform maintenance for this E&S control measure but is to minimize sediment transport to the basin through best management practices (BMP's).
- B. Existing landfill ditches and diversion berms may be used as E&S control measures. Contractor is required to improve, inspect and maintain existing ditches and diversion berms.



**Technical Specification 02900 – Erosion and Sediment Control  
East Bend Station, East Landfill Final Cover Modifications**

Boone County, Kentucky  
S&ME Project No. 7217-17-004K

- C. Contractor is required to clean-out the sediment trap located in the South Perimeter Ditch as needed throughout construction. Sediment removed from the ditch shall be placed in the landfill top deck.
- D. The northeast landfill downdrain (Downdrain B) carries stormwater runoff off-site through a separate NPDES permit for Outfall 017. The requirements of this permit must be met at all times during construction. Additionally, under no circumstances is contact water allowed to exit the landfill through this outfall. Contractor shall complete the work in a manner to limit this possibility. The risk reduction measures proposed by the Contractor shall be submitted in a detailed plan as previously listed under Submittals.
- E. Contractor is required to install new or improve as required any existing erosion and sediment controls in-place around the existing stockpile areas that are used as part of construction. All stockpile areas disturbed as part of construction shall be included in the Contractor's Erosion and Sediment Control Plan.

## 2.0 Execution

- A. The Storm Water Pollution Prevention Plan and associated erosion and sedimentation control drawings shall be on-site at all times throughout the contract period.
- B. Erosion and sedimentation control measures shall be installed in accordance with the Storm Water Pollution Prevention Plan and the erosion and sedimentation control drawings prior to initiation of earth disturbing activities. As construction progresses, additional erosion and sedimentation control measures shall be installed in accordance with the Storm Water Pollution Prevention Plan and the erosion and sedimentation control drawings or as needed based on the Contractor's work.
- C. Erosion and sedimentation control measures shall be inspected and maintained by the Contractor as per the Erosion and Sediment Control Plan and the SWPPP. Inspection reports shall be submitted by the Contractor to the Owner in accordance with the frequency requirements included in the SWPPP.
- D. Contractor shall consider temporary construction activities in SWPPP preparation such as, but not necessarily limited to, staging areas, stockpile areas, and access roads.
- E. All erosion and sedimentation control measures which have not been designated by the Owner to remain, shall be removed at the completion of the contract work.
- F. Contractor is to remove all accumulated sediment from ditches at the completion of the project. This includes ditches around the East Landfill and any ditches which have silted in surrounding the various on-site stockpiles. Contractor shall remove sediment during the project as determined necessary by the Owner for functional operation of the ditches and pond. Contractor is to re-seed the ditches if necessary to restore them to the pre-construction condition. The ditches would be considered disturbed areas as identified in Technical Specification 02000.



**Technical Specification 02900 – Erosion and Sediment Control**  
**East Bend Station, East Landfill Final Cover Modifications**  
Boone County, Kentucky  
S&ME Project No. 7217-17-004K

**END OF SECTION**



**Technical Specification 02924 – Seeding and Mulching**  
**East Bend Station, East Landfill Final Cover Modifications**  
Boone County, Kentucky  
S&ME Project No. 7217-17-004K

**Apr 2021**

Reference: **Technical Specification 02924 – Seeding and Mulching**  
**East Bend Station, East Landfill Final Cover Modifications**  
Boone County, Kentucky  
S&ME Project No. 7217-17-004K



## Section 02924 Seeding and Mulching

### 1.0 General

The following technical specification addresses permanent vegetation requirements for the project.

#### 1.1 Section Includes:

This item of work includes providing all labor, equipment, and materials necessary to furnish and install a permanent vegetative cover in accordance with the Drawings, these Specifications, and the Construction Quality Control (CQC) Plan. This item of work includes the final cover grades of the landfill that are to receive permanent seeding.

#### 1.2 Related Sections:

1. Section 02000 - Mobilization
2. Section 02900 – Erosion and Sediment Control

#### 1.3 Unit Price – Measurement

##### A. Permanent Seeding and Mulching

1. Basis of Measurement: Contractor shall be responsible for making measurements of area (acres) for purpose of payment. Documentation of measurement shall be submitted with request for payment. Owner may, at his discretion, verify Contractor measurements.
2. Measurement for purpose of payment shall be a field survey of the perimeter of the actual areas of work completed and accepted. Survey points around the perimeter shall be obtained on intervals no greater than 50 feet. Measurement shall be plan view area without adjustment for slopes.

##### B. Erosion Control Blanket

1. Basis of Measurement: Contractor shall be responsible for making measurements of area (acres) for purpose of payment. Documentation of measurement shall be submitted with request for payment. Owner may, at his discretion, verify Contractor measurements.
2. Measurement for purpose of payment shall be a field survey of the perimeter of the actual areas of work completed and accepted. Survey points around the perimeter shall be obtained on intervals no greater than 50 feet. Measurement shall be plan view area without adjustment for slopes.



Technical Specification 02924 – Seeding and Mulching  
East Bend Station, East Landfill Final Cover Modifications

Boone County, Kentucky  
S&ME Project No. 7217-17-004K

## 1.4 References

- A. Construction Quality Control (CQC) Plan for the Project.
- B. Kentucky Transportation Cabinet - *Standard Specifications for Road and Bridge Construction*, Edition of 2019, Approved for June 1, 2019, Published by the Kentucky Transportation Cabinet.

## 1.5 Definitions

- A. Seeding and Mulching is for permanent vegetation of the completed project areas. Areas to receive temporary vegetative cover as detailed in Section 02900 shall refer to the seeding requirements included on the Construction Drawings or the SWPPP.
- B. Weeds: Vegetative species other than specified species to be established in given area.
- C. Erosion Control Blanket (ECB) is for all finished areas on the landfill, as identified on the Drawings and in these documents

## 1.6 Submittals

- A. Contractor shall submit the specifications for the proposed seed, fertilizer and mulch for the project and clearly identify the rates at which each will be placed.
- B. Contractor shall provide a submittal detailing their installation methods and how the seeding rates will be verified.
- C. Contractor shall submit proposed material type for the erosion control blanket. Contractor shall submit manufacturer's installation instructions for the matting.

## 1.7 Materials

- A. Seeding and Mulching as identified in Construction Quality Control (CQC) Plan. The contractor may elect to place additional seed, fertilizer and/or mulch at a greater rate than the minimum required to promote establishment of a proper vegetative cover and limit the amount of re-seeding that would then be required.
- B. Erosion Control Blanket shall be EroNet® S150® as manufactured by North American Green, or approved equal.

## 2.0 Execution

- A. Prior to installation, the Contractor must receive approval of the finished grade surface from the Owner or their Representative. The finished surface, when inspected immediately prior to Erosion Control Blanket installation and seeding, shall be free of erosion rills and other undulations which would prevent the erosion control blanket from functioning as designed.
- B. Install erosion control blanket in accordance with the manufacturer's recommendations and KYTC 827.07. Where discrepancies exist, the more stringent shall apply.
- C. Additional seeding and mulching requirements are included in the CQC Plan, Section 6.0.



**Technical Specification 02924 – Seeding and Mulching**  
**East Bend Station, East Landfill Final Cover Modifications**  
Boone County, Kentucky  
S&ME Project No. 7217-17-004K

- D.** Contractor shall re-seed areas at no additional cost to the Owner that do not establish vegetation meeting the requirements listed in Section 6.5 of the CQC Plan.
- E.** If erosion rills form on the finished surface prior to establishment of vegetation, the Contractor shall remove the erosion control blanket, re-grade the finished surface, and re-seed and re-install the erosion control blanket. This work shall be performed at no additional cost to the Owner.

## **2.1 Protection of Work**

- A.** Contractor is responsible for any maintenance required and protection required to control erosion on the embankment fill surfaces prior to establishment of vegetation.
- B.** Contractor to re-seed as necessary following rain events if seed is washed away until grass is established.

**END OF SECTION**



**APPENDIX 3**

**CLOSURE PLAN**

**EAST BEND STATION**

**EAST LANDFILL**

Prepared for:  
DUKE ENERGY



East Bend Station  
6293 Beaver Rd.  
Union, KY 41091

**EAST BEND STATION  
EAST COAL COMBUSTION RESIDUAL LANDFILL**

**CLOSURE PLAN**

**OCTOBER 2016  
July 2020, Rev 2**

Prepared by:



6190 ENTERPRISE CT.  
DUBLIN, OHIO 43016  
PHONE: 614.793.2226  
FAX: 614.793.2410  
S&ME PROJECT: 7217-17-004E

## Closure Plan

### 1.0 INTRODUCTION

This Closure Plan was prepared for the East Bend Station – East Coal Combustion Residual Landfill. This plan was prepared in accordance with 40 C.F.R., Part 257 Subpart D and is consistent with the requirements of 40 C.F.R. § 257.102(b) for closure of coal combustion residuals landfills. The information contained in this plan will be used to assist Duke Energy Kentucky, Inc. (Duke Energy) in the closure of the active waste unit. A summary of the Revisions to this Plan are as follows:

- October 2016 Original Plan
- August 2019 Revision 1 - allowed for use of, either, a soil cover system or a Closure Turf system as final cover.
- July 2020 Revision 2 – Limits use of Closure Turf to downdrains only.

The East Landfill is owned and operated by Duke Energy. The landfill is located along the Ohio River, near the town of Rabbit Hash in Boone County, Kentucky on Duke Energy property. The East Landfill is located northeast of the plant, south of SR 338, north of the Ohio River and west of Lick Creek. The general location of the landfill is depicted on Vicinity Map included as Plate 1 attached to this Plan. This Closure Plan includes a written certification from a qualified professional engineer, licensed in the Commonwealth of Kentucky, that this written Closure Plan meets the requirements of 40 C.F.R. § 257.102.

The East Coal Combustion Residual Landfill is permitted through the Kentucky Department of Environmental Protection via 401 KAR 46. Waste disposal is limited to coal combustion residual material.

The landfill was designed with 16 phases. Approximately 107 acres of the 162 acre landfill was closed incrementally prior to October 19, 2015 as final grades were achieved. This Closure Plan addresses the final approximately 55 acres which remained active after October 19, 2015. The limits of the remaining active area are depicted on Plate 2 attached to this plan.

### 2.0 Closure Plan

#### 2.1 Overview of Closure Approach

The purpose of the Closure Plan is to outline the sequence for closing the landfill consistent with recognized and generally accepted good engineering practices. Closure is designed to minimize the need for long term maintenance and to control the post-closure release of contaminants.

The landfill will be closed with the coal combustion residuals remaining in-place. The facility will be closed in accordance with the requirements of 40 C.F.R. § 257.102. Closure will occur within

the timeframes as stated in 40 C.F.R. § 257.102(f). This Closure Plan may be amended in accordance with the requirements of 40 C.F.R. § 257.102(b)(3).

## 2.2 Estimated Maximum Inventory of CCR

The landfill design provides approximately 23 million cubic yards of disposal capacity. It is anticipated that the full design capacity of coal combustion residual material will be placed prior to closure.

## 2.3 Largest Area Requiring Cover System

Final cover has been constructed on an incremental basis since the landfill first was constructed in the 1980's. Approximately 55 acres of the East Landfill remain to be closed at the time the CCR Rules went into effect on October 19, 2015. This area is identified on Figure 2, included as an attachment to this Plan.

## 2.4 Final Cover System

### 2.4.1 *General*

The design of the final cover system presented herein has been certified under separate cover by a professional engineer as having been completed in accordance with the requirements of 40 C.F.R. § 257.102(d)(3).

### 2.4.2 *Closure Cover System*

The final cover system described in this paragraph was designed to meet the requirements of 40 CFR § 257.102(d)(3)(i). The final cover system installed will consist of:

- ◆ a 6-inch thick vegetated erosion layer;
- ◆ an 18-inch thick soil infiltration layer;
- ◆ a geocomposite drainage layer; and
- ◆ a 40-mil textured linear low density polyethylene (LLDPE) geomembrane.

The system described above will be installed, either, directly on the coal combustion residuals or on partially removed prior installed temporary soil cover

The bottom liner of the landfill consists of either natural soils removed and re-compacted in-place or a composite liner system consisting of a geomembrane and GCL beneath the leachate drainage layer. The proposed cover system has been designed to reduce infiltration into the landfill and to resist erosion.

With the type of waste that has been landfilled and the nature of the fill placement, no decomposition of the waste material is expected, therefore minimal, if any, settlement is expected. Due to the highly elastic nature of the geomembrane and the stable

nature of the waste, the final cover system will accommodate any differential settlement that may occur in the waste during the post closure care period.

### 2.4.3 *Runoff Controls.*

The prior installed downdrains on the landfill are constructed of concrete. Downdrains to be installed as part of final closure may be, either, concrete or a Closure Turf system. Closure Turf downdrains, if installed, will consist of:

- ◆ a 0.75 inch thick layer of sand mixed with cement (HydroBinder®: a proprietary product developed by WatershedGeo);
- ◆ an engineered turf consisting of woven geotextiles tufted with polyethylene yarns;
- ◆ a 50-mil textured LLDPE structured geomembrane with integral drainage layer.

The system described above would be installed, either, directly on the coal combustion residuals or on partially removed prior installed temporary soil cover.

The geomembrane of this alternate system provides an equivalent reduction in infiltration as the systems described in paragraph 2.4.2. The sand ballast layer in conjunction with the woven geotextile layer provide equivalent protection from wind or water erosion as the vegetated erosion layer for the systems described in paragraph 2.4.2.

With the type of waste that has been landfilled and the nature of the fill placement, no decomposition of the waste material is expected, therefore minimum, if any, settlement is expected. Due to the highly elastic nature of the geomembrane and the stable nature of the waste, the downdrain system will accommodate any differential settlement that may occur in the waste during the post closure care period.

### 2.4.4 *Performance Standards*

Closure of the facility will be conducted in a manner that minimizes the need for further maintenance and controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, the post-closure escape of uncontrolled leachate, surface runoff, or waste decomposition products to the groundwater, surface water, or the atmosphere.

The final cover system with run-on and run-off controls will minimize the need for post-closure maintenance. The final slopes of the landfill will promote runoff. Landfill benches and downslope drainage conveyances will convey surface runoff to the existing lined retention basin designed for removal of sediment prior to discharge.

A low-permeability final cover system will be constructed and maintained that minimizes the infiltration of precipitation into the waste mass. By minimizing infiltration, the proposed final cover will minimize leachate generation.

The final slopes of the landfill will not be less than five percent to reduce the potential for ponding.

The CCR unit will be closed in a manner that provides for slope stability to prevent the sloughing or movement of the final cover system. In order to maintain stable slopes for the final cover, the internal and interface friction angle of all the components have been designed to be greater than the slope angle by a margin called the factor of safety. Since the maximum regulatory slopes are 3:1, only materials which exhibit adequate shear strength under the design load cases will be used. To ensure the stability of the final cover system, adequate sub-surface drainage has been provided to prevent the systems from becoming saturated and subject to seepage forces.

The cover system Design Certification includes the analysis demonstrating the stability of proposed cap section during both static and seismic conditions. A factor of safety of 1.5 or greater was utilized for static conditions and a factor of safety of 1.0 or greater was utilized for seismic conditions to guard against slope failure.

## 2.5 Schedule

It is planned to install the final cover system within six months following the beginning of closure construction, unless otherwise approved. If more than six months are necessary, steps to prevent threats to human health and the environment from the unclosed portions of the landfill will be undertaken and a demonstration as to the need for additional time will be placed in the operating record.

In accordance with 40 C.F.R. § 257.102(e), the facility will begin closure activities within 30 days after final receipt of waste, or if the landfill has remaining capacity and there is a reasonable likelihood that the landfill will receive additional wastes, not later than two years after the most recent receipt of wastes. Contractor mobilization will occur during the initial 30 day period after last receipt of waste.

In accordance with 401 C.F.R. § 257.102(g), no later than the date on which closure of the landfill is initiated, a notification of intent to close will be prepared, which includes the certification by a qualified professional engineer for the design of the final cover system as required by § 257.102(d)(3)(iii).

Closure of this facility is currently anticipated to occur in 2022; however, the actual closure date will be adjusted based on the actual landfill fill date.

A likely schedule for closure activities is as follows:

Timing/Duration	Activity
Prior to last receipt of waste	Permitting, detailed closure design and contractor selection
Initial 30 days after last receipt of waste	Mobilization of contractor
Months 0-1 after beginning construction	Grading/partial removal of temporary cover
Months 1-4 after beginning construction	Placement of flexible membrane liner, drainage layer, and soil protective layers
Months 4-5 after beginning construction	Installation of diversion berms and downslope conveyances
Months 5-6 after beginning construction	Seed, fertilize, and mulch

Following closure construction, a closure certification report will be prepared in accordance with 40 C.F.R. § 257.102(f)(3). The certification report will be prepared by a qualified professional engineer and verify that closure has been completed in accordance with this Closure Plan and 40 C.F.R. § 257.102.

### 3.0 Deed Notation

In accordance with 40 C.F.R. § 257.102(h), within 30 days following completion of closure of the landfill, Duke Energy will record a notation on the deed to the landfill property stating that the property has been used as a landfill and its use is restricted under the Post-Closure Plan and the post-closure care requirements as provided by 40 C.F.R § 257.104(d)(1)(iii).

In accordance with KRS Chapter 382.337, Duke Energy will file an affidavit with the Boone County Clerk of Courts to supplement the information contained in the deed for the parcel on which the landfill is located. The affidavit will identify:

- ◆ Waste placement limits.
- ◆ Period of landfill operation.
- ◆ Types of wastes in the landfill.
- ◆ Require that approval from the Solid Waste Branch be obtained prior to excavation on the cover system beyond that required for routine maintenance.
- ◆ Name, address, and signature of person who prepared the affidavit.

A copy of the affidavit will be submitted to the Kentucky Solid Waste Branch as part of the documentation of closure activities.

Within 30 days of recording the notation, Duke Energy will prepare a notification stating that the notation has been recorded and placed into the facility's operating record. Pursuant to 40 C.F.R. § 257.106(d), Duke Energy will send the appropriate regulatory agency the notification of intent to close, notification of closure completion, and notification deed notation, within 30 days of placing each such notification in the operating record.

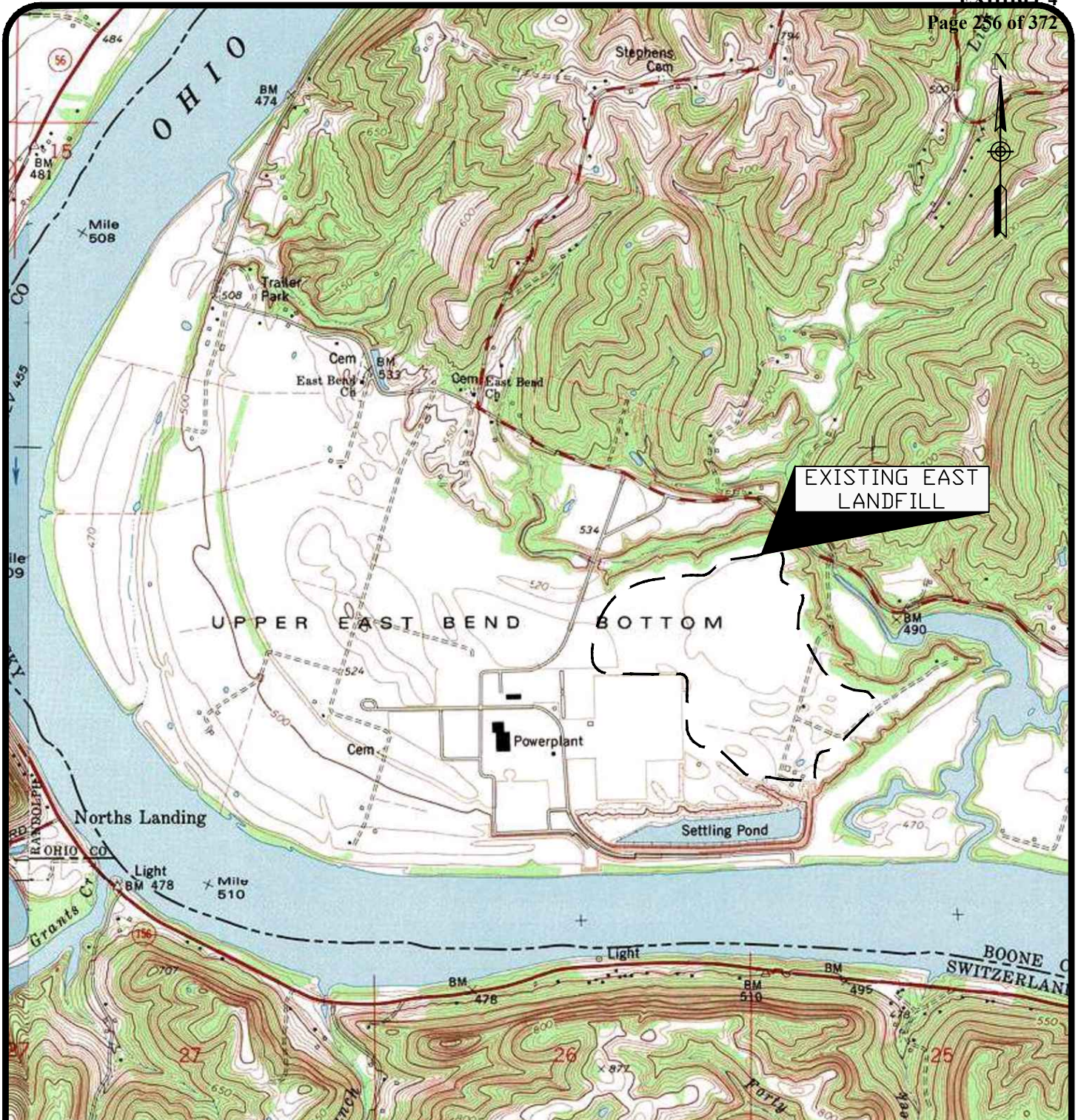
#### 4.0 Qualified Professional Engineer Certification

I, Jason D. Ross, being a registered Professional Engineer, in accordance with the Commonwealth of Kentucky's Professional Engineer's Registration do hereby certify to the best of my knowledge, information, and belief, that the information contained in this report dated July 29, 2020 was conducted in accordance with the requirements of 40 C.F.R. § 257.102, is true and correct, and has been prepared in accordance with recognized and generally accepted good engineering practices.

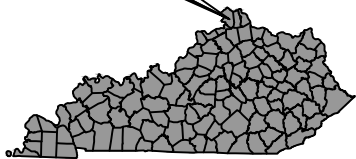




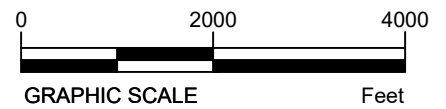
## **CLOSURE PLAN ATTACHMENTS**



Project Location  
Boone County, Kentucky



USGS Mapping:  
Rising Sun Quad



SCALE:	1:2000
DATE:	8-2-2016
DRAWN BY:	DCV
PROJECT NO:	7217-14-004R



**LOCATION MAP  
 EAST LANDFILL CLOSURE PLAN**

EAST BEND STATION  
 BOONE COUNTY, KY

FIGURE NO.

**1**

Drawing path: T:\Resources\Energy\Power Plant Project Data\Multi-Project Docs\_EBS\CADD\7217-17-004D\7217-17-004D-CCR-Cover.dwg



FINAL COVER INSTALLED PRIOR TO 2015, 103.9 ACRES. FINAL COVER PER 401 KAR 45 PERMIT AND PREVIOUS PERMITS AS DISCUSSED IN CONSTRUCTION PROGRESS REPORT

FINAL COVER NOT INSTALLED AS OF OCTOBER 19, 2015, 55.3 ACRES. FINAL COVER TO CONFORM TO 401 KAR 46 PERMIT REQUIREMENTS

FINAL COVER INSTALLED 2015, 2.8 ACRES. FINAL COVER PER 401 KAR 45 PERMIT



*Jason D. Ross*

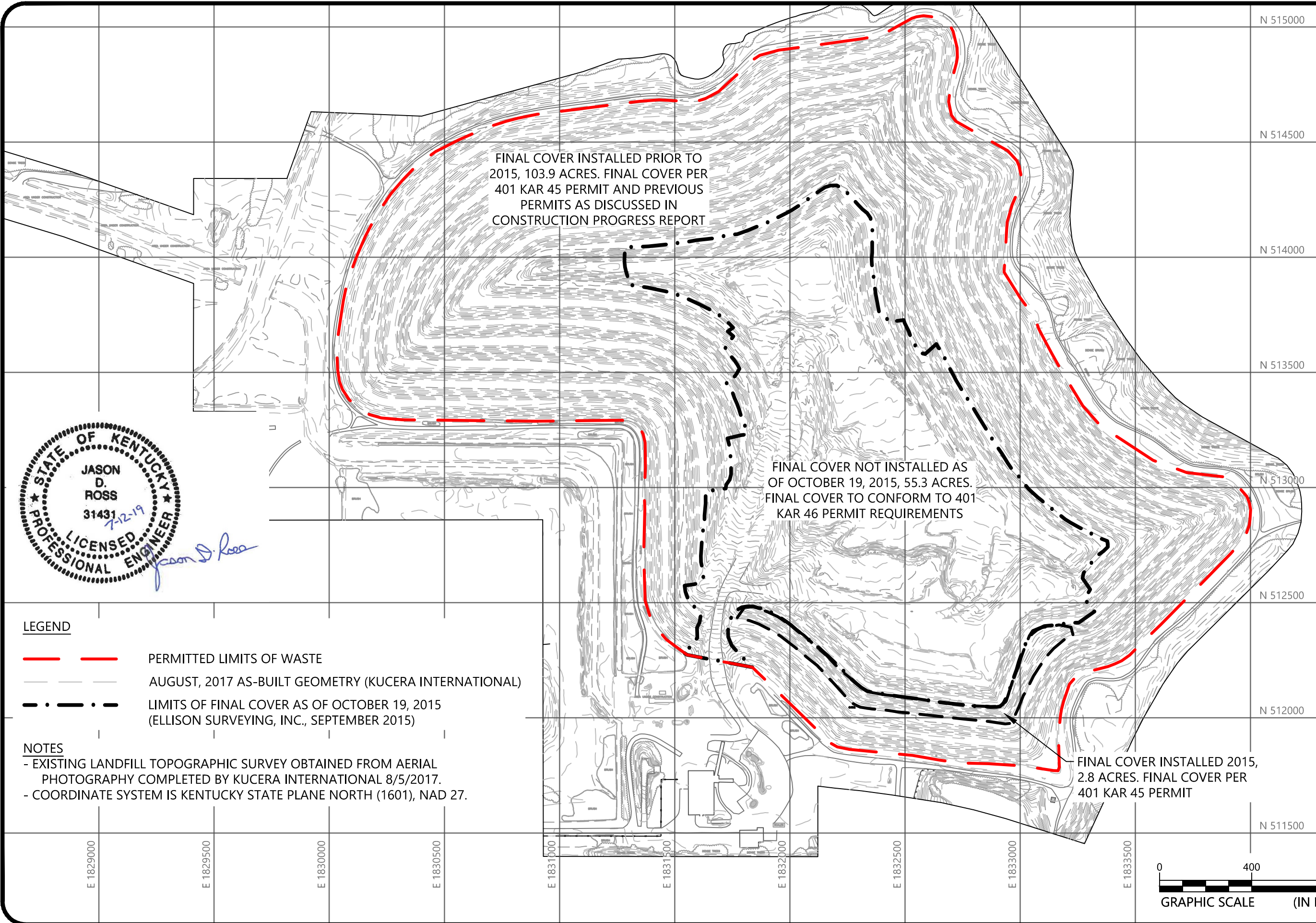
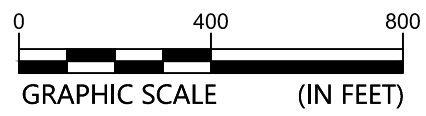
- LEGEND**
- PERMITTED LIMITS OF WASTE
  - AUGUST, 2017 AS-BUILT GEOMETRY (KUCERA INTERNATIONAL)
  - LIMITS OF FINAL COVER AS OF OCTOBER 19, 2015 (ELLISON SURVEYING, INC., SEPTEMBER 2015)

- NOTES**
- EXISTING LANDFILL TOPOGRAPHIC SURVEY OBTAINED FROM AERIAL PHOTOGRAPHY COMPLETED BY KUCERA INTERNATIONAL 8/5/2017.
  - COORDINATE SYSTEM IS KENTUCKY STATE PLANE NORTH (1601), NAD 27.

**FINAL COVER SITE PLAN**

FINAL COVER CONSTRUCTION PROGRESS REPORT, 1981-2015  
EAST BEND STATION, EAST LANDFILL  
BOONE COUNTY, UNION, KENTUCKY

SCALE:
GRAPHIC
DATE:
7/12/19
PROJECT NUMBER
7217-17-004D
FIGURE NO.



**APPENDIX 4**

**BEST MANAGEMENT PRACTICES**

**EAST BEND STATION**

**EAST LANDFILL**

**BEST MANAGEMENT PRACTICES/  
POLLUTION PREVENTION PLAN  
DUKE ENERGY  
EAST BEND STATION**

Duke Energy, Kentucky  
East Bend Station  
6293 Beaver Rd.  
Union, Kentucky 41091

4/18/2017

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## **BACKGROUND & STATEMENT OF BMP POLICY & OBJECTIVES**

### **Overview of Facility Operations**

The East Bend Station is a coal-fired steam electric power plant. The station produces electricity by means of converting potential chemical energy of fuel into electrical energy. Fuel is used to heat the boiler, which produces steam that expands through the turbine causing it to spin. This motion also spins the generator causing a magnetic field hence creating electricity. A plant water balance is included in Appendix D.

### **Regulatory Background**

The NPDES permit for Duke Energy East Bend Station (KPDES Permit No. KY0040444), contains a condition that requires the Station to prepare and implement a best management practices/pollution prevention plan (BMP3). The BMP3 must be prepared in accordance with good engineering practices and identify potential sources of pollution that may reasonably be expected to affect the quality of storm water and wastewater discharges from the East Bend Station. The BMP3 also describes and ensures the implementation of best management practices that will be used to reduce the pollutants in station discharges and to assure compliance with the terms and conditions of the NPDES permit.

### **Purpose of the Best Management Practices/Pollution Prevention Plan**

The purpose of this best management practices/pollution prevention plan (BMP3) is to focus operating personnel at East Bend Station on potential sources of water pollution and to control those sources to eliminate or minimize the risk of water pollution. As the name implies, the emphasis of the BMP3 is towards pollution prevention.

### **Key Elements of the Best Management Practices/Pollution Prevention Plan**

1. Identification of potential sources of storm water and waste water pollution at the East Bend Station and an evaluation of their significance;
2. Where required, management of potential pollution sources by the implementation of best management practices; and
3. Review of the physical site, operations and BMP3 at least annually to insure that the management controls (i.e., BMPs) are still effective and that the BMP3 is up to date.



Due to the nature of electric production operations, changing economic conditions, chemical substitutions, changes in operations, management and personnel changes, and a variety of other factors, the BMP3 must be a dynamic plan to remain an effective tool in minimizing waste and storm water pollution. It must be updated at least annually to ensure that the plan achieves what it was designed to accomplish – prevention of waste and storm water pollution.

### **Best Management Practices/Pollution Prevention Plan Distribution**

Site Environmental Field Professional's office  
Document Control Center  
Corporate CCP Environmental Services

### **Statement of Corporate Policy**

Duke Energy requires full compliance with all laws and regulations at each of its facilities, including the provisions of the Clean Water Act. It is the policy of Duke Energy that no pollutant will be discharged from its facilities to surface waters unless the discharge occurs in compliance with a current NPDES permit. Further, the facility will adopt reasonable practices to ensure that chemical products, oils, and other materials used or stored on-site will not be inadvertently discharged to surface waters as a result of accidental spills or storm water conveyance.

**BEST MANAGEMENT PRACTICES/ POLLUTION PREVENTION PLAN CERTIFICATION**

Facility Name: Duke Energy, Kentucky – East Bend Station  
Facility Type: Coal-fired Steam Electric Power Generating Facility  
Facility Address: 6293 Beaver Rd.  
Union, Kentucky 41091

Designated person who will be accountable for Storm water Pollution Prevention at this facility:

Craig Daniels, Site Environmental Field Professional

I certify under penalty of law that this document and all attachments were prepared under my direction of supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for known violations.

Gary Cook 4-18-17  
Gary Cook Date  
Station Manager

Engineer Certification  
Signature Nick Seller  
Printed name Nick Seller  
Job Title TECHNICAL SUPT  
Date 4/18/17

## **SECTION 1**

### **BEST MANAGEMENT PRACTICES/POLLUTION PREVENTION COMMITTEE**

The purpose of the best management practices/pollution prevention committee is to develop and implement this BMP3. The committee's goal is to prevent or minimize the introduction of pollutants from station operations to the Ohio River.

Members of the committee shown below were selected because each of them satisfied one or more of the following criteria:

- Position of authority to implement provisions of the BMP3
- Scope of the BMP3 is within the range of assigned duties
- Knowledgeable of plant operations
- Familiar with the facility's present and past operations and waste management practices

Table 1-1 lists the individuals who comprise the BMP3 committee, and a list of their individual responsibilities as members of the committee. Job titles of committee members include: Station Manager, Environmental Coordinator, Production Manager, CCP Environmental Permitting and Compliance Specialist and Laboratory Technician(s). Based on the size and complexity of the facility, this committee is sufficient to ensure the BMP3 is developed and implemented.

Communication, in addition to the selection of the proper committee members, is an important factor in ensuring the BMP3 is successful and continues to improve along with dynamic station operations. The make-up of the committee addresses all aspects of the BMP3, and its size will not pose a problem scheduling regular BMP3 meetings. Also, with the close interaction of station personnel, regular, informal contact will further strengthen the lines of communication. The committee will utilize other plant personnel, as needed, to gather information or accomplish tasks related to the BMP3.

The committee meets annually to discuss the BMP3 and address action items as identified by the committee leader. The committee leader may request additional meetings depending on the number and complexity of the action items. Prior to each scheduled meeting the committee leader or his or her designate will prepare a meeting agenda to ensure all critical items are discussed. If the committee leader cannot make a scheduled meeting he or she will ensure one of the alternates listed in the BMP3 will be available. If a committee member cannot attend he or she will make all reasonable efforts to secure a competent substitute for the meeting. Any major items from this

meeting are found in the inspection report in Appendix C. This annual meeting will follow the annual storm water inspection by the committee leader and an environmental services representative. The findings from this inspection will be discussed at the annual meeting. The committee will also discuss any spills or BMP excursions, which have occurred over the past year.

Appendix B is a contact list for current members of the BMP3 Committee.

**TABLE 1-1 BMP3 COMMITTEE AND RESPONSIBILITIES**

Job Title	Role	Responsibilities
Site Environmental Field Professional	Committee Leader	<ul style="list-style-type: none"> <li>• Perform initial site assessment</li> <li>• Identify pollutant sources and risks</li> <li>• Specification of BMPs with input from committee</li> <li>• Establish spill emergency procedures and reporting requirements</li> <li>• Develop and Implement (BMP3)</li> <li>• Schedule and chair committee meetings</li> <li>• Assist other committee members, as needed, to implement, maintain, and revise the BMP3</li> <li>• Facility contact for outside inquiries concerning BMP3</li> <li>• Review inspection reports and follow up action items.</li> <li>• Schedule and participate in the annual comprehensive site compliance inspection</li> <li>• Evaluate effectiveness of BMP3 by conducting periodic inspections</li> </ul>
CCP Environmental Field Professional		<ul style="list-style-type: none"> <li>• Assist in implementation of BMP3</li> <li>• Assist in identification of pollutant sources and risks; Serve as liaison to CCP operating groups and gives input on CCP projects which may affect BMP3</li> <li>• Follow up on inspection report action items related to CCP projects</li> <li>• Serves as backup for Site Environmental Professional for outside inquiries concerning BMP3</li> <li>• Support Team Leader as requested</li> <li>• Participate in annual site compliance inspection</li> </ul>
Station Manager	Member	<ul style="list-style-type: none"> <li>• Participate in committee meetings</li> <li>• Review action item list and provide resources needed for completion.</li> </ul>
Production Manager	Member	<ul style="list-style-type: none"> <li>• Provide input to development of spill emergency procedures</li> <li>• Participate in committee meetings</li> <li>• Alternate facility contact</li> <li>• Provide assistance and follow-up as necessary to ensure that action items from the inspections are completed on</li> </ul>

		schedule.
CCP Environmental Permitting and Compliance Specialist	Primary Alternate for Committee Leader	<ul style="list-style-type: none"> <li>• Serve as Team Leader in his/her absence</li> <li>• Participate in annual compliance inspection</li> <li>• Participate in committee meetings</li> <li>• Senior reviewer of BMP3</li> <li>• Provide technical/regulator advise to Team Leader</li> </ul>
Laboratory Technicians	Members	<ul style="list-style-type: none"> <li>• Assist in implementation of BMP3</li> <li>• Assist in identification of pollutant sources and risks</li> <li>• Support Team Leader as requested</li> <li>• Perform sampling and inspections of storm water outfalls and equipment inspections.</li> <li>• Participate in annual site compliance inspection</li> </ul>

**SECTION 2**  
**RISK IDENTIFICATION AND ASSESSMENT**

**2.1 Pollutant Sources for Storm Water Outfalls and Existing Control Measures**

<b>Outfall</b>	<b>Pollutant Sources</b>	<b>Control Measures</b>
<b>Outfall 001</b>  <i>NPDES Permit No. KY0040444</i>	East Scrubber sludge landfill runoff	<p>The maximum active landfill area is 55 acres based on current management practices (limits the contact area for storm water runoff).</p> <p>Scrubber sludge is fixed with fly ash/lime (minimize the metals concentration in the leachate).</p>
	Runoff from portions of the closed, inactive landfill (contains fixed scrubber sludge)	Inactive landfill areas vegetated to minimize soil erosion.
	Coal pile runoff (internal Outfall 010)	Diversion ditch around the coal pile (controls runoff and conveys it to the ash basin).
	Gasoline aboveground storage tank runoff	The gasoline aboveground storage tank area includes a concrete secondary containment structure and storm water runoff is collected and treated with an oil/water separator prior to discharge to the ash basin.
	Fertilizers and pesticides on agricultural land prior to landfill expansion	Licensed contractors used for fertilizer/pesticide application; they follow current laws.
	Coal conveyer runoff	The coal conveyer catch basin receives storm water runoff for solids control prior to discharge to the ash basin.
	Storm water runoff	Concrete dikes are used to control storm water runoff in the cooling tower area and the water treatment area.
	Dewatering, ash removal and repurposing activities have the potential to add pollutants from interstitial water in the ash basin.	<p>Ash basin dewatering for the free water with low TSS (targeting &lt;24 mg/L) will be pumped directly to the Ohio River at location of 001 discharge. Approved polymer logs and sediment curtains will be utilized as needed to control TSS as the level of the pond is lowered and therefore retention time is reduced. Once interstitial water level is reached (TSS &gt; target 24 mg/L), water will be processed through the new Holding Basin where it can be treated with polymer to aid in the TSS removal.</p> <p>Temporary diesel pump set up for dewatering. The pump and tank will have containment and be inspected daily. These will be replaced with electric pumps once an electric feed is installed to the area(s).</p>
	West Landfill sedimentation pond discharge to the ash basin	<p>The maximum active landfill area is 55 acres based on current management practices (limits the contact area for storm water runoff).</p> <p>Scrubber sludge is fixed with fly ash/lime (minimize the metals concentration in the leachate).</p> <p>Settling time in the sedimentation pond prior to pumping to the ash basin where additional treatment</p>

		will occur prior to discharge at Outfall 001.
	Bottom ash pyrites and economizer fly ash sluice water	Discharges directed to the ash basin for settling.
	Miscellaneous plant drains	
	Cooling tower blowdown (internal Outfall 010)	
	Sanitary wastewater (internal Outfall 007)	
	Demineralizer regeneration water	
	Metal cleaning waste (internal Outfall 008)	
<b>Outfall 003</b>  <i>NPDES Permit No. KY0040444</i>	Closed cooling water heat exchanger by-pass water	Storm water does not influence this outfall.
<b>Outfall 013</b>  <i>NPDES Permit No. KY0040444</i>	Exterior embankment of the ash basin	Embankment of ash basin is vegetated to minimize soil erosion.
	Ash basin water (Outfall 001) release from external discharge line (temporary placement during maintenance/repairs to ash basin)	Embankment of ash basin is vegetated to minimize soil erosion.
	Generator/tanker truck diesel oil (temporary placement during dewater, ash removal and repurposing of the ash basin.	Generators include secondary containment for fuel oil reservoirs. Absorbents staged nearby during refueling from tanker trucks.
	Potential for hose leak from dewatering operation if/when the discharge hose is placed outside the footprint of the existing basin.	Contingency plan in place for this event which involves immediately stopping the pumping operation and remediating the problem.
<b>Outfall 014</b>  <i>NPDES Permit No. KY0040444</i>	Fuel oil No. 2 aboveground storage tank and the fly ash silo.	A lined earthen dike (secondary containment) used to control storm water runoff from the fuel oil tank area.  Outfall has sorbent socks in the event trace amounts of oil are present in the discharge.
	Liquid fertilizers/pesticides used once per month as needed.	Licensed contractors used for fertilizer/pesticide application; they follow current laws.
	Equipment containing lime slurry in varying degrees of density.	Systems maintained to minimize discharge to storm water.
	The cooling tower blowdown valves (drain the cooling tower in the event of a unit outage or to adjust the cooling tower level discharge to this outfall).	Outfall 014 is monitored on a quarterly basis for station NPDES permit (flow, total suspended solids, oil and grease, hardness, pH, Total Recoverable metals.)
	Ammonia storage tank, vaporizer skids, and associated piping.	Secondary containment around storage tank.  Systems maintained to minimize discharge to storm water.  Outfall 014 is monitored on a quarterly basis for station NPDES permit (flow, total suspended solids, oil and grease, hardness, pH, Total Recoverable metals.)

<b>Outfall 015</b>	Fly ash precipitator, Trona	Runoff directed to holding area; determined to be non-polluted or pumped to building sump.
	Lime unloading area	A large portion of the drainage area vegetated; low-lying areas have brush and trees (nonstructural controls minimize soil erosion and filters any runoff solids).
	Nitrogen farm, parking lots	
	Liquid herbicides used as needed.	Licensed contractors used for herbicide application; they follow current laws.
<b>Outfall 016</b>	Lime silo.	Outfall 016 drainage area is vegetated to minimize soil erosion and acts as a filter for any runoff solids.
	Service water (river water).	
<b>Outfall 017</b> <i>Landfill surface-water-monitoring program</i>	Runoff from a portion of the closed, inactive landfill (contains fixed scrubber sludge).	Inactive landfill areas vegetated to minimize soil erosion.  Outfall monitored for the landfill surface water monitoring program on a semi-annual basis (flow, pH, chlorides, sulfate, iron, sodium, organic carbon, COD, specific conductivity, TSS and TDS).



## 2.2 Storm water Map

The storm water map, Appendix A, includes drainage areas that would predict the direction of flow in the event that there was a spill in one of these areas.

## 2.3 Materials Inventory and Risk Assessment

A Safety Data Sheet (SDS) database is kept for the company. SD sheets for chemicals at East Bend station can be accessed on the Duke Energy web site. Chemicals that are purchased are tagged with SD sheet required status and the material cannot be received and issued out until the SD sheet has been verified in the system.

The purchase of chemicals not already in use at East Bend requires the approval of Corporate Environmental Services to ensure it will not pose an unnecessary risk to East Bend personnel or the environment.

East Bend, as required under EPCRA regulations, files a SARA-Section 312 (EPCRA 312), annual chemical inventory report. A map of the site is included with this inventory detailing the location of these chemicals on the plant site. The EPCRA 312 inventory report is also sent to the local fire departments to assist them in the event they respond to the station.

### *Hazardous and Toxic Chemicals*

<b>Chemical</b>	<b>Average Quantity</b>	<b>Location, Direction &amp; Rate of Flow If Spilled</b>	<b>Risk of Release to Surface Water</b>
Anhydrous ammonia	150,000 lbs.	Ammonia storage tank, pipes, equipment, & vaporizer skid; tank would spill into containment; all spills would rapidly vaporize to air	L (tanks in containment, will evaporate if released)
Bituminous Coal	200,000 tons	Coal pile, mills, conveyer, unloader, & bunkers; spill during unloading would fall to river, spill from conveyor to bank or storm drain	H (incidental spillage)
Coal fly and bottom ash	200,000 tons	Precipitators, hoppers, WSP fly ash silo, main plant fly ash silo;	M (incidental spillage)
Carbon dioxide	18,000 lbs.	Storeroom #30 tank house, SE ash pond dike, basement, main steam plant; release to atmosphere	L/none (stored as gas)
Caustic soda	125,000 lbs.	Demineralizer caustic tank, storeroom #30, building #1, demineralizer caustic day tank, main plant lab; building sumps to ash pond	M (floor drain goes to building sumps to ash pond)

Diesel Fuel No. 2	300,000 gallons	Landfill garage, diesel fire pump fuel tank, main fuel oil storage tank, fuel oil day tank, Boone (station tugboat), generator reservoirs for pumping ash pond water (temporary); spill to secondary containment, then storm drain to river	M (high volume, but secondary containment)
Lime	7,000 tons	FGD day bin, FGD lime silo, WSP lime silo, unloader, conveyers; spill to river during unloading, spill from conveyor to bank or storm drain	H (incidental spillage)
Hydrazine	23+2576+5160 =8,000 LBS	Warehouse, , Storeroom #30, building #1, demineralizer room; spill to containment, then building sump to ash pond	L (floor drains to sump to ash pond)
Nitrogen	5,062 lbs.	Nitrogen farm; release to atmosphere	L/none (stored as gas)
Polymer (exact chemical to be determined, future use)	Amount TBD 5-50 ppm, TSS dependent	The permanent location of the chemical feed building (polymer only) is identified on the Temporary WR Phase drawings. Feed location will be in the Boiler Sump discharge line, just ahead of the split in the line directing water to the Holding Basin. This will provide same feed point for either flow direction. See sheet SKC012	
Sulfur molten	45,000 lbs.	FGD slaker building; spill inside building to sump, solidifies when released	L (solidifies when released)
Sulfuric acid (70-100%, 98%, 15-40%, concentrate)	92+23+15+5+208565+10+6,098=15,000 lbs.	Batteries, main plant, fire pump house, main plant lab, storeroom #30 building #1, warehouse, demineralizer acid day tank, demineralizer acid tank, cooling tower acid tank, waste stabilization plant; spill to containment or building sumps to ash pond, or to cooling tower to ash pond	M (drains to sump to ash pond)
Trona T-50, T-200	50 tons	Trona silo; spill to containment ditch	L (incidental spillage to containment ditch)

#### 2.4 Ash basin Dewatering, Ash Removal and Repurposing

Dewatering operations were approved by KDEP in a letter dated October 17, 2016. This letter will need to be renewed every 90 days until a permit modification has been received. In December 2016, the bottom ash divider dike between the East and West halves of the pond was breached

returning the pond to one continuous area. This allowed gravity dewatering to begin in the West portion so that ash removal could begin. In spring 2017 the dewatering of the pond will begin by lowering the pond level by 10 feet so that ash can be transported to the West Landfill as drainage layer for cell 1. This will allow for further dewatering of the ash in the West side of the pond for removal of the ash and installation of the sheet pile wall. After this wall has been installed and flows to the West side have been rerouted to the East the ash removal, lining and repurposing as the West Retention Basin (WRB) can continue. This work should be completed in fall 2018. During this timeframe, the Holding Basin construction will be completed and the Holding Basin put into service in spring 2018. Bottom Ash sluice water will have also ceased during the spring of 2018, resulting in a reduction of overall solids and flow volume to the basin.

Once the WRB is complete, the eastern portion of the Ash basin will be taken out of service for dewatering, ash removal, lining and repurposing as the East Retention Basin (ERB). This work will be initiated in spring 2019 and should be completed in summer/fall 2020. The complete dewatering plan is contained in Appendix F.

Because the overall pond level is being lowered by 10 feet and held at that level until work on the East half begins, the discharge line will need to be run along the dike wall or within the concrete ditch at the base of the dike in order for the dewatering operation not to interfere with earthwork that is on-going. In the event that the discharge pipe is located outside the basin footprint the following contingency plan will be in place.

The temporary discharge line will not have secondary containment and will be located on the south face of the ash basin diking, directly uphill from the river. It will be exposed to freezing ambient temperatures over the period of use. In the event of a break or leak in the line, ash basin water discharging from the leak may erode soil on the diking or river bank, and may reach the river at a location other than the permitted outfall. Should this happen, East Bend personnel will take the following steps:

1. Immediately discontinue pumping to stop the discharge.
2. Quickly assess the release. If the discharge has been in sufficient quantity to reach the river, notify KDEP Division of Water. If the release has involved ash basin water gushing to the river, immediately notify KDEP using the state's 24-hour number for environmental emergencies: (800) 928-2380.
3. Promptly repair the piping to return the discharge line to good working condition.

4. Characterize impacts and damages from the release, and assess actions necessary to mitigate environmental harm, or repair erosion to the ash basin diking or slope.

Portable diesel generators will be present during this project to provide power for the ash basin pumps, and these generators will be periodically resupplied with diesel fuel transferred from a tanker truck. Oil absorbents will be available during fuel transfers to capture drips from hose connections. Any spillage will be promptly cleaned up to remove all residual oil. Should an oil spill occur from a generator or tanker truck to the river, the event will be immediately reported to federal and state agencies as outlined in the SPCC Plan.

Construction storm water management practices (see section 5.2) will be employed to minimize any discharge of soil that may be disturbed during the ash removal and lining of the basin sections.

## **2.5 Hazardous Waste & PCB Management**

### *Hazardous Waste*

The East Bend site includes various satellite collection areas for temporary storage of drums containing hazardous waste. These are all located inside buildings and enclosed within self-contained storage cabinets, providing protection from precipitation and secondary containment against leaks and spills. Consequently, these areas cannot impact storm water or floor drains. Each accumulation area is inspected weekly in addition to examinations conducted as part of the regular storm water inspections described in section 7.1.

### *PCBs*

East Bend is designated as a PCB free station. All transformer oil containing PCBs has been replaced with non-PCB oil.

## **2.6 Landfill Management**

East Bend has a landfill used for disposal of stabilized FGD sludge. Storm water from the active portion of the landfill drains to the station's ash pond in accordance with the station's NPDES permit. Storm water from inactive areas drains to storm water outfall 017, (012 and 019 were re-routed to the active area run-off through the leachate collection system. See Section 6). The potential for contamination of this storm water outfall is minimized through material stabilization, landfill construction techniques and storm water monitoring. The sludge is stabilized with fly ash and lime to create Poz-O-Tec®. Once in place, the Poz-O-Tec® is covered with a layer of topsoil and then seeded to create vegetation that minimizes erosion of the cover and potential storm water

contamination. The station also monitors for potential releases through periodic sampling of storm water runoff from the inactive portion of the landfill and visual inspections of the landfill. In the event of a potential release into the storm water runoff from the inactive portions of the landfill is identified, the station will conduct further analysis and characterization to confirm the nature and sources of any release. If a release is identified, the station then will develop and implement and appropriate action to address the cause. Response measures such as replacement of a portion of the soil/vegetation cover or removal of a portion of the land filled material in conjunction with replacement of a portion of the soil/vegetation may be considered. The station added two new landfill cells to accept “off-spec.” gypsum from the Miami Fort station. These two new cells have a different design than the old cells, including a synthetic liner, a drainage layer, and leachate collection system.

#### *New Landfill Construction*

East Bend is in the process of creating a new solid waste landfill on Station property west of the main plant. Construction activities are expected to occur from spring 2015 through fall 2017. The project will include installation of: new landfill Cell 1; an associated sediment pond; permanent and temporary access roads; a 4,000-foot pipeline and access road to convey water from the new sediment pond to East Bend’s existing ash pond; and a soil stockpile for the landfill construction. The new landfill will include a liner system, a leachate collection system, and surface water and contact water collection systems.

Best management practices to protect storm water during landfill construction are summarized in the attached document, Appendix E, “Storm water Pollution Prevention Plan for East Bend Station, Cell 1 Construction”. The earthwork contractor will be responsible for fulfilling the requirements of this landfill construction SWPPP, under direction from East Bend personnel.

## **2.7 Periodically Discharged Process Waters**

East Bend may discharge other process water streams that are not specifically addressed by effluent limitations within the NPDES permit. The following water streams are subject to control through this BMP Plan.

#### *Intake Strainer Backwash*

East Bend withdraws water from the Ohio River at the plant intake, located within the Service Water Building, for use throughout the plant. Strainers (screens) at the intake remove coarse debris from river water; a stream of service air from the plant is used to periodically flush this debris from the screen surface and back into the river.

Leaks may occasionally occur from pumps or piping connections within the Service Water Building. In the event of a leak that could flow from the building and reach a storm water drain or the river, plant personnel will visually inspect the discharge for contaminants (e.g., solids or sediment from erosion). If a contaminant is observed, the plant will take appropriate action to control the discharge, including covering storm drains, or filtering the discharge through straw bales.

#### Fire Protection Water

Water for East Bend's fire protection system is drawn from the cooling tower basin, consisting of service water (i.e., river water that has passed through strainers to remove debris). Fire hydrants are located throughout the property, and these are flushed approximately twice per year to remove sediment and assure functional availability in the event of a fire. Infrequently, a buried water line within the fire protection system may leak or break and flow over the ground surface to plant storm drains (discharging from Outfall 014) or the river. Fire Protection Water is also used for roadway dust suppression by spraying on the roads from a water truck. In the event that water used for dust suppression doesn't allow enough capacity for fire protection the water trucks will be filled by drawing water either from the cooling tower basin or directly from the river. Any release of fire protection water, whether intentional or accidental, will be visually monitored to assure that it does not carry oil or sediments to storm drains or the river. If a contaminant is observed, the plant will take appropriate action to control the discharge, including covering storm drains, or filtering the discharge through straw bales.

#### Purified Water: Filtered, Boiler, and Drinking Water

Water from East Bend's deep wells is passed through sand filters and stored in the Filtered Water Tank, which has a 100-gallon capacity. From this tank, water may be chlorinated and used in East Bend's potable (drinking) water system, or it may pass through the demineralizers to one of the two Condensate (Demin Water) Storage Tanks for use as boiler water. In the event that an overflow occurs from Filtered Water or Condensate Storage Tanks, the water may flow over the ground surface to plant storm drains (discharging from Outfall 014). Ultra-pure boiler water in the form of steam condensate may also leak to the ground from the ammonia skid.

Any release from these sources will be visually monitored to assure that it does not carry oil or sediments to storm drains or the river. If a contaminant is observed, the plant will take appropriate action to control the discharge, including covering storm drains, or filtering the discharge through available filtering media (such as a fabric filter, silt fence, or straw bales).

#### Routine Cooling Water System Maintenance (NPDES permit section (3.2.2.2))

Approximately every one to two years, East Bend must perform routine maintenance on the cooling towers and cooling water system. When this occurs, both the cooling tower basin and circulating lines must be drained. Water in the cooling tower basin drains by its normal path, discharging to the ash pond through Outfall 010. Because the circulating lines are below ground elevation, water in the lines cannot drain to the ash pond. Instead, the plant must drain this water into a storm water line, discharging to the Ohio River via Outfall 014.

Prior to drainage, water in the cooling tower basin will be visually inspected to assure the absence of oil, foam, scum, or discoloration that may be discharged from Outfall 014 to the Ohio River. The cooling water system will not be drained until traces of these pollutants have been removed. During the draining event, the Outfall 014 discharge will be visually inspected to assure there are no adverse impacts to the environment, including erosion of the river bank. If adverse impacts are identified, the draining event will be discontinued until the cause has been resolved (visual assessment).

The discharge water will be sampled at least once during the drainage event, and analyzed to assure that it meets the following criteria. Should analysis show that the discharge has failed to meet the criteria for any of these parameters, East Bend will notify the KDEP Division of Water about the exceedance within 24 hours of discovery. The discharge monitoring results will be maintained at the site for at least three years with other NPDES monitoring records.

<b>Parameter</b>	<b>Average</b>	<b>Maximum</b>	<b>Units</b>
Chromium, total recoverable	0.2	0.2	mg/l
Zinc, total recoverable	1.0	1.0	mg/l
126 Priority Pollutants	No detectable amount (may be demonstrated using engineering calculations as described in 40 CFR 423.43(d)(3))		
Flow	Report	Report	MGD
Temperature	Report	105	°F
pH	6.0 (minimum)	9.0 (maximum)	SU
Total Suspended Solids	Report	Report	mg/l
Oil & Grease	Report	Report	mg/l

### SECTION 3 REPORTING OF BMP INCIDENTS

East Bend Station takes a proactive approach to prevention of spills. The station follows its “Spill Prevention Control and Countermeasure Plan”. This procedure was written specifically to cover potential spills to the Ohio River. However, it is utilized to cover all spills at the station. It also includes information to make any required outside notification (ex. Coast Guard for spills to Ohio River).

The “Spill Prevention Control and Countermeasure Plan” is kept at the station. The plan includes a list of resources available to the plant to deal with a spill. These include resources available on site and leased services that can be called upon when required. The procedure includes a monthly inspection of the plant’s main storm water outfall (014), by the station’s operating group. Other locations checked are the Fuel Oil Tanks, the Dike around Fuel Oil Tank, the Fuel Oil Tank dike drain discharge manhole, the Turbine Oil Tanks, the Turbine Oil Room Sump, the Boiler Room Oil Separator, and the Ammonia Storage area, Vaporizers, and associated piping.

This regular inspection facilitates addressing concerns before they result in discharges to our storm water drains. Problems are handled while they are still contained prior to discharge. Table 3-1 lists some spill scenarios and response procedures for these.



**TABLE 3-1 EXAMPLE SPILL RESPONSE PROCEDURES**

<b>Materials</b>	<b>Example Spill</b>	<b>Response</b>
<u>Liquids</u> Examples: Di-ethylene glycol, Sodium Hydroxide, Sulfuric Acid, Betz Correshield MD 4100, Betz Spectrus CT1300, CT 1103 or NX114, Hydrazine, Emulsified Sulfur, Scrubber Slurry mixture, Dubois Confidence 10, sodium sulfate	Leak, Ruptured Tanker Truck, Ruptured Pipe, Overfill Tank, ruptured drum	1) Observer shall immediately begin notification procedures as described in the "Notification Procedures" section of the SPCC plan. 2) Trained personnel wearing appropriate safety equipment shall contain spill using sorbent materials and proper containment procedures. 3) Trained personnel wearing appropriate safety equipment shall begin clean-up and disposal procedures. 4) If there is an off-site discharge, notify ES immediately so that EPA can be contacted.
<u>Fibers</u> Asbestos	Piping insulation damaged by moving equipment	1) Notify Safety Officer immediately. 2) Safety Officer will ensure that caution tape is installed in the area. 3) Outside contractor notified to patch or remove asbestos. 4) If there is an off-site discharge, notify ES immediately so that EPA can be contacted.
<u>Gases</u> Nitrogen, Hydrogen, Carbon dioxide,	Ruptured tank	1) Observer shall immediately evacuate area and begin notification procedures as described in the "Notification Procedures" section of the SPCC plan. 2) Trained personnel wearing appropriate safety equipment shall immediately begin testing the area using an analyzer until the area is safe to resume working. 3) If there is an off-site discharge, notify ES immediately so that EPA can be contacted.
<u>Solid</u> Coal Fly ash	Ruptured silo	1) Observer shall immediately evacuate area and begin notification procedures as described in the "Notification Procedures" section of the SPCC plan. 2) Trained personnel wearing appropriate safety equipment shall immediately begin testing the area using an analyzer until the area is safe to resume working. 3) Contained fly ash will be disposed of through normal landfill procedures. 4) If there is an off-site discharge, notify ES immediately so that EPA can be contacted.
<u>Liquid</u> #2 Fuel Oil, Transformer Oil, used oil	Leak, Ruptured Tanker Truck, Ruptured Pipe, Overfilled Tank, leaking or ruptured drum	1) Observer shall shut off oil pumping equipment to the tank and begin checking dike drains to verify that they are closed and providing containment. 2) Observer shall begin notification procedures as described in the "Notification Procedures" section of the SPCC plan. 3) All areas where the oil has reached the electric motors should be de-energized. 4) Facility personnel or an Oil Response Contractor will be required to remove standing oil into a suitable oil drum or container. 5) If there is an off-site discharge, notify ES immediately so that EPA can be contacted.
<u>Solids</u> Tri-sodium phosphate, Di-sodium Phosphate, soda ash, HTH powder	Dumped Bags, Dumped Buckets, Ruptured Tank	1) Observer shall immediately begin notification procedures as described in the "Notification Procedures" section of this section of the SPCC plan. 2) Trained personnel wearing appropriate safety equipment shall immediately begin containment. 3) Trained personnel wearing appropriate safety equipment shall begin clean-up and disposal procedures. 4) If there is an off-site discharge, notify ES immediately so that EPA can be contacted.
<u>Liquids</u> Ash pond water	Break in temporary discharge line	1) Observer shall immediately notify the Control Room. 2) Immediately discontinue pumping into the discharge line 3) If there is a water release to the river, notify ES immediately so that KDEP can be contacted.

**SECTION 4**  
**MATERIALS COMPATIBILITY**

Good engineering practices are used on the storage of materials at East Bend. The plant consults relevant and applicable industry standards when designing and operating containers, piping, and pumps. Small containers of flammable liquids, caustics and acids are stored in appropriate protective cabinets. Lab personnel work with storeroom and other plant personnel to make every effort to ensure materials are stored safely away from incompatible materials. Safe storage of materials will be one of the areas looked at during each yearly comprehensive site compliance evaluation.

## SECTION 5 GOOD HOUSEKEEPING

### 5.1 General Housekeeping

East Bend Station staff ensures that good housekeeping practices are promoted and utilized on site. Housekeeping is the responsibility of all station employees to keep their area clean and dispose of waste in a proper manner. The station Facilities Services department which currently consists of four contract employees, maintain both the inside and outside areas of the site. Weed eating and trimming on the riverbank and around the discharges is done as needed. Garbage cans inside of the buildings are emptied daily while outside garbage is picked up and cans are emptied on an as needed basis. Contractors empty the dumpsters on site as they are filled. The station Production Department is responsible for cleaning the unit weekly and ensuring all walkways and passages are easily accessible. Coal spills are swept by the Material Services (coal yard) personnel as needed. This includes an annual PM to clean the riverbank and under the conveyors to take care of any spilled coal from them. Laboratory personnel monitor hazardous waste quantities so that the materials can be analyzed and properly removed from the property. These drums are stored in the Hazardous Waste area until the material is removed. It is the responsibility of each area that changes oil out of equipment to collect the oil in a properly labeled drum and transfer the used oil to the storeroom used oil area for disposal. When a sufficient amount of used oil collects in the area the storeroom personnel contact a used oil recycling vendor to pump out the drums. The storeroom personnel maintain a file of all used oil shipments.

Member of Station Management tour the plant regularly to ensure orderly conditions on site. When an unclean and unsafe situation is observed the appropriate section is notified and cleanup is completed within a reasonable amount of time. The current schedule calls for monthly Environmental/Safety walk downs of different areas of the plant. These walk downs are done at the main plant, FGD system, coal yard, WSP area, warehouses, cooling towers, and unloading areas. The Environmental Coordinator and the Safety Coordinator, and one manager (this rotates through the 5 managers), attend the monthly inspections.

### 5.2 Station Construction Activities

Periodically, as business and operating needs change, construction activities are necessary. This may create a need for disturbance of vegetated areas of the plant property. The department, which is responsible for the construction activity is also responsible for maintenance of the site. House-

keeping and soil maintenance activities (such as silt fence) are required to maintain storm water that is free of contaminants. When large construction projects take place on the site, such as construction of the new landfill, an independent SWPPP including drawings, will be developed and attached as an appendix to this document.

## SECTION 6 PREVENTATIVE MAINTENANCE

The preventative maintenance (PM) program involves inspection and testing of plant equipment and systems to uncover conditions which could cause breakdown or failures with resultant discharge of chemicals to receiving waters. The PM plan for storm water pollution prevention will consist of inspections of all equipment that could potentially pollute the storm water drains and inspection of the outfalls.

The Production Team walks down the site daily; personnel are required to inspect for spots or puddles of chemicals, deterioration or corrosion of equipment and tanks, and leaks in the equipment areas. Production personnel will also be instructed to visually examine the pipes, tanks, and containment areas for malfunctions.

The main plant storm water outfall at East Bend Station is inspected weekly as part of the SPCC inspections. At the time of the visual inspection, production personnel document all work needed to be completed to comply with preventative maintenance requirements.

The station laboratory inspects the outfalls during sampling events. The lab also inspects the outfalls monthly, in addition to the sampling events. During these informal inspections, the station lab documents any of the following: any garbage requiring removal from the area, bushes and weeds around the drains that need trimming, and any obstructions removed from discharge pipes.

Any issues observed during the previously stated inspections will be immediately reported to a Supervisor, who is responsible for writing a work order to ensure the problem is corrected.

Periodic inspections of the landfill are performed by Environmental Services to identify potential sources of leakage to storm water. Any problems detected in the inspection, are reported to the CCP System Owner to be corrected.

Immediately prior to the annual BMP3 committee meeting an inspection of the entire plant site is performed and areas of concern are documented for discussion/action plan development at the meeting (see Section 7.2 for more information on this inspection). Responsibility for follow up on each action is also assigned at that time. Additional meetings are scheduled as necessary until completion of any action items developed at the annual meeting.

## SECTION 7 INSPECTIONS AND RECORDS

### 7.1 Inspections

**Quarterly:** There will be a quarterly inspection of the station's main storm water outfall (014) as part of the sampling process, by the station laboratory.

**Semi-annual:** Station laboratory employees in conjunction with semi-annual sampling events will perform inspections of the remaining storm water outfalls (including Outfall 017). Each inspection will consist of a thorough examination of all tank piping and discharges.

**Annual:** In addition to these inspections, the station will conduct annual comprehensive site compliance evaluations. All outfalls are examined at this inspection (see section 7.2).

Additional inspections for the Ash basin Dewatering, Ash Removal and Repurposing will occur.

**Daily Inspections** (by pump operator): The dewatering process will be inspected as outlined below. A record of the inspection will be documented in the operator logs.

- (1) The pump operator will record the flow rate, fuel level, and basin height.
- (2) Operators will also observe the following:
  - (a) pump, intake and discharge hoses;
  - (b) Pump hoses and connections;
  - (c) Pump operation ;
  - (d) Intake hose and floating weir;
  - (e) Secondary containment and erosion controls, if installed.

The site CCP Environmental Field Coordinator (or designee) will also visually observe the discharge at the outfall, periodically during the dewatering operation. This will be done in coordination with the station lab supervisor/lab technicians.

### 7.2 Comprehensive Site Compliance Evaluation

The purpose of the comprehensive site compliance evaluation is to evaluate the overall effectiveness of the Best Management Practices Plan. Specifically, the site compliance evaluation will allow the inspector to: 1) verify the accuracy of the potential pollutant sources listed in the plan, 2) determine if the drainage map is accurate or needs to be updated to reflect current conditions, 3) verify that the BMPs listed in the plan are properly identified, in place and working,

and 4) identify areas where new controls (i.e. BMPs) are needed so they may be incorporated into the plan.

The Environmental Coordinator, the CCP Permitting and Compliance Specialist, and/or one or more lab technicians will conduct the annual comprehensive site compliance evaluations. These individuals are knowledgeable of all facility industrial operations and BMP3 goals and requirements. The results of this inspection will be reported to plant management, who has the authority to implement recommendations made by the Inspection Team.

The activities planned for the annual comprehensive site compliance evaluation include the following:

1. Inspect storm water drainage areas for evidence of pollutants entering the drainage system.
2. Evaluate the effectiveness of measures to reduce pollutant loading and whether additional measures are needed. This includes a review of all monitoring data from outfalls 014 & 017 for the previous year.
3. Observe structural measures, sediment controls, and other storm water BMPs to ensure proper operation.
4. Inspect any equipment needed to implement the plan, such as spill response equipment.
5. Update the plan as needed.
6. Implement any necessary changes in a timely manner.
7. Prepare a report summarizing inspection results and follow up action, the date of inspection and personnel who conducted the inspection.
8. Identify any incidents of noncompliance or state that the facility is in compliance with the plan.
9. All incidents of noncompliance must be documented in the inspection report. Where there are no incidents of noncompliance, the inspection report must contain a statement that the facility is in compliance with the plan.

Annual Compliance inspection reports will be retained in Appendix C.

### **7.3 Record Keeping**

Any issues found in conjunction with the Preventative Maintenance (PM), including the weekly SPCC inspections, plan can be found through the station computerized maintenance scheduling system (MAXIMO). Records from the Quarterly and Semi-Annual inspections will be kept in the

station laboratory. Records from the Annual inspection are kept in Appendix C of this plan. Records of the Weekly E&SC inspections are kept by the CCP System Owner with the *East Bend Station Landfill Cell 1 Construction Storm water Pollution Prevention Plan*.

The Environmental Coordinator and Environmental Services keep a file of all records of reported spills at East Bend Station. Reporting Procedures are located in the station's SPCC plan under "Notification Procedures". This procedure specifies spill-reporting measures that are to be taken as emergency response to a spill at East Bend Station.

Records are kept for a minimum of three years.



## **SECTION 8**

### **SECURITY**

Security is maintained at the station to ensure that only authorized personnel have access to the plant. The perimeter of the plant is fenced or posted. A security guard on all three shifts staffs the main plant entrance. Station personnel are required to enter the plant through a pass-activated gate for security purposes and for emergency accountability. Anyone who wants access to the plant must first stop at the guard house and inform the guard who their station liaison is. At that point the guard calls the liaison to approve/deny access, this includes all outside visitors and contractors.

## SECTION 9 EMPLOYEE TRAINING

### 9.1 Employee Training

With the development of this Best Management Practices plan, Duke Energy will continue training programs designed to train all non-administrative employees on the contents and goal of the plan. Topics, such as, spill response, good housekeeping, and material management practices will be included in the training program. Completed records for training will be kept in “My Training” on the Duke Portal for a minimum of three years.

All personnel will receive a minimum of introductory training on spill prevention and handling. The emphasis of all of these training classes will be on the prevention of spills. Station personnel must also annually take computer based training entitled “Storm water Pollution Plan.” This training contains the following topics:

- SWPPP
  - Pollutants
  - Regulations
  - Water Quality
  - Prevention
- What you can do
  - Basic Steps
- Site Information
  - Overview
  - Completion

### 9.2 Contract Employee Training

The station hires contract employees for various jobs at the station, especially during times of unit outages and new construction projects. When contract employees are brought to work on the plant property, for the first time, they are required to attend an orientation training that includes discussions of safety and environmental policies at the station.

**EAST BEND BEST MANAGEMENT PRACTICES/POLLUTION PREVENTION PLAN  
APPENDIX**

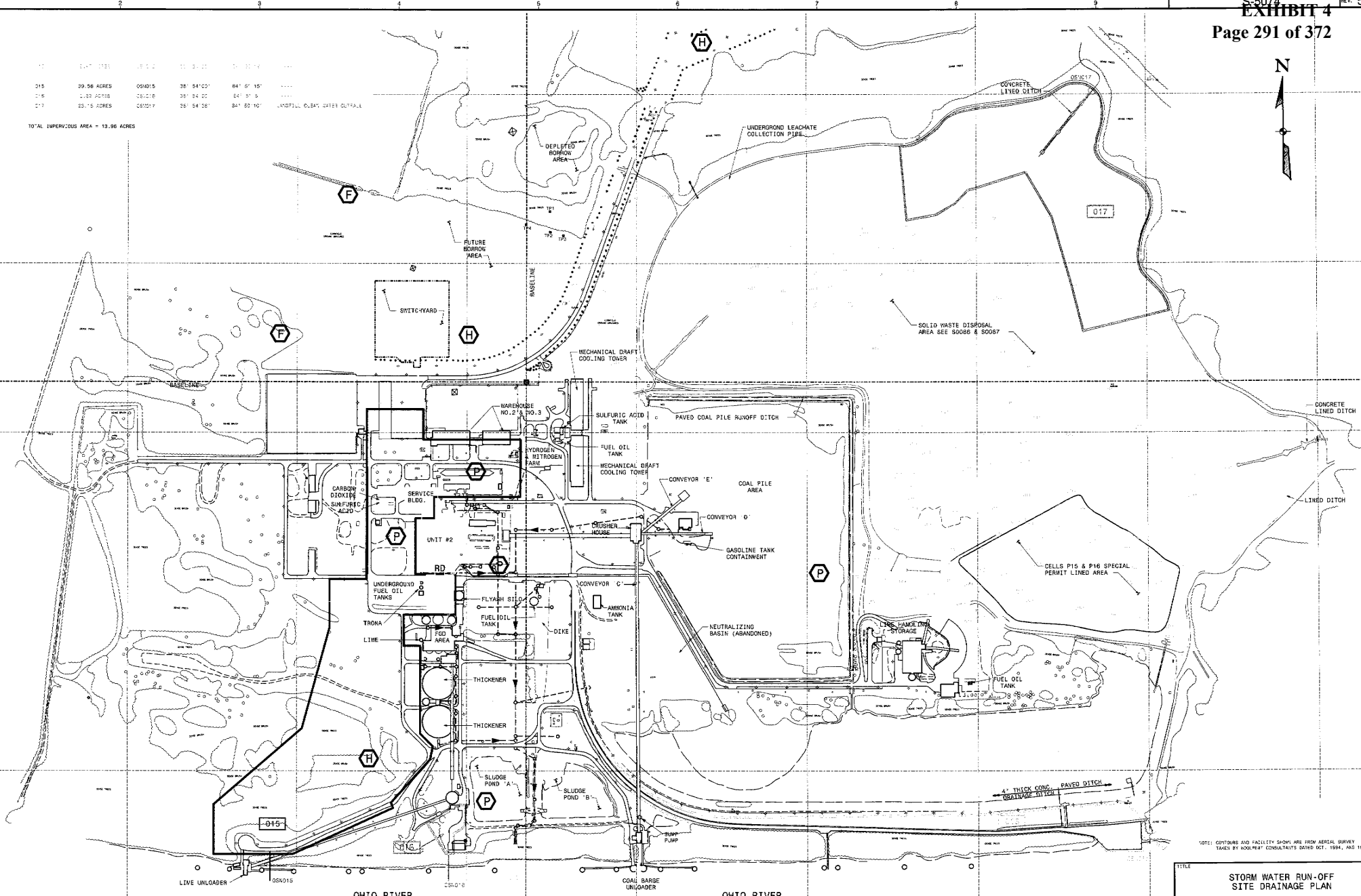
- A East Bend Storm water Map
- B BMP3 Contact List Not applicable to ELF Closure
- ~~C Annual Compliance Inspection Forms/ Annual BMP3 committee meeting minutes~~
- D Plant water balance diagram Not applicable to ELF Closure
- ~~E East Bend Station Landfill Cell 1 Construction Storm water Pollution Prevention Plan~~
- ~~F East Bend Ash basin Dewatering, Ash Removal and Repurposing Plan~~ Not applicable to E:F Closure

**APPENDIX A: EAST BEND STORMWATER MAP**



015	39.56 ACRES	05/01/15	38' 34' 00"	84' 0' 15"	.....
016	1.33 ACRES	08/12/16	38' 24' 00"	84' 0' 0"	.....
017	23.75 ACRES	08/12/17	38' 54' 30"	84' 50' 10"	LANDFILL CLEANS WATER OUTFALL

TOTAL IMPERVIOUS AREA = 13.96 ACRES



NOTE: CONDITIONS AND FACILITY SHOWN ARE FROM AERIAL SURVEY TAKEN BY "NOVA" CONSULTANTS DURING OCT. 1994, AND 1997.

OHIO RIVER

OHIO RIVER

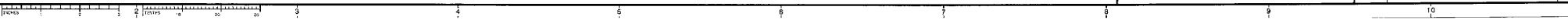
**LEGEND**

- (P) PESTICIDES
- (F) FERTILIZERS
- (H) HERBICIDES
- RD ROOF DRAIN
- IMPERVIOUS ROADWAYS
- IMPERVIOUS AREA
- STORM SEWER

**REFERENCES:**

- S-60 STORM SEWER PLAN
- S-60A STORM WATER PIPE RELOCATION PLAN

TITLE		STORM WATER RUN-OFF SITE DRAINAGE PLAN	
FOR		EAST BEND STATION - UNIT 2	
		SCALE: 1"=400'	DATE: 7-20-93
REV#	DATE	JOB NO.	PROJECT TYPE
01	05/01/15	05A015	STORM SEWER
02	08/12/16	05A015	STORM SEWER
03	08/12/17	05A015	STORM SEWER
04	08/12/17	05A015	STORM SEWER
05	08/12/17	05A015	STORM SEWER
06	08/12/17	05A015	STORM SEWER
07	08/12/17	05A015	STORM SEWER
08	08/12/17	05A015	STORM SEWER
09	08/12/17	05A015	STORM SEWER
10	08/12/17	05A015	STORM SEWER
11	08/12/17	05A015	STORM SEWER
12	08/12/17	05A015	STORM SEWER
13	08/12/17	05A015	STORM SEWER
14	08/12/17	05A015	STORM SEWER
15	08/12/17	05A015	STORM SEWER
16	08/12/17	05A015	STORM SEWER
17	08/12/17	05A015	STORM SEWER
18	08/12/17	05A015	STORM SEWER
19	08/12/17	05A015	STORM SEWER
20	08/12/17	05A015	STORM SEWER
21	08/12/17	05A015	STORM SEWER
22	08/12/17	05A015	STORM SEWER
23	08/12/17	05A015	STORM SEWER
24	08/12/17	05A015	STORM SEWER
25	08/12/17	05A015	STORM SEWER
26	08/12/17	05A015	STORM SEWER
27	08/12/17	05A015	STORM SEWER
28	08/12/17	05A015	STORM SEWER
29	08/12/17	05A015	STORM SEWER
30	08/12/17	05A015	STORM SEWER
31	08/12/17	05A015	STORM SEWER
32	08/12/17	05A015	STORM SEWER
33	08/12/17	05A015	STORM SEWER
34	08/12/17	05A015	STORM SEWER
35	08/12/17	05A015	STORM SEWER
36	08/12/17	05A015	STORM SEWER
37	08/12/17	05A015	STORM SEWER
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39	08/12/17	05A015	STORM SEWER
40	08/12/17	05A015	STORM SEWER
41	08/12/17	05A015	STORM SEWER
42	08/12/17	05A015	STORM SEWER
43	08/12/17	05A015	STORM SEWER
44	08/12/17	05A015	STORM SEWER
45	08/12/17	05A015	STORM SEWER
46	08/12/17	05A015	STORM SEWER
47	08/12/17	05A015	STORM SEWER
48	08/12/17	05A015	STORM SEWER
49	08/12/17	05A015	STORM SEWER
50	08/12/17	05A015	STORM SEWER



**APPENDIX B: BMP3 CONTACT LIST**

<b>Job Title</b>	<b>Name</b>	<b>Phone (Work / Cell)</b>
Site Environmental Field Professional	Craig Daniels	513 467-4833 / 704 467-7111
CCP Environmental Field Professional	Jonnie Braswell	513 467-4672/ 704 998-8253
Station Manager	Gary Cook	513 467-4840 / 513 218-3017
Production Manager	Mike Boots	513 467-4646/ 513 490-5760
CCP Environmental Permitting and Compliance Specialist	Rhonda Herzog	513 287-3424 / 513 543-0249
Laboratory Technicians	Julie Gripshover	513 467-4849
	Tony Holtgreffe	513 467-4848
	Edgar J. Haynes	513 467-4820
	Kim Peddenpohl (Lab Supervisor)	513 467-4635/513 375-9052

**APPENDIX D: PLANT WATER BALANCE DIAGRAM**

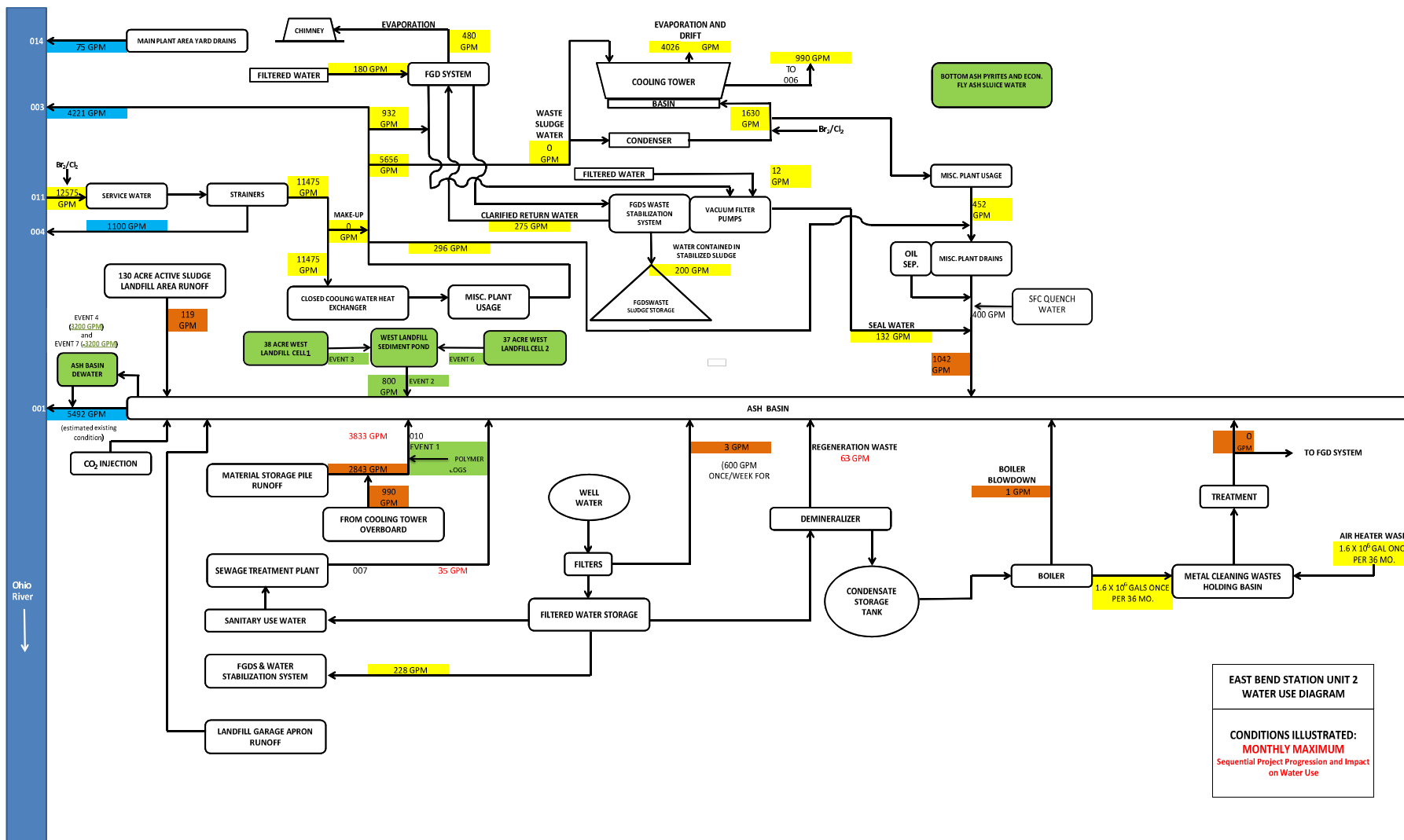
AI 176  
KY0040444  
Duke Energy East Bend Generating Station  
Outfall 001 Modifications  
(Sequential Project Progression and Impact on Water Use Diagram)

Event	Timeframe (estimated)	System Change	Monthly Average			Monthly Maximum		
			Effective Change (in discharge flows)	Resulting Discharge		Effective Change (in discharge flows)	Resulting Discharge	
				GPM	MGD		GPM	MGD
	November 1, 2014	Existing Conditions (from current permit)	0	2339	3.37	0	5492	7.91
1	January 27, 2017	Approved to use Applied Polymer Systems, 706B Flocculants at Outfall 010 discharge to Ash Basin.	0	2339	3.37	0	5492	7.91
2	April 2017	West Landfill Sediment Pond Discharge to Ash Basin (approval letter received 2-28-2017)	484	2823	4.07	800	6292	9.06
3	July 2017	Start placing waste in West Landfill (38 Acre) Cell 1	0	2823	4.07	800	7092	10.21
4	April 2017 - March 2019	Temporary dewatering of Ash Basin (conditional approval received from KDEP 10-17-2016)	3200	6023	8.67	3200	9492	13.67
5	March 2018	Permanently cease Bottom Ash Sluice to Ash Basin	-188	5835	8.40	-396	9096	13.10
6	2018 - 2019	Construct new (acre) West Landfill Cell 2 and place in service	0	5835	8.40	800	9896	14.25
7	March 2019 - October 2019	Dewatering Complete. Process water through West Retention Basin, pumped to Outfall 001	-3200	2635	3.79	-3200	5896	8.49

\*Attachments contain more information about the System Changes (events)

\*Effective flow changes are estimates based on degin data available. The actual flows will be measured and the entire water balance diagram will be updated with the next KPDES permit renewal in 2019.





Legend:  
 = flow leaving EBS from outfalls  
 = flow entering and circulating EBS system  
 = flow going into Ash Basin  
 = modification to flow based on Events

**APPENDIX 5**

**LANDFILL PERMIT**

**EAST BEND STATION**

**EAST LANDFILL**



**Kentucky Energy and Environment Cabinet  
Department for Environmental Protection  
Division of Waste Management**

**PERMIT**

**Facility: Duke Energy - East Bend Station  
6293 Beaver Rd  
Union, KY 41091**

**Permittee: Duke Energy  
1000 E Main St Rm WP994  
Plainfield, IN 46168**

**Agency Interest: Duke Energy KY East Bend  
6293 Beaver Rd  
Union, KY 41091**

The Division has issued the permit under the provisions of KRS Chapter 224 and regulations promulgated pursuant thereto. This permitted activity or activities are subject to all conditions and operating limitations contained herein. Issuance of this permit does not relieve the permittee from the responsibility of obtaining any other permits, licenses or approvals required by this Division or other state and local agencies.

No deviation from the plans and specifications submitted with your application or any condition specified herein is allowed, unless authorized in writing from the Division. Violation of the terms and conditions specified herein may render this permit null and void. All rights of inspection by representatives of the Division are reserved. Conformance with all applicable Waste Management Regulations is the responsibility of the permittee.

**Agency Interest ID #: 176**

**Solid Waste Permit #: SW00800006**

**County: Boone**

**Permitted Activities:**

Subject Item	Activity	Type	Status
ACTV004	Special Waste Landfill-Coal/00800006	Construction/Operation	Converted
ACTV006	Special Waste Landfill-Coal/00800006	Construction/Operation	Converted
ACTV008	Coal Combustion Residuals Surface Impoundment/00800006	Registered Permit by Rule	Converted
ACTV012	CCR Unit - Landfill/00800006	Construction/Operation	Active
ACTV013	CCR Unit - Landfill/00800006	Construction/Operation	Active
ACTV014	CCR Unit - Impoundment/00800006	Activity Terminated	Terminated

PERMIT

**Acreeage Summary:**

**Waste Disposal Area (in Acres):**

Activity	Disposal Area
CCR Unit - Landfill	162.00
CCR Unit - Landfill	203.70
<b>Total Disposal Area</b>	<b>365.70</b>
<b>Total Permitted Area</b>	<b>470.40</b>

**Cost Estimate Summary:**

Coverage Type	Cost Estimate	Effective	Comments
Closure	\$18,992,117.00	04/16/2021	Approved under APE20200002
Post-Closure	\$13,878,600.00	04/16/2021	Approved under APE20200002

**Financial Assurance Summary:**

The owner or operator shall maintain the following financial assurance approved by the Division in compliance with KRS Chapter 224.40-650, KRS Chapter 224.50-862, 401 KAR 45:080, and 401 KAR 48:310:

Instrument Type	Instrument Number	Amount	Date Received	Comments
Surety Bond	B8087915	\$10,000.00	05/17/1984	
Corporate Financial Test	1	\$16,099,479.00	11/01/2019	
Corporate Financial Test	0	\$16,771,248.00	11/30/2020	

**First Operational Permit Effective Date: 07/16/1982 -- ACTV0004, Inert Landfill Activity**

**Permit Effective Date: 07/16/1992**

**Permit Expiration Date: Life of Facility**

**Permit issued: 04/16/2021**

Sincerely,

 Recoverable Signature

*Robin Green*

for

**Danny Anderson, P.E.  
Manager, Solid Waste Branch**

## PERMIT

**Permit Conditions:****Facility Information and/or Conditions:**

1. The closure cost estimate for ACTV0012 (East Landfill) is \$9,272,969 and the post-closure care estimate is \$6,826,500. This estimate was approved and updated under APE20200002.
2. The closure cost estimate for ACTV0013 (West Landfill) is \$9,719,148 and the post-closure care estimate is \$7,052,100. This estimate was approved and updated under APE20200002.

**Subject Items****ACTV0004 - Special Waste Landfill-Coal****Variances, Alternate Specifications and Special Conditions:**

1. General: The East Landfill consists of approximately 162 acres of disposal area and 185 acres of total permitted area; it has been converted from a Special Waste Landfill (ACTV004) to a CCR Unit - Landfill (ACTV012) on September 6, 2019. The landfill is a CCR Unit as defined by 401 KAR 46:101 and is subject to the standards pursuant to 401 KAR 46:110, and the landfill remains subject to the procedural requirements in 401 KAR Chapter 45. [401 KAR 45:020, 401 KAR 45:025, 401 KAR 45:030, 401 KAR 45:040, 401 KAR 45:050, 401 KAR 45:080, 401 KAR 45:140, 401 KAR 46:110]

**Approved Applications - The owner or operator shall comply with applicable statutes and regulations and the following approved applications:**

1. 06-07-82 - First Operational Permit for Inert Landfill (effective on 7-16-82)
2. 04-05-84 - Modification for Inert Landfill
3. 07-15-87 - Renewal for Inert Landfill
4. 03-01-96 - Permit Renewal - conversion to Special Waste (effective date 7-16-92)
5. 07-24-96 - Groundwater Monitoring Plan - LI1MOGW1
6. 01-16-97 - Modification Add/Delete Waste Sources - MOAD1
7. 11-12-97 - Modification Add/Delete Waste Sources - MOAD2
8. 11-27-00 - Modification Add/Delete Waste Sources - MOAD3
9. 11-22-04 - APE20040001 - Minor Modification - Add/Delete Modification
10. 04-05-05 - APE20040005 - Minor Modification - Add/Delete Modification
11. 06-07-05 - AIN20010001 - Groundwater Assessment Plan
12. 07-13-05 - APE20050001 - Minor Modification - Leachate Collection System
13. 12-12-05 - AIN20050001 - Groundwater Assessment Plan - East Landfill
14. 10-04-06 - APE20060001 - Permit Transfer (to Union Light, Heat, and Power Coop)
15. 10-04-06 - APE20060006 - Minor Modification - Change the Active Area from 40 Acres to 55 Acres
16. 12-06-06 - AIN20060001 - Groundwater Assessment Report - East Landfill
17. 02-16-07 - APE20070001 - Construction Progress Report - Cells P-15 & P16
18. 03-20-07 - APE20060007 - Permit Transfer (to Duke Energy Kentucky, Inc.)
19. 08-15-07 - APE20070003 - Minor Modification - Add Source (bottom ash and plastic for truck lining from Miami Fort)
20. 08-15-07 - APE20070007 - Minor Modification previously labeled as APE20070005 - Add Source (Gypsum from Killen Station)

## PERMIT

21. 04-14-11 - CMN20100015 - Acceptance Letter Issued, Groundwater Assessment Report Update - Ash Pond and East Landfill
22. 07-06-12 - APE20120005 - Minor Modification - Add Source (Fly Ash from Spurlock Station)
23. 08-15-12 - AIN20110002 - Groundwater Assessment Report Update - East Landfill
24. 09-22-14 - APE20140004 - Minor Modification - Add Source (Fly Ash from Ghent Generating Station)
25. 05-06-15 - AIN20140003 - Revised Groundwater Assessment Plan - Site-Wide
26. 06-08-15 - AIN20150002 - Groundwater Assessment Report Update - East Landfill
27. 08-18-16 - APE20160004 - Minor Modification - Add Source (Fly Ash from Gallagher Generating Station & Clifty Creek Generating Station)
28. 08-18-16 - APE20150007 - Minor Modification - Chimney Drain, Waste Boundary, and Waste Placement Lift Thickness
29. 09-06-19 - See the CCR Unit - Landfill activity [ACTV0012] for additional information

**ACTV0006 - Special Waste Landfill-Coal****Variances, Alternate Specifications and Special Conditions:**

1. Construction Requirements: The owner or operator shall proof-roll all sub-subgrade and subgrade areas in accordance with approved applications and permit. All proof-rolls shall be completed using a minimum 100,000 pound loaded four (4) tire scraper with a minimum capacity of 20 cubic yards or approved equivalency. The Solid Waste Branch must be notified at least 48 hours prior to proof-rolling of the final subgrade surface. [401 KAR 45:110 Section 2, 401 KAR 45:140]
2. General: The West Landfill consists of approximately 203.7 acres of disposal area and 232 acres of total permitted area; it has been converted from a Special Waste Landfill (ACTV006) to a CCR Unit - Landfill (ACTV013) on September 6, 2019. The landfill is a CCR Unit as defined by 401 KAR 46:101 and is subject to the standards pursuant to 401 KAR 46:110, and the landfill remains subject to the procedural requirements in 401 KAR Chapter 45. [401 KAR 45:020, 401 KAR 45:025, 401 KAR 45:030, 401 KAR 45:040, 401 KAR 45:050, 401 KAR 45:080, 401 KAR 45:140, 401 KAR 46:110]

**Approved Applications - The owner or operator shall comply with applicable statutes and regulations and the following approved applications:**

1. 12-08-2008 - APE20070004 - New Special Waste Activity - West Special Waste Landfill
2. 03-09-2011 - APE20100002 - Groundwater Monitoring Plan Modification - West Special Waste Landfill
3. 02-28-2012 - APE20110004 - Construction Progress Report - Floodplain Area Filling (2.1 acres)
4. 07-06-2012 - APE20120005 - Minor Modification - Add Source (Fly Ash from Spurlock Station)
5. 09-22-2014 - APE20140004 - Minor Modification - Add Source (Fly Ash from Ghent Generating Station)
6. 11-18-2015 - APE20150007 - Minor Modification - Updated Attachment 41 Construction Quality Control Plan
7. 06-13-2016 - APE20150008 - Minor Modification - Sediment Pond and Surface Water Controls
8. 08-18-2016 - APE20160004 - Minor Modification - Add Source (Fly Ash from Gallagher Generating Station & Clifty Creek Generating Station)
9. 10-27-2016 - APE20160007 - Minor Modification - Chimney Drain System
10. 03-23-2017 - APE20170002 - Minor Modification - Surface Water Monitoring Plan Revision
11. 09-08-2017 - APE20170005 - Construction Progress Report - Cell 1 (38.32 acres), Sediment Pond and Contact Water Ditch
12. 09-06-2019 - See the CCR Unit - Landfill activity [ACTV0013] for additional information

## PERMIT

**ACTV0008 - Coal Combustion Residuals Surface Impoundment****Variances, Alternate Specifications and Special Conditions:**

1. General: The Coal Combustion Residuals Surface Impoundment consisted of approximately 53.4 acres and was converted from a Coal Combustion Residuals Surface Impoundment (ACTV008) to a CCR Unit - Impoundment (ACTV014) on September 6, 2019. [401 KAR 45:140, 401 KAR 46:110]

**Approved Applications - The owner or operator shall comply with applicable statutes and regulations and the following approved applications:**

1. 10-04-06 - APE20060001 - Permit Transfer (to Union Light, Heat, and Power Coop)
2. 03-20-07 - APE20060007 - Permit Transfer (to Duke Energy Kentucky, Inc.)
3. 08-15-07 - AIN20070001 - Groundwater Assessment Plan - Ash Pond
4. 07-16-10 - AIN20080001 - Groundwater Assessment Report - Ash Pond
5. 04-14-11 - CMN20100015 - Acceptance Letter Issued, Groundwater Assessment Report Update - Ash Pond and East Landfill
6. 08-15-12 - AIN20110001 - Groundwater Assessment Report Update - Ash Pond
7. 05-06-15 - AIN20140003 - Revised Groundwater Assessment Plan - Site-Wide
8. 06-08-15 - AIN20150001 - Groundwater Assessment Report Update - Ash Pond
9. 09-06-19 - See the CCR Unit - Impoundment activity [ACTV0014] for additional information

**ACTV0012 - CCR Unit - Landfill****Variances, Alternate Specifications and Special Conditions:**

1. The East Landfill consists of approximately 162 acres of disposal area and 185 acres of total permitted area; it has been converted from a Special Waste Landfill (ACTV004) to a CCR Unit - Landfill (ACTV012) on September 6, 2019. The landfill is a CCR Unit as defined by 401 KAR 46:101 and is subject to the standards pursuant to 401 KAR 46:110, and the landfill remains subject to the procedural requirements in 401 KAR Chapter 45. [401 KAR 45:020, 401 KAR 45:025, 401 KAR 45:030, 401 KAR 45:040, 401 KAR 45:050, 401 KAR 45:080, 401 KAR 45:140, 401 KAR 46:110]

2. General: The owner or operator of a Coal Combustion Residuals (CCR) Unit shall comply with KRS Chapter 224 and 401 KAR Chapter 46 for the construction, operation, maintenance, and closure of a CCR Unit and other provisions pursuant to 401 KAR Chapters 30, 40, and 45 as applicable. The owner or operator shall comply with the applicable provisions in the Approved Applications listed on this permit document for ACTV0004 - Special Waste Landfill-Coal and with all provisions in the Approved Applications listed on this permit document for ACTV0012 - CCR Unit - Landfill. [401 KAR 45:030, 401 KAR 45:140]

3. General: The owner or operator shall submit the \$15,000 annual fee no later than July 31 of each year pursuant to 401 KAR 46:120. Applications and reports specific to only the landfill, or only other CCR Units, for this facility shall not be subject to the filing fees pursuant to 401 KAR 45:250. [401 KAR 46:120 Section 4]

4. Construction: While the Construction Progress Report (CPR) describing construction of the East Landfill (accepted on September 6, 2019) identifies the landfill as a CCR Unit that is subject to the provisions of Chapter 46, this CPR (APE20190004) relevantly depicts the area(s) of constructed cap prior to October 19, 2015, in

## PERMIT

accordance with the technical standards of the permit issued in accordance with 401 KAR Chapter 45. [401 KAR 45:140, 401 KAR 46:110]

5. Groundwater Well Construction: The approval of the Monitoring Well Construction Progress Report (CPR) associated with tracking number APE20190006 in no way constitutes the acceptance of any monitoring well construction, modification, or abandonment activities conducted previously and not specified in this permit. Approval of the CPR does not constitute Division of Waste Management acceptance of any well or well network as being appropriate for monitoring groundwater in any particular aquifer or aquifer zone at any CCR Unit pursuant to the provision(s) of 401 KAR Chapter 46. [401 KAR 45:140 Section 2, 401 KAR 6:350]

6. Financial Assurance: The owner or operator shall provide site-wide financial assurance to the Division of Waste Management for both the East and West Landfills by December 1, 2021. The financial assurance amount shall meet or exceed the Closure and Post-Closure cost estimates associated with the action referenced as APE20200002, approved on April 16, 2021. [401 KAR 45:080, 401 KAR 46:110]

**Approved Applications - The owner or operator shall comply with applicable statutes and regulations and the following approved applications:**

1. 09-06-19 - See the Special Waste Landfill - Coal activity [ACTV0004] for additional information and site history
2. 09-06-19 - Construction Progress Report, Portions of East Landfill Cap Constructed Prior to October 19, 2015 - APE20190004
3. 09-04-20 - Monitoring Well Construction Progress Report - APE20190006
4. 04-16-21 - Final Cover Plan Minor Modification - APE20200002

## **ACTV0013 - CCR Unit - Landfill**

**Variances, Alternate Specifications and Special Conditions:**

1. General: The West Landfill consists of approximately 203.7 acres of disposal area and 232 acres of total permitted area; it has been converted from a Special Waste Landfill (ACTV006) to a CCR Unit - Landfill (ACTV013) on September 6, 2019. The landfill is a CCR Unit as defined by 401 KAR 46:101 and is subject to the standards pursuant to 401 KAR 46:110, and the landfill remains subject to the procedural requirements in 401 KAR Chapter 45. [401 KAR 45:020, 401 KAR 45:025, 401 KAR 45:030, 401 KAR 45:040, 401 KAR 45:050, 401 KAR 45:080, 401 KAR 45:140, 401 KAR 46:110]

2. General: The owner or operator of a Coal Combustion Residuals (CCR) Unit shall comply with KRS Chapter 224 and 401 KAR Chapter 46 for the construction, operation, maintenance, and closure of a CCR Unit and other provisions pursuant to 401 KAR Chapters 30, 40, and 45 as applicable. The owner or operator shall comply with the applicable provisions in the Approved Applications listed on this permit document for ACTV0006 - Special Waste Landfill-Coal and with all provisions in the Approved Applications listed on this permit document for ACTV0013 - CCR Unit - Landfill. [401 KAR 45:030, 401 KAR 45:140]

3. General: The owner or operator shall submit the \$15,000 annual fee no later than July 31 of each year pursuant to 401 KAR 46:120. Applications and reports specific to only the landfill, or only other CCR Units, for this facility shall not be subject to the filing fees pursuant to 401 KAR 45:250. [401 KAR 46:120 Section 4]

4. Construction: The owner or operator shall construct the landfill in accordance with 401 KAR 46:110, Section



## PERMIT

3, which includes meeting all material specifications and required testing for the alternate composite liner as specified in the approved application(s). [401 KAR 46:110 Section 3]

5. Groundwater Well Construction: The approval of the Monitoring Well Construction Progress Report (CPR) associated with tracking number APE20190006 is limited to the construction activities specifically listed herein. This approval in no way constitutes the acceptance of any monitoring well construction, modification, or abandonment activities conducted previously and not specified in this permit. Approval of the CPR does not constitute Division of Waste Management acceptance of any well or well network as being appropriate for monitoring groundwater in any particular aquifer or aquifer zone at any CCR Unit pursuant to the provision(s) of 401 KAR Chapter 46. [401 KAR 45:140 Section 2, 401 KAR 6:350]

6. Financial Assurance: The owner or operator shall provide site-wide financial assurance to the Division of Waste Management for both the East and West Landfills by December 1, 2021. The financial assurance amount shall meet or exceed the Closure and Post-Closure cost estimates associated with the action referenced as APE20200002, approved on April 16, 2021. [401 KAR 45:080, 401 KAR 46:110]

**Approved Applications - The owner or operator shall comply with applicable statutes and regulations and the following approved applications:**

1. 09-06-19 - See the Special Waste Landfill - Coal activity [ACTV0006] for additional information and site history
2. 09-06-19 - Alternate Performance Standard, Alternate Liner Demonstration - APE20190001
3. 05-01-20 - Alternate Performance Standard, Alternate Liner Demonstration - APE20190008
4. 09-04-20 - Monitoring Well Construction Progress Report - APE20190006
5. 09-04-20 - Construction Progress Report - West Landfill Cell 2 Liner Construction - APE20200003

## ACTV0014 - CCR Unit - Impoundment

**Variances, Alternate Specifications and Special Conditions:**

1. General: The Coal Combustion Residuals Surface Impoundment consisted of approximately 53.4 acres and was converted from a Coal Combustion Residuals Surface Impoundment (ACTV008) to a CCR Unit - Impoundment (ACTV014) on September 6, 2019; at the time, the impoundment was a CCR Unit as defined by 401 KAR 46:101. The CCR Unit was clean closed, and the permitted activity was terminated by the Cabinet on May 1, 2020. [401 KAR 45:140, 401 KAR 46:110]

**Approved Applications - The owner or operator shall comply with applicable statutes and regulations and the following approved applications:**

1. 09-06-19 - See the Coal Combustion Residuals Surface Impoundment activity [ACTV0008] for additional information and site history
2. 09-06-19 - Construction Progress Report, Portions of East Landfill Cap Constructed Prior to October 19, 2015-APE20190004 & Alternate Performance Standard, Alternate Liner Demonstration - APE20190001
3. 05-01-20 - Construction Progress Report, Clean Closure of Ash Pond - APE20190009

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**Financial Assurance****ACTV0001 - Financial Assurance**

The following is a history of the financial assurance for this facility:

1. 07-10-1987 - SB# B80-201654, \$83,000.00
2. 07-06-1992 - SB# B80-201654, \$539,900.00
3. 09-05-2001 - SB# B80-201654, \$564,102.00
4. 09-16-2002 - SB# B80-201654, \$577,534.00
5. 10-23-2003 - Financial Test, \$2,120,500.00
6. 10-31-2003 - SB# B80-201654 released
7. 05-15-2006 - Financial Test, \$2,259,062.00
8. 05-31-2007 - Financial Test, \$2,324,575.00
9. 07-30-2007 - Financial Test, \$2,324,575.00
10. 09-26-2011 - Financial Test, \$2,522,049.00
11. 12-16-2013 - Financial Test, \$2,598,255.00
12. 12-18-2015 - Financial Test, \$2,674,150.00
13. 05-17-1984 - SB# B-80-87915 - \$10,000.00
14. 07-14-2017 - Financial Test, \$2,700,892.00
15. 07-14-2017 - Financial Test, \$4,427,734.00
16. 11-01-2018 - East Landfill Financial Test increased to \$2,727,901.00
17. 11-01-2018 - West Landfill Financial Test increased to \$4,472,012.00
18. 11-01-2019 - East Landfill Financial Test increased to \$16,099,479.00
19. 11-01-2019 - West Landfill Financial Test increased to \$14,885,924.00
20. 11-30-2020 - West Landfill Financial Test increased to \$16,771,248.00

**Monitoring Conditions****GSTR0001 - Groundwater Monitoring - SW: Groundwater Monitoring Group - East Special Waste Landfill**

**Group Members:** STRC0001 - Well MW-1; STRC0002 - Well MW-3; STRC0003 - Well MW-4; STRC0004 - Well MW-5; STRC0005 - Well MW-6; STRC0006 - Well MW-6D; STRC0026 - Well P-7; STRC0028 - Well P-9; STRC0032 - Well MW-7; STRC0040 - Well MW-09; STRC0067 - Well MW-02A

**Variances, Alternate Specifications and Special Conditions:**

1. No monitoring well construction, maintenance, or abandonment may be conducted without prior approval by the Division of Waste Management. [401 KAR 45:140 Section 1(1)]
2. Reports and Submittals: The owner or operator shall submit a Construction Progress Report (CPR) within 45 days of any groundwater monitoring well abandonment activities. [401 KAR 45:140]
3. Only a Kentucky Certified Monitoring Well Driller may construct or abandon monitoring wells. [401 KAR 6:350]

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4. The owner or operator shall provide the division a minimum of ten (10) working days advance notice for all groundwater monitoring well construction and abandonment activities. [401 KAR 6:350 Section 12(2)]

### **GSTR0003 - Groundwater Monitoring - SW: Assessment Well Group - East Special Waste Landfill and Ash Pond**

**Group Members:** STRC0003 - Well MW-4; STRC0023 - Well P-4; STRC0024 - Well P-5; STRC0025 - Well P-6; STRC0026 - Well P-7; STRC0027 - Well P-8; STRC0028 - Well P-9; STRC0030 - Well MW-5D (Assessment); STRC0031 - Well MW-8D (Assessment); STRC0039 - Well MW-04D; STRC0041 - Well MW-10

**Variances, Alternate Specifications and Special Conditions:**

1. The owner or operator shall comply with the four (4) permit conditions listed under the "GSTR0001 - Groundwater Monitoring - SW: Groundwater Monitoring Group - East Special Waste Landfill" section of this document. [401 KAR 45:140, 401 KAR 6:350]

### **GSTR0005 - Groundwater Monitoring - SW: Groundwater Observation Well Group - West Special Waste Landfill**

**Group Members:** STRC0033 - Well OW-105; STRC0034 - Well OW-106; STRC0035 - Well OW-104; STRC0036 - Well OW-103; STRC0037 - Well OW-102; STRC0038 - Well OW-101

**Variances, Alternate Specifications and Special Conditions:**

1. The owner or operator shall comply with the four (4) permit conditions listed under the "GSTR0001 - Groundwater Monitoring - SW: Groundwater Monitoring Group - East Special Waste Landfill" section of this document. [401 KAR 45:140, 401 KAR 6:350]

### **GSTR0006 - Groundwater Monitoring - SW: Groundwater Monitoring Group - West Special Waste Landfill - Wells Proposed for Construction**

**Group Members:** STRC0046 - Well MW-205 (Proposed); STRC0047 - Well MW-206 (Proposed); STRC0048 - Well MW-207 (Proposed)

**Variances, Alternate Specifications and Special Conditions:**

1. The owner or operator shall comply with the four (4) permit conditions listed under the "GSTR0001 - Groundwater Monitoring - SW: Groundwater Monitoring Group - East Special Waste Landfill" section of this document. [401 KAR 45:140, 401 KAR 6:350]

### **GSTR0008 - Groundwater Monitoring - SW: Groundwater Monitoring Group - West Special Waste Landfill**

**Group Members:** STRC0051 - Well MW-201; STRC0052 - Well MW-202; STRC0053 - Well MW-204; STRC0054 - Well MW-208; STRC0055 - Well MW-203

## PERMIT

**Variations, Alternate Specifications and Special Conditions:**

1. The owner or operator shall comply with the four (4) permit conditions listed under the "GSTR0001 - Groundwater Monitoring - SW: Groundwater Monitoring Group - East Special Waste Landfill" section of this document. [401 KAR 45:140, 401 KAR 6:350]

**GSTR0010 - Groundwater Monitoring - SWB: Chapter 46 Group**

**Group Members:** AIOO0176 -

**Variations, Alternate Specifications and Special Conditions:**

1. Groundwater Monitoring: The owner or operator shall monitor groundwater and provide notifications in accordance with 401 KAR Chapter 46 and submit the results and analysis to the Division of Waste Management, Solid Waste Branch upon request. [401 KAR 45:030, 401 KAR 46:110 Section 10, 401 KAR 46:110 Section 8]
2. Only a Kentucky Certified Monitoring Well Driller may construct or abandon monitoring wells. [401 KAR 6:350]
3. The owner or operator shall provide the division a minimum of ten (10) working days advance notice for all groundwater monitoring well construction and abandonment activities. [401 KAR 6:350 Section 12(2)]

**GSTR0011 - Groundwater Monitoring - SW: Groundwater Monitoring Well Installation Development and Abandonment**

**Group Members:** AIOO0176 -

**Variations, Alternate Specifications and Special Conditions:**

1. Groundwater Well Construction: The Division of Waste Management (DWM) accepts that Monitoring Wells MW-9A and MW-19A were properly installed and developed pursuant to 401 KAR 6:350 as documented in the Monitoring Well Construction Progress Report (CPR) associated with tracking number APE20190006; DWM accepts that Monitoring Wells MW-9R and MW-19 were properly abandoned pursuant to 401 KAR 6:350 as documented in the CPR. [401 KAR 6:350]
2. Groundwater Well Construction: As documented in the Monitoring Well Construction Progress Report associated with tracking number APE20190006, the Division of Waste Management accepts that the following work on the following wells was conducted in accordance with 401 KAR 6:350.

MW-1: One bollard installed

MW-2A: Two bollards and two weep holes installed

MW-3: One bollard installed

MW-5: One bollard installed

MW-5D: Two bollards and two weep holes installed

MW-6: One bollard installed

MW-6D: One bollard installed

MW-7: Two bollards and two weep holes installed

## PERMIT

MW-8D: One bollard and two weep holes installed  
MW-9: Two weep holes installed  
MW-10: Two bollards installed  
MW-11: Two weep holes installed  
MW-12: One bollard and two weep holes installed  
MW-13: One bollard and two weep holes installed  
MW-14: Two weep holes installed  
MW-18: One bollard installed between MW-18 & 18D, One weep hole installed  
MW-18D: One bollard installed between MW-18 & 18D, One weep hole installed  
MW-201: Two weep holes installed  
MW-202: One bollard and two weep holes installed  
MW-203: Two weep holes installed  
MW-204: Two weep holes installed  
MW-208: Two weep holes installed  
MW-209: One bollard and two weep holes installed  
MW-210: One bollard and two weep holes installed  
MW-211: One bollard and two weep holes installed  
MW-P4: Two bollards and two weep holes installed  
MW-P5: Two weep holes installed  
MW-P7: One weep hole installed  
P-6: Two bollards and two weep holes installed  
P-8: Two weep holes installed  
P-9: One bollard and one weep hole installed  
P-10: Two bollards and one weep hole installed  
P-11: Two bollards and one weep hole installed  
P-14: One weep hole installed  
P-15: Two bollards and one weep hole installed  
OW-101: Two weep holes installed  
OW-102: Two weep holes installed  
OW-103: Two weep holes installed. [401 KAR 6:350]

3. Groundwater Well Construction: The approval of the Monitoring Well Construction Progress Report (CPR) associated with tracking number APE20190006 is limited to the construction activities specifically listed herein. This approval in no way constitutes the acceptance of any monitoring well construction, modification, or abandonment activities conducted previously and not specified in this permit. Approval of the CPR does not constitute DWM acceptance of any well or well network as being appropriate for monitoring groundwater in any particular aquifer or aquifer zone at any CCR Unit pursuant to the provision(s) of 401 KAR Chapter 46. [401 KAR 6:350]

**APPENDIX 6**

**TITLE V AIR PERMIT**

**EAST BEND STATION**

**EAST LANDFILL**

Commonwealth of Kentucky  
Energy and Environment Cabinet  
Department for Environmental Protection  
Division for Air Quality  
200 Fair Oaks Lane, 1<sup>st</sup> Floor  
Frankfort, Kentucky 40601  
(502) 564-3999

**Final**

**AIR QUALITY PERMIT**  
Issued under 401 KAR 52:020

**Permittee Name:** Duke Energy Kentucky Inc., East Bend Station  
**Mailing Address:** 139 East Fourth Street, Mail Code EM740,  
Cincinnati, OH 45202

**Source Name:** Duke Energy Kentucky Inc., East Bend Station  
**Mailing Address:** 6293 Beaver Road,  
Union, KY 40191

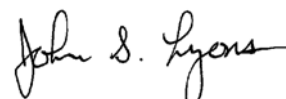
**Source Location:** Bank of the Ohio River

**Permit:** V-12-023  
**Agency Interest:** 176  
**Activity:** APE20120001  
**Review Type:** Title V, Operating  
**Source ID:** 21-015-00029

**Regional Office:** Florence Regional Office  
8020 Veterans Memorial Drive, Suite 110  
Florence, KY 41042  
(859) 525-4923

**County:** Boone

**Application**  
**Complete Date:** April 8, 2012  
**Issuance Date:** April 19, 2013  
**Revision Date:**  
**Expiration Date:** April 19, 2018



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**John S. Lyons, Director**  
**Division for Air Quality**

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	Permit type	Activity#	Complete Date	Issuance Date	Summary of Action
V-06-038	Renewal	APE20040006	10/01/05	08/06/07	Renewal Permit
V-12-023	Renewal	APE20120001	04/08/12	04/19/13	Renewal Permit



**SECTION A - PERMIT AUTHORIZATION**

Pursuant to a duly submitted application the Kentucky Division for Air Quality (Division) hereby authorizes the operation of the equipment described herein in accordance with the terms and conditions of this permit. This permit has been issued under the provisions of Kentucky Revised Statutes (KRS) Chapter 224 and regulations promulgated pursuant thereto.

The permittee shall not construct, reconstruct, or modify any affected facilities without first submitting a complete application and receiving a permit for the planned activity from the permitting authority, except as provided in this permit or in 401 KAR 52:020, Title V Permits.

Issuance of this permit does not relieve the permittee from the responsibility of obtaining any other permits, licenses, or approvals required by the Kentucky Energy and Environment Cabinet (Cabinet) or any other federal, state, or local agency.

## **SECTION B - EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS**

### **Emissions unit: 02 - Unit 2 Indirect Heat Exchanger**

#### **Description:**

Pulverized coal-fired, dry bottom, wall-fired unit with an electrostatic precipitator (ESP), flue gas desulfurization (FGD), Selective Catalytic Reduction (SCR) and low nitrogen oxides modified burners

Number two fuel oil used for startups and flame stabilization

Secondary Fuel: petroleum coke

Maximum continuous rating: 6,313 MMBtu/hour, 301 tons coal/hour

Construction commenced: 1976

#### **Applicable Regulations:**

**401 KAR 59:015**, Indirect Heat Exchangers

**401 KAR 60:005 Section 3(b)**, incorporating by reference **40 CFR 60, Subpart D**, Standards of Performance for Fossil-Fuel-Fired Steam Generators, for an emissions unit greater than 250 MMBtu /hour and commenced after August 17, 1971

**401 KAR 50:012**, General application

**401 KAR 51:017**, Prevention of significant deterioration of air quality

**401 KAR 51:160**, NO<sub>x</sub> requirements for large utility and industrial boilers; incorporating by reference 40 CFR 96

**401 KAR 51:210**, CAIR NO<sub>x</sub> Annual Trading Program (See Section K).

**401 KAR 51:220**, CAIR NO<sub>x</sub> Ozone Season Trading Program (See Section K)

**401 KAR 51:230**, CAIR SO<sub>2</sub> Trading Program (See Section K)

**401 KAR 52:060**, Acid rain permits, incorporating by reference the Federal Acid Rain provisions as codified in 40 CFR Parts 72 to 78

**40 CFR Part 64**, Compliance Assurance Monitoring (CAM)

**40 CFR 63 Subpart UUUU**, National Emission Standards for Hazardous Air Pollutants, Coal- and Oil-Fired Electric Utility Steam Generating Units

#### **1. Operating Limitations:**

NA

#### **2. Emission Limitations:**

- a) Pursuant to 40 CFR 60.43(a)(2) and 401 KAR 51:017, the sulfur dioxide emissions shall not exceed 1.2 lbs/MMBtu based on a three-hour average.
- b) Pursuant to 40 CFR 60.42(a)(1) and 401 KAR 51:017, particulate emissions shall not exceed 0.10 lb/MMBtu based on a three-hour average.
- c) Pursuant to 40 CFR 60.42(a)(2), emissions shall not exceed twenty (20) percent opacity based on a six-minute average except:
  1. a maximum of twenty-seven (27) percent opacity shall be permissible for not more than one (1) six (6) minute period in any sixty (60) consecutive minutes.

## SECTION B -EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)

2. Emissions from an indirect heat exchanger shall not exceed 20 percent opacity based on a six-minute average except during building a new fire for the period required to bring the boiler up to operating conditions provided the method used is that recommended by the manufacturer and the time does not exceed the manufacturer's recommendations.
- d) Pursuant to 401 KAR 50:012, nitrogen oxides emissions shall not exceed 0.5 lbs/MMBtu based on a thirty (30) calendar day continuous rolling average.

### ***Compliance Demonstration Method:***

To provide assurance that the particulate and the visible emission limitations are being met the permittee shall comply with the 3. Testing Requirements below. To provide assurance that sulfur dioxide and nitrogen oxides emission limits are being met the permittee shall comply with the 4. Specific Monitoring Requirements below.

- e) The permittee shall comply with all applicable provisions of 40 CFR Part 63.9991

### ***Compliance Demonstration Method:***

1. The permittee shall comply with this subpart no later than April 16, 2015. [40 CFR Part 63.9984 (b)]
2. The permittee shall meet the notification requirements in 40 CFR Part 63.10030 according to the schedule in 40 CFR Part 63.10030 and in subpart A of this part. Some of the notifications must be submitted before compliance with the emission limits and work practice standards in this subpart is required. [40 CFR Part 63.9984 (c)]
3. The permittee shall demonstrate that compliance has been achieved, by conducting the required performance tests and other activities, no later than 180 days after the applicable date in paragraph (b), or (c) of this section. [40 CFR Part 63.9984 (f)]
4. The permittee shall demonstrate continuous compliance according to 40 CFR 63.10000 through 40 CFR 63.10023.

### **3. Testing Requirements:**

- a) Pursuant to 401 KAR 50:045, the permittee shall submit within six months of the issuance date of the final permit a schedule, to conduct a performance test for particulate compliance within one year of issuance of this permit.
- b) Testing shall be conducted in accordance with 401 KAR 50:045, Performance Tests, and pursuant to 40 CFR 64.4(c)(1), the testing shall be conducted under conditions representative of maximum emissions potential under anticipated operating conditions at the pollutant-specific emissions unit.

## SECTION B -EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)

- c) In accordance with 4.b Specific Monitoring Requirements, the permittee shall submit a schedule within six months from the date of issuance of this permit to conduct testing within one year following the issuance of this permit to re-establish the correlation between opacity and particulate emissions.
- d) If no additional stack tests are performed pursuant to 4.b(ii) Specific Monitoring Requirements, the permittee shall conduct a performance test for particulate emissions by the start of the fourth year of this permit to demonstrate compliance with the applicable standard.
- e) If no EPA Reference Method 9 tests are performed pursuant to 4.a(ii) Specific Monitoring Requirements, then the permittee shall determine the opacity of emissions from the stack by Method 9 at least once every 14 boiler operating days when operating, or more frequently if requested by the Division, to demonstrate compliance with the opacity standard. If no Method 9's are completed during the time period, the reason for not completing a test shall be documented and the permittee may use the COM system for assuring compliance with the visible emission limitation during that period.
- f) The permittee shall comply with all applicable provisions of 40 CFR 63.10005 through 40 CFR 63.10009 and 40 CFR 63.10011.

### 4. Specific Monitoring Requirements:

- a) Pursuant to 40 CFR 60.45, Performance Specification 1 of 40 CFR 60, Appendix B, and 401 KAR 52:020, Section 10, a continuous opacity monitoring (COM) system shall conform to requirements of these sections which include installing, calibrating, operating, and maintaining the continuous monitoring system for accurate opacity measurement. Excluding exempted time periods, if any three consecutive six-minute average opacity values exceed the opacity standard, the permittee shall, as appropriate:
  - (i) Accept the readout from the COM as an indicator of equipment performance and perform an inspection of the COM and/or the control equipment and make any repairs or;
  - (ii) Within thirty (30) minutes after the third consecutive COM indicated exceedance of the opacity standards, if emissions are visible, initiate a determination of opacity using Reference Method 9. Also within thirty (30) minutes after the third consecutive COM indicated exceedance, inspect the COM and/or the control equipment, and initiate any repairs. If a Method 9 cannot be performed, the reason for not performing the test shall be documented.
- b) Pursuant to 40 CFR 64.4(a)(1), opacity shall be used as an indicator of particulate matter emissions, as measured by the COM. The opacity indicator for compliance assurance is twenty percent (20%).

**SECTION B -EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)**

- c) Pursuant to 40 CFR Part 64.4(c)(1), the facility shall continuously record COM data collected during the required PM performance test. COM Data recorded during each test run shall not exceed 20% based on a six-minute average. The 20% opacity indicator level shall provide reasonable assurance that particulate matter emissions are in compliance. Excluding exempted time periods:
- (i) If any three (3) hour average of opacity values exceeds the opacity indicator level, the permittee shall, as appropriate, initiate an inspection of the control equipment and/or the COM system and make any necessary repairs.
  - (ii) If five (5) percent or greater of the COM data (three (3) hour average of opacity values) recorded in a calendar quarter show excursions above the opacity indicator level, the permittee shall perform a stack test in the following calendar quarter to demonstrate compliance with the particulate standard while operating at representative conditions. The permittee shall submit a compliance test protocol as required by Section G.5.a of this permit before conducting the test. The Division may waive this testing requirement upon a demonstration that the cause(s) of the excursions have been corrected, or may require stack tests at any time pursuant to 401 KAR 50:045, Performance Tests.
- d) Pursuant to 401 KAR 52:020, Section 10, the permittee shall monitor the ESP primary/secondary current and voltage on a daily basis.
- e) Pursuant to 40 CFR 60.45(a) and 401 KAR 52:020, Section 10, continuous emission monitoring systems shall be installed, calibrated, maintained, and operated for measuring the opacity of emissions, sulfur dioxide emissions, nitrogen oxides emissions and either oxygen or carbon dioxide emissions. The continuous emission monitoring systems shall comply with 401 KAR 59:015, Section 7 particularly, performance specification 2 of Appendix B to 40 CFR 60 or 40 CFR 75, Appendix A. Pursuant to 40 CFR 64.3(d), the continuous emission monitoring systems shall be used to satisfy CAM requirements.
- f) Pursuant to 401 KAR 52:020, Section 10, to meet the monitoring requirement for sulfur dioxide, the permittee shall use a continuous emission monitor (CEM) Excluding the startup and shut down periods, if any 3-hour average sulfur dioxide value exceeds the standard, the permittee shall, as appropriate, initiate an inspection of the control equipment and/or the CEM system and make any necessary repairs as soon as practicable.
- g) Pursuant to 401 KAR 52:020, Section 10, to meet the monitoring requirement for nitrogen oxide, the permittee shall use a continuous emission monitor (CEM). Excluding the startup and shut down periods, if any 3-hour average nitrogen oxide value exceeds the standard, the permittee shall, as appropriate, initiate an investigation of the cause of the exceedance and/or the CEM system and make any necessary repairs or take corrective actions as soon as practicable.

**SECTION B -EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)**

- h) Pursuant to 40 CFR 60.45(c)(1), for performance evaluations of the sulfur dioxide and nitrogen oxides continuous emission monitoring system as required under 401 KAR 59:005, Section 4(3) and calibration checks as required under 401 KAR 59:005, Section 4(4), reference methods 6c or 7e shall be used as applicable as described by 401 KAR 50:015.
- i) Pursuant to 40 CFR 60.45(c)(2), sulfur dioxide or nitric oxide (nitrogen oxides), as applicable, shall be used for preparing calibration gas mixtures under Performance Specification 2 of Appendix B to 40 CFR 60, filed by reference in 401 KAR 50:015.
- j) Pursuant to 40 CFR 60.45(c)(3), the span value for the continuous emission monitoring system measuring opacity of emissions shall be eighty (80), ninety (90), or one-hundred (100) percent and the span value for the continuous emission monitoring system measuring sulfur dioxide and nitrogen oxides emissions shall be in accordance with 40 CFR 60.45(c)(3)(i) or 40 CFR 75, Appendix A.
- k) Continuous emission monitoring data shall be converted into the units of applicable standards using the conversion procedure described in 40 CFR 60.45(e).
- l) Pursuant to 40 CFR 60.45(5), for an indirect heat exchanger that simultaneously burns fossil fuel and nonfossil fuel, the span value of all continuous monitoring systems shall be subject to the Division's approval.
- m) Pursuant to 401 KAR 52:020, Section 10, the permittee shall monitor the duration of the start up.
- n) The permittee shall comply with all applicable continuous monitoring requirements of 40 CFR 63.10010, 40 CFR 63.10020 and 40 CFR 63.10021.

**5. Specific Recordkeeping Requirements:**

- a) Pursuant to 401 KAR 59:005, Section 3 (4), the owner or operator of the indirect heat exchanger shall maintain a file of all measurements, including continuous monitoring system, monitoring device, and performance testing measurements; all continuous monitoring system performance evaluations; all continuous monitoring system or monitoring device calibration checks; adjustments and maintenance performed on these systems and devices; and all other information required by 401 KAR 59:005 recorded in a permanent form suitable for inspection.
- b) Pursuant to 401 KAR 59:005, Section 3(2), the owner or operator of this unit shall maintain the records of the occurrence and duration of any startup, shutdown, or malfunction in the operation of the affected facility, any malfunction of the air pollution control equipment; or any period during which a continuous monitoring system or monitoring device is inoperative.

**SECTION B -EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)**

- c) The permittee shall maintain records of the COM data on a three-hour rolling average basis, the number of excursions above the indicator range, time and date of excursions, opacity value of the excursions, and percentage of the COM data showing excursions from the indicator level in each calendar quarter.
- d) Pursuant to 401 KAR 52:020, Section 10, the permittee shall keep records of primary/secondary voltage, current and the results of compliance tests shall be maintained with long-term operational records for a period of five (5) years.
- e) Pursuant to 401 KAR 52:020, Section 10, the permittee shall keep visible observation records and Method 9 observations in a designated logbook and/or an electronic format. Records shall be maintained for five (5) years.
- f) Pursuant to 401 KAR 52:020, Section 10, the permittee shall record the duration of start up.
- g) The permittee shall comply with all applicable recording provisions of 40 CFR 63.10030 through 40 CFR 63.10033.

**6. Specific Reporting Requirements:**

- a) Pursuant to 401 KAR 59:005, Section 3 (3), minimum data requirements which follow shall be maintained and furnished in the format specified by the Division. Owners or operators of facilities required to install continuous monitoring systems shall submit for every calendar quarter a written report of excess emissions (as defined in applicable sections) to the Division. The averaging period used for data reporting should correspond to the averaging period specified in the emission test method used to determine compliance with an emission standard for the pollutant/source category in question. All quarterly reports shall be postmarked by the thirtieth (30th) day following the end of each calendar quarter and shall include the following information:
  - 1. The magnitude of the excess emission computed in accordance with 401 KAR 59:005, Section 4(8), any conversion factors used, and the date and time of commencement and completion of each time period of excess emissions.
  - 2. All hourly averages shall be reported for sulfur dioxide and nitrogen oxides monitors. The hourly averages shall be made available in the format specified by the Division.
  - 3. Specific identification of each period of excess emissions that occurs during startups, shutdowns, and malfunctions of the affected facility. The nature and cause of any malfunction (if known), the corrective action taken or preventive measures adopted.
  - 4. The date and time identifying each period during which continuous monitoring system was inoperative except for zero and span checks and the nature of the system repairs or adjustments.

## SECTION B -EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)

5. When no excess emissions have occurred or the continuous monitoring system(s) have not been inoperative, repaired, or adjusted, such information shall be stated in the report.
  - b) Pursuant to 40 CFR 60.45(g), for the purposes of reports required under 401 KAR 59:005, Section 3(3), periods of excess emissions that shall be reported are defined as follows:
    1. Excess emissions are defined as any six minute period during which the average opacity of emissions exceeds twenty percent opacity, except that one (1) six (6) minute average per hour of up to twenty-seven (27) percent opacity need not be reported.
    2. Excess emissions of sulfur dioxide are defined as any three (3) hour period during which the average emissions (arithmetic average of three contiguous one hour periods) exceed the applicable sulfur dioxide emissions standard.
    3. Pursuant to 401 KAR 50:012, excess emissions for the emissions unit using a continuous monitoring system for measuring nitrogen oxides are defined as any thirty (30) day period during which the average emissions (arithmetic average of thirty contiguous calendar days) exceed the applicable nitrogen oxides emissions standard.
  - c) The permittee shall report the number of excursions (excluding startup, shutdown, malfunction data) above the opacity indicator level, date and time of excursions, opacity value of the excursions, and percentage of the COM data showing excursions above the opacity indicator level in each calendar quarter.
  - d) Pursuant to 401 KAR 52:020, Section 10, for exceedances that occur as a result of start-up, the permittee shall report:
    1. The type of start-up (cold, warm, or hot);
    2. Whether or not the duration of the start-up exceeded the manufacturer's recommendation or typical, historical durations, and if so, an explanation of why the start-up exceeded recommended or typical durations.
  - e) The permittee shall comply with all applicable reporting provisions of 40 CFR 63.10030 through 40 CFR 63.10033.
  - f) See Section D, Source Emission Limitations and Testing Requirements.
- 7. Specific Control Equipment Operating Conditions:**
- a) Pursuant to 401 KAR 50:055, the electrostatic precipitator (ESP), SO<sub>2</sub> scrubber (FGD), and selective catalytic reduction (SCR) shall be operated to maintain compliance with permitted emission limitations, in accordance with manufacturer's specifications and/or standard operating practices.



**SECTION B -EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)**

- b) Pursuant to 401 KAR 52:020, Section 10, records regarding the maintenance (e.g., routine scheduled service, replacement of parts, etc.) of the control equipment shall be maintained.
  
- c) Refer to Section E, Source Control Equipment Requirements.

## SECTION B -EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)

### Emissions unit: 03 (01-07, 22) - Coal Handling Operations

#### Description:

Equipment includes:

Emission Unit:	Description:	Process Rate (tons/hour):	Control Method:
03-01	Coal Unloader Digging Coal	4500	Water Spray
03-02	Coal Unloader to Conveyor A	4500	Full Enclosure
03-03	Conveyor A to Conveyor B	4500	Full Enclosure
03-04	Conveyor B to Conveyor C	4500	Full Enclosure
03-05	Conveyor C to Conveyor E	4500	Full Enclosure with Baghouse
03-06	Conveyor E to 1200 Ton Storage Bin	4500	Full Enclosure with Baghouse
03-07	1200 Ton Storage Bin to Pan Scraper	4500	Precautionary Measures
03-22	Coal Pile Wind Erosion	10	None

Construction commenced: 1976

#### Applicable Regulations:

**401 KAR 63:010**, Fugitive emissions is applicable to each affected facility which emits or may emit fugitive emissions and is not elsewhere subject to an opacity standard within the administrative regulations of the Division for Air Quality;

**401 KAR 51:017**, Prevention of significant deterioration of air quality.

#### 1. Operating Limitations:

- a) Pursuant to 401 KAR 63:010, Section 3, reasonable precautions shall be taken to prevent particulate matter from becoming airborne. Such reasonable precautions shall include, when applicable, but not be limited to the following:
  1. Application and maintenance of asphalt, application of water, or suitable chemicals on roads, material stockpiles, and other surfaces which can create airborne dusts;
  2. Installation and use of hoods, fans, and fabric filters to enclose and vent the handling of dusty materials, or the use of water sprays or other measures to suppress the dust emissions during handling.
  3. The maintenance of paved roadways in a clean condition;
  4. The prompt removal of earth or other material from a paved street which earth or other material has been transported thereto by trucking or other earth moving equipment or erosion by water.
- b) Pursuant to 401 KAR 63:010, Section 3, no person shall cause or permit the discharge of visible fugitive dust emissions beyond the lot line of the property on which the emissions originate.

**SECTION B - EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)**

- c) Pursuant to 401 KAR 63:010, no one shall allow earth or other material being transported by truck or earth moving equipment to be deposited onto a paved street or roadway.

**2. Emission Limitations:**

NA

**3. Testing Requirements:**

NA

**4. Specific Monitoring Requirements:**

Pursuant to 401 KAR 52:020, Section 10, the permittee shall monitor the amount of coal (tonnages) received and processed through each piece of conveying or handling equipment, including stockpiles, on a weekly basis. Visible emissions from each piece of equipment or operation described for this item or group shall be monitored daily during daylight hours to determine whether conditions appear to be normal or abnormal.

**5. Specific Recordkeeping Requirements:**

Pursuant to 401 KAR 52:020, Section 10, records of the amount of coal (tonnages) received and processed through each piece of conveying or handling equipment, including stockpiles, on a weekly basis.

**6. Specific Reporting Requirements:**

Refer to Section F, Monitoring, Recordkeeping and Reporting Requirements.

**7. Specific Control Equipment Operating Conditions:**

- a) Pursuant to 401 KAR 50:055, the watering and compaction on the stockpile shall be used and operated to maintain compliance with permitted emission limitations and applicable requirements, in accordance with standard operating practices.
- b) Pursuant to 401 KAR 52:020, Section 10, records regarding the maintenance and operation of the control equipment and measures mentioned in Subsection 7(a) shall be maintained.
- c) Refer to Section E, Source Control Equipment Requirements.

## SECTION B - EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)

**Emissions unit: 04 (03 (08-21)) - Coal crushing and processing operations**

### **Description:**

Equipment includes:

Emission Unit:	Description:	Process Rate (tons/hour):	Control Method:
03-08	Pan Scraper Loads into Pile	4500	Precautionary Measures
03-09	Loaded Pan Scraper on Storage Pile	39.6	Precautionary Measures
03-10	Empty Pan Scraper on Storage Pile	61.6	Precautionary Measures
03-11	Loading Pan Scraper on Storage Pile	22	Precautionary Measures
03-12	Pan Scraper Scrapes Coal from Pile	19	Precautionary Measures
03-13	Pan Scraper to Reclaim Hopper	2000	Precautionary Measures
03-14	Reclaim Hopper to Conveyer D	2000	Full Enclosure & Baghouse
03-15	Conveyer D to 270 Ton Surge Bin	2000	Full Enclosure & Baghouse
03-16	270 Ton Surge Bin to Coal Crusher	2000	Full Enclosure & Baghouse
03-17	Coal Crushing	2000	Full Enclosure & Baghouse
03-18	Coal Crusher to Conveyer F1	2000	Full Enclosure & Baghouse
03-19	Conveyer F1 to Conveyer G1	2000	Full Enclosure & Baghouse
03-20	Conveyer G1 to tripper G1-1	2000	Full Enclosure & Baghouse
03-21	Tripper G1-1 to Unit 2 Bunkers	2000	Full Enclosure & Baghouse

Construction commenced: 1976

### **Applicable Regulations:**

**401 KAR 60:005**, incorporating by reference 40 CFR 60, Subpart Y, Standards of performance for coal preparation plants, for emissions units commenced after October 24, 1974.

**401 KAR 51:017**, Prevention of significant deterioration of air quality

### **1. Operating Limitations:**

NA

### **2. Emission Limitations:**

Pursuant to 40 CFR 60.252, the owner or operator subject to the provisions of this regulation shall not cause to be discharged into the atmosphere from any coal processing and conveying equipment, coal storage system, or transfer and loading system processing coal, gases which exhibit 20 percent opacity or greater.

### **Compliance Demonstration Method:**

See 4.b Specific Monitoring Requirements for compliance.

### **3. Testing Requirements:**

a) Pursuant to 40 CFR 60.254, EPA Reference Method 9 and the procedures in 40 CFR 60.11 shall be used to determine opacity.

## **SECTION B - EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)**

- b) If no additional Method 9 performance tests are performed pursuant to 4.c) Specific Monitoring Requirements, the permittee shall conduct at least one Method 9 evaluation on each emission point stack, each calendar quarter to demonstrate compliance with the particulate standard.

### **4. Specific Monitoring Requirements:**

- a) Pursuant to 401 KAR 52:020, Section 10, the permittee shall monitor the amount of material processed and the hours of operation of the unit on a weekly basis.
- b) Pursuant to 40 CFR 64.4(a)(1) and the CAM plan filed, opacity shall be used as an indicator of particulate matter emissions. The permittee shall perform a visible observation of the opacity of emissions from each stack on a daily weekday (Monday thru Friday) basis and maintain a log of the observation. If visible emissions from a stack are seen, then an inspection shall be initiated of the control equipment for any repairs.
- c) Pursuant to 401 KAR 52:020, Section 10, if during qualitative visible observations, visible emissions from an affected facility are seen at least once each week for two consecutive weeks, then the opacity of emissions shall be determined by EPA Reference Method 9 at least once during that two-week period while the affected facility is operating at representative capacity or at a frequency requested by the Division.

### **5. Specific Recordkeeping Requirements:**

Pursuant to 401 KAR 52:020, Section 10, the permittee shall record the amount of coal received and processed on a weekly basis for emissions inventory purposes.

### **6. Specific Reporting Requirements:**

Refer to Section F, Monitoring, Recordkeeping and Reporting Requirements.

### **7. Specific Control Equipment Operating Conditions:**

- a) Pursuant to 401 KAR 50:055, Section 2, the enclosure and baghouses on the two crushers, and the enclosures and baghouses on the conveyors and transfer points, baghouses for the coal bunker load-in, and baghouses (same as for crushers) for the coal pile reclaim shall be operated to maintain compliance with permitted emission limitations, in accordance with manufacturer's specifications and standard operating practices.
- b) Pursuant to 401 KAR 52:020, Section 10, records regarding the maintenance of the control equipment shall be maintained.
- c) Refer to Section E, Source Control Equipment Requirements.

## SECTION B - EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)

### Emissions unit: 08 (01-07) -Main Flyash Storage Silo Loadout to Dump Trucks

#### Description:

Equipment includes:

Emission Unit:	Description:	Process Rate (tons/hour):	Control Method:
08-01	ESP Hopper to Pneumatic Conveyer	50	Drop Heights
08-02	Pneumatic Conveyer to Main Fly Ash Silo	150	Full Enclosure & ESP
08-03	Main Fly Ash Silo to Pneumatic Conveyer	150	Full Enclosure
08-04	Pneumatic Conveyer to Fixing Plant Ash silo	100	Full Enclosure & Baghouse
08-05	Main Fly Ash Silo to Pug Mill	300	Full Enclosure
08-06	Pug Mill Mixing	150	Full Enclosure & Mix Material with Water
08-07	Pug Mill to Dump Truck	300	Drop Heights & Residual Moisture

Construction commenced: 1976

#### Applicable Regulations:

**401 KAR 63:010**, Fugitive emissions is applicable to each affected facility which emits or may emit fugitive emissions and is not elsewhere subject to an opacity standard within the administrative regulations of the Division for Air Quality.

#### 1. Operating Limitations:

- a) Pursuant to 401 KAR 63:010, Section 3, reasonable precautions shall be taken to prevent particulate matter from becoming airborne. Such reasonable precautions shall include, when applicable, but not be limited to the following:
  1. Application and maintenance of asphalt, application of water, or suitable chemicals on roads, material stockpiles, and other surfaces which can create airborne dusts;
  2. Installation and use of hoods, fans, and fabric filters to enclose and vent the handling of dusty materials, or the use of water sprays or other measures to suppress the dust emissions during handling.
  3. The maintenance of paved roadways in a clean condition;
  4. The prompt removal of earth or other material from a paved street which earth or other material has been transported thereto by trucking or other earth moving equipment or erosion by water.
- b) Pursuant to 401 KAR 63:010, Section 3, no person shall cause or permit the discharge of visible fugitive dust emissions beyond the lot line of the property on which the emissions originate.

## **SECTION B - EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)**

- c) Pursuant to 401 KAR 63:010, no one shall allow earth or other material being transported by truck or earth moving equipment to be deposited onto a paved street or roadway.

### **2. Emission Limitations:**

NA

### **3. Testing Requirements:**

NA

### **4. Specific Monitoring Requirements:**

Refer to Section F, Monitoring, Recordkeeping and Reporting Requirements.

### **5. Specific Recordkeeping Requirements:**

Pursuant to 401 KAR 52:020, Section 10, records of the flyash processed (tonnages) shall be maintained for emission inventory purposes.

### **6. Specific Reporting Requirements:**

Refer to Section F, Monitoring, Recordkeeping and Reporting Requirements.

### **7. Specific Control Equipment Operating Conditions:**

- a) Pursuant to 401 KAR 50:055, Adequate control measures shall be used to maintain compliance with permitted applicable requirements, in accordance with manufacturer's specifications and standard operating practices.
- b) Pursuant to 401 KAR 52:020, Section 10, records regarding the maintenance and operation/use of the control equipment and measures mentioned in Subsection 7(a) shall be maintained.
- c) Refer to Section E, Source Control Equipment Requirements.

## SECTION B - EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)

### Emissions unit: 10 (01-15) - Flue Gas Desulfurization Sludge Fixing Plant

#### Description:

Equipment includes:

Emission Unit:	Description:	Process Rate (tons/hour):	Control Method:
10-01	Fixing Plant Ash Silo to Conveyer CO-267	72	Full Enclosure
10-02	Conveyer CO-267 to Conveyer CO-264	72	Full Enclosure
10-03	Conveyer CO-264 to Pug Mill 2-1 & 2-2	72	Full Enclosure
10-04	Fixing Plant Lime Silo to Conveyer CO-265	72	Full Enclosure
10-05	Conveyer CO-265 to Conveyer CO-264	72	Full Enclosure
10-06	Conveyer CO-264 to Pug Mill 2-1 & 2-2	72	Full Enclosure
10-07	Pug Mill Mixer 2-1 & 2-2 Mixing	500	Rotoclones, Full Enclosure
10-08	Pug Mill Mixers to Mixer Conveyer	500	Full Enclosure
10-09	Mixer Discharge Conveyer to Pile	500	Precaution
10-10	Pile to Track Hoe (Mobile Loader)	500	Precaution
10-11	Track Hoe to Dump Truck	500	Precaution
10-12	Dump Truck to Emergency Hopper	50	Precaution
10-13	Emergency Hopper to Belt Feeder	50	Full Enclosure
10-14	Belt Feeder to Reclaim Hopper	50	Full Enclosure
10-15	Reclaim Conveyer to Pug Mill Mixer 2-1	50	Full Enclosure

Construction commenced: 1976

#### Applicable Regulations:

**401 KAR 59:010**, New process operations, applicable to an emissions unit commenced on or after July 2, 1975

#### **1. Operating Limitations:**

Pursuant to 401 KAR 52:020, Section 10, the operating rate shall not exceed 250 tons/hour.

#### **2. Emission Limitations:**

a) Pursuant to 401 KAR 59:010, Section 3(2), particulate matter emissions into the open air shall not exceed  $[17.31(P)^{0.16}]$  pounds per hour based on a three-hour average where P is the processing rate in tons per hour. (The permittee may assure compliance with the particulate standard by calculating emissions using the following formula: pounds PM per hour = Material throughput in Tons/Hour x 0.012 pounds per ton x (1-0.91).)

b) Pursuant to 401 KAR 59:010, Section 3(1)(a) visible emissions shall not equal or exceed twenty (20) percent opacity based on a six-minute average.

#### **Compliance Demonstration Method:**

See 4.a and 4.b Specific Monitoring Requirements for compliance.



## **SECTION B - EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)**

### **3. Testing Requirements:**

Testing shall be conducted at such times as may be requested by the cabinet in accordance with 401 KAR 59:005, Section 2(2) and 401 KAR 50:045, Section 4.

### **4. Specific Monitoring Requirements:**

a) Pursuant to 401 KAR 52:020, Section 10, the permittee shall monitor the processing rate and hours of operation on a weekly basis.

b) Pursuant to 40 CFR 64.4(a)(1) and the CAM plan filed, opacity shall be used as an indicator of particulate matter emissions. The permittee shall perform a visible observation of the opacity of emissions from each stack on a daily weekday (Monday thru Friday) basis and maintain a log of the observation. If visible emissions from a stack are seen, then an inspection shall be initiated of the control equipment for any repairs.

c) Pursuant to 401 KAR 52:020, Section 10, if during qualitative visible observations, visible emissions from an affected facility are seen at least once each week for two consecutive weeks, then the opacity of emissions shall be determined by EPA Reference Method 9 at least once during that two-week period while the affected facility is operating at representative capacity or at a frequency requested by the Division.

### **5. Specific Record Keeping Requirements:**

a) Pursuant to 401 KAR 52:020, Section 10, records of the weekly material processed (tonnages) and the weekly hours of operation shall be maintained.

b) Pursuant to 401 KAR 52:020, Section 10, records documenting the results of each opacity reading by EPA Reference Method 9 shall be maintained.

### **6. Specific Reporting Requirements:**

Refer to Section F, Monitoring, Recordkeeping and Reporting Requirements.

### **7. Specific Control Equipment Operating Conditions:**

a) Pursuant to 401 KAR 50:055, the enclosures shall be used on all conveyors and transfer points, and enclosure and two hydrostatic rotoclones (wet type dust collectors) shall be used on the two pug mills and operated to maintain compliance with permitted emission limitations, in accordance with manufacturer's specifications and standard operating practices.

b) Pursuant to 401 KAR 52:020, Section 10, records regarding the maintenance and operation and use of all control equipment in Subsection 7(a) shall be maintained.

c) Refer to Section E, Source Control Equipment Requirements.

## SECTION B - EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)

### Emissions unit: 11 (11 and 12) - Plant Roadways

#### Description:

Emission Unit:	Description:	Process Rate (1000 tons of material transported/hour):	Control Method:
11	Unpaved Roads	0.5	Full Enclosure
12	Paved Roads	0.5	Full Enclosure

#### Applicable Regulations:

**401 KAR 63:010**, Fugitive emissions is applicable to each affected facility which emits or may emit fugitive emissions and is not elsewhere subject to an opacity standard within the administrative regulations of the Division for Air Quality.

#### 1. Operating Limitations:

- a) Pursuant to 401 KAR 63:010, Section 3, reasonable precautions shall be taken to prevent particulate matter from becoming airborne. Such reasonable precautions shall include, when applicable, but not be limited to the following:
  1. application and maintenance of asphalt, application of water, or suitable chemicals on roads, material stockpiles, and other surfaces which can create airborne dusts;
  2. the maintenance of paved roadways in a clean condition;
  3. the prompt removal of earth or other material from a paved street which earth or other material has been transported thereto by trucking or other earth moving equipment or erosion by water.
- b) Pursuant to 401 KAR 63:010, Section 3, no person shall cause or permit the discharge of visible fugitive dust emissions beyond the lot line of the property on which the emissions originate.
- c) Pursuant to 401 KAR 63:010, no one shall allow earth or other material being transported by truck or earth moving equipment to be deposited onto a paved street or roadway.

#### 2. Emission Limitations:

NA

#### 3. Testing Requirements:

NA

#### 4. Specific Monitoring Requirements:

Refer to Section F, Monitoring, Recordkeeping and Reporting Requirements.

#### 5. Specific Record Keeping Requirements:

Pursuant to 401 KAR 52:020, Section 10, records of the tonnage of materials hauled shall be maintained.

**SECTION B - EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)**

**6. Specific Reporting Requirements:**

Refer to Section F, Monitoring, Recordkeeping and Reporting Requirements.

**7. Specific Control Equipment Operating Conditions:**

a) Pursuant to 401 KAR 63:010, plant roadways shall be controlled with water.

b) Refer to Section E, Source Control Equipment Requirements.

## SECTION B - EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)

### Emissions unit: 12 (12-14) -Landfill Operations

#### Description:

Equipment includes:

Emission Unit:	Description:	Operating Hours:	Control Method:
12-12	Bulldozing	1	None
12-13	Truck Dumping	500	Watering as needed

Construction commenced: 1976

Emission Unit:	Description:	Acre Years of Exposure:	Control Method:
12-14	Wind Erosion	25	Watering as needed

Construction commenced: 1976

#### Applicable Regulations:

**401 KAR 63:010**, Fugitive emissions is applicable to each affected facility which emits or may emit fugitive emissions and is not elsewhere subject to an opacity standard within the administrative regulations of the Division for Air Quality.

#### 1. Operating Limitations:

- a) Pursuant to 401 KAR 63:010, Section 3, reasonable precautions shall be taken to prevent particulate matter from becoming airborne. Such reasonable precautions shall include, when applicable, but not be limited to the following:
  1. Application and maintenance of asphalt, application of water, or suitable chemicals on roads, material stockpiles, and other surfaces which can create airborne dusts;
  2. Installation and use of hoods, fans, and fabric filters to enclose and vent the handling of dusty materials, or the use of water sprays or other measures to suppress the dust emissions during handling;
  3. The maintenance of paved roadways in a clean condition;
  4. The prompt removal of earth or other material from a paved street which earth or other material has been transported thereto by trucking or other earth moving equipment or erosion by water.
- b) Pursuant to 401 KAR 63:010, Section 3, no person shall cause or permit the discharge of visible fugitive dust emissions beyond the lot line of the property on which the emissions originate.
- c) Pursuant to 401 KAR 63:010, Section 3, no one shall allow earth or other material being transported by truck or earth moving equipment to be deposited onto a paved street or roadway.

#### 2. Emission Limitations:

NA

**SECTION B - EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)****3. Testing Requirements:**

NA

**4. Specific Monitoring Requirements:**

Refer to Section F, Monitoring, Recordkeeping and Reporting Requirements.

**5. Specific Record Keeping Requirements:**

Pursuant to 401 KAR 52:020, Section 10, records of the disposal rate (tonnages) shall be maintained.

**6. Specific Reporting Requirements:**

Refer to Section F, Monitoring, Recordkeeping and Reporting Requirements.

**7. Specific Control Equipment Operating Conditions:**

- a) Pursuant to 401 KAR 63:010, watering shall be used to maintain compliance with applicable requirements, in accordance with standard operating practices.
- b) Pursuant to 401 KAR 52:020, Section 10, records regarding the maintenance and use of the control measures in Subsection 7(a) shall be maintained.
- c) Refer to Section E, Source Control Equipment Requirements.

## SECTION B - EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)

### Emissions unit: 14 (01-25) - Lime Handling Operations (Fugitive Emissions)

#### Description:

Equipment includes:

Emission Unit:	Description:	Process Rate (tons/hour):	Control Method:
14-01	Lime Barge Loader	600	Short Drop Heights
14-02	Lime Barge Unloader Hopper	600	Part Encl & Baghouse
14-03	Lime Hopper to belt Feeder	600	Total Encl & Baghouse
14-04	Belt Feeder to Conveyer 1	600	Total Encl & Baghouse
14-05	Conveyer 1 to Main Lime Silo	600	Total Encl & Baghouse
14-06	Main Lime Silo to Conveyer 3-A	120	Total Encl & Baghouse
14-07	Conveyer 3-A to Vibrating Screen	120	Total Encl & Baghouse
14-08	Vibrating Screen	120	Total Encl & Baghouse
14-09	Vibrating Screen to day Bin	120	Total Encl & Baghouse
14-10	Day bin to screw Conveyer	32	Total Encl & Baghouse
14-11	Screw Conveyer to vert-Mill	32	Total Encl & Baghouse
14-12	Lime Crushers (4)	32	Total Encl & Baghouse
14-13	Dump Crush Lime to Dumper House Hopper	25	Part Encl & Baghouse
14-14	Dumper House Hopper to belt Feed	25	Total Encl & Baghouse
14-15	Belt Feed to Conveyer 3	25	Total Encl & Baghouse
14-16	Conveyer 3 to conveyer 3-A	25	Total Encl & Baghouse
14-17	Main Lime Silo to truck Loading	25	Total Enclosed
14-18	FGD Sludge Fix Plant Truck Dump	25	Part Encl & Baghouse
14-19	Sludge Fix Plant to Lime crusher	25	Total Encl & Baghouse
14-20	Lime Crusher (4)	25	Total Encl & Baghouse
14-21	Lime Crusher to Belt Feeder	25	Total Encl & Baghouse
14-22	Belt Feeder to Sludge Fix Plant Lime Conveyer	25	Total Encl & Baghouse
14-23	Sludge Fix Plant Lime Conveyer to Lime Silo	25	Total Encl & Baghouse
14-24	FGD Plant Lime Tanker Unload	75	Total Encl & Baghouse
14-25	FGD Plant Lime Silo	75	Total Encl & Baghouse

Construction commenced: 1976

#### Applicable Regulations:

**401 KAR 63:010**, Fugitive emissions is applicable to each affected facility which emits or may emit fugitive emissions and is not elsewhere subject to an opacity standard within the administrative regulations of the Division for Air Quality.

**401 KAR 51:017**, Prevention of significant deterioration of air quality.

#### 1. Operating Limitations:

- a) Pursuant to 401 KAR 63:010, Section 3, reasonable precautions shall be taken to prevent particulate matter from becoming airborne. Such reasonable precautions shall include, when applicable, but not be limited to the following:

**SECTION B - EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)**

1. Application and maintenance of asphalt, application of water, or suitable chemicals on roads, material stockpiles, and other surfaces which can create airborne dusts;
  2. Installation and use of hoods, fans, and fabric filters to enclose and vent the handling of dusty materials, or the use of water sprays or other measures to suppress the dust emissions during handling.
  3. The maintenance of paved roadways in a clean condition;
  4. The prompt removal of earth or other material from a paved street which earth or other material has been transported thereto by trucking or other earth moving equipment or erosion by water.
- b) Pursuant to 401 KAR 63:010, Section 3, no person shall cause or permit the discharge of visible fugitive dust emissions beyond the lot line of the property on which the emissions originate.
- c) Pursuant to 401 KAR 63:010, Section 4, no one shall allow earth or other material being transported by truck or earth moving equipment to be deposited onto a paved street or roadway.
2. **Emission Limitations:**  
NA
  3. **Testing Requirements:**  
NA
  4. **Specific Monitoring Requirements:**  
Refer to Section F, Monitoring, Recordkeeping and Reporting Requirements.
  5. **Specific Record Keeping Requirements:**  
Pursuant to 401 KAR 52:020, Section 10, records of the lime received and processed (tonnages) shall be maintained on a weekly basis for emission inventory purposes.
  6. **Specific Reporting Requirements:**  
Refer to Section F, Monitoring, Recordkeeping and Reporting Requirements.
  7. **Specific Control Equipment Operating Conditions:**
    - a) Pursuant to 401 KAR 63:010, watering shall be used to maintain compliance with applicable requirements, in accordance with standard operating practices.
    - b) Pursuant to 401 KAR 52:020, Section 10, records regarding the maintenance and use of the control measures in Subsection 7(a) shall be maintained.
    - c) Refer to Section E, Source Control Equipment Requirements.

**SECTION B - EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)****Emissions unit: 13 - Emergency Diesel Generator****Description:**

Number two-fuel oil-fired unit

Maximum continuous rating: 7.7 MMBtu/hour (1100 HP)

Construction commenced: 1976

**Applicable Regulations:**

401 KAR 63:002, incorporating by reference 40 CFR 63 Subpart ZZZZ, National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines; existing stationary RICE with a site rating of more than 500 brake (HP) located at a major source of HAP emissions, that was constructed before December 19, 2002.

**1. Operating Limitations:**

- a) 40 CFR 63.6590(b)(3)(iii), an existing emergency stationary RICE with a site rating of more than 500 brake HP located at a major source of HAP emissions does not have to meet the requirements of 40 CFR 63, Subpart ZZZZ, including initial notification requirements.
- b) Pursuant to 40 CFR 63.6640(f)(2), Requirements for emergency stationary RICE, the permittee must operate the engine according to the conditions described in paragraphs (f)(2)(i) through (iii) of this section. If the engine is not operated according to the requirements in paragraphs (f)(2)(i) through (iii) of this section, the engine will not be considered an emergency engine under this subpart and will need to meet all requirements for non-emergency engines.
  - (i) There is no time limit on the use of emergency stationary RICE in emergency situations.
  - (ii) The permittee may operate the emergency stationary RICE for the purpose of maintenance checks and readiness testing, provided that the tests are recommended by the manufacturer, the vendor, or the insurance company associated with the engine. Required testing of such units should be minimized, but there is no time limit on the use of emergency stationary RICE in emergency situations and for routine testing and maintenance.
  - (iii) The permittee may operate the emergency stationary RICE for an additional 50 hours per year in non-emergency situations. The 50 hours per year for non-emergency situations cannot be used for peak shaving or to generate income for a facility to supply power to an electric grid or otherwise supply power as part of a financial arrangement with another entity.

**2. Emission Limitations:**

NA

**3. Testing Requirements:**

Testing shall be conducted at such times as may be requested by the cabinet in accordance with 401 KAR 59:005, Section 2(2) and 401 KAR 50:045, Section 4.



**SECTION B - EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)****4. Specific Monitoring Requirements:**

- a) Pursuant to 401 KAR 52:020, Section 10, the permittee shall monitor the amount of fuel used at the engine on a monthly basis.
- b) Pursuant to 401 KAR 52:020, Section 10, the permittee shall monitor the hours of operation for the engine on a monthly basis.

**5. Specific Record Keeping Requirements:**

- a) Pursuant to 401 KAR 52:020, Section 10, the permittee shall maintain records of the amount of fuel oil usage (gallons) for the engine monthly basis.
- b) Pursuant to 401 KAR 52:020, Section 10, the permittee shall maintain records of the hours of operation of the engine on a monthly basis.

**6. Specific Reporting Requirements:**

Refer to Section F, Monitoring, Recordkeeping and Reporting Requirements.

**SECTION B - EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)****Emissions unit: 16 - Emergency Diesel Fire Pump****Description:**

Cummins, Model NT-855-F2

Maximum continuous rating: 2.1 MMBtu/hour (285 HP)

Construction commenced: 1976

**Applicable Regulations:**

401 KAR 63:002, incorporating by reference 40 CFR 63 Subpart ZZZZ, National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines; existing stationary RICE with a site rating of less than 500 brake (HP) located at a major source of HAP emissions, that was constructed before June 12, 2006.

**1. Operating Limitations:**

- a) Pursuant to 40 CFR 63.6595(a), the permittee shall comply with these operating conditions no later than May 3, 2013.
- b) Pursuant to 40 CFR 63.6602, the permittee shall:
  1. Change oil and filter every 500 hours of operation or annually, whichever comes first;
  2. Inspect air cleaner every 1,000 hours of operation or annually, whichever comes first; and
  3. Inspect all hoses and belts every 500 hours of operation or annually, whichever comes first, and replace as necessary.
- c) Pursuant to 40 CFR 63.6625(i), the permittee has the option of utilizing an oil analysis program in order to extend the specified oil change requirement above. The oil analysis must be performed at the same frequency specified for changing the oil as described above. The analysis program must at a minimum analyze the following three parameters: Total Base Number, viscosity, and percent water content. The condemning limits for these parameters are as follows: Total Base Number is less than 30 percent of the Total Base Number of the oil when new; viscosity of the oil has changed by more than 20 percent from the viscosity of the oil when new; or percent water content (by volume) is greater than 0.5. If all of these condemning limits are not exceeded, the permittee is not required to change the oil. If any of the limits are exceeded, the permittee shall change the oil within 2 days of receiving the results of the analysis; if the engine is not in operation when the results of the analysis are received, the permittee shall change the oil within 2 days or before commencing operation, whichever is later. The permittee shall keep records of the parameters that are analyzed as part of the program, the results of the analysis, and the oil changes for the engine. The analysis program shall be part of the maintenance plan for the engine.
- d) Pursuant to 40 CFR 40 CFR 63.6605(a), the permittee shall be in compliance with the emission limitations and operating limitations at all times.

**SECTION B - EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)**

- e) Pursuant to 40 CFR 6605(b), at all times the permittee shall operate and maintain any affected source, including associated air pollution control equipment and monitoring equipment, in a manner consistent with safety and good air pollution control practices for minimizing emissions. The general duty to minimize emissions does not require the permittee to make any further efforts to reduce emissions if levels required by this standard have been achieved. Determination of whether such operation and maintenance procedures are being used will be based on information available to the Division which may include, but is not limited to, monitoring results, review of operation and maintenance procedures, review of operation and maintenance records, and inspection of the source.
- f) Pursuant to 40 CFR 63.6625(e), 40 CFR 63.6640(a), the permittee shall operate and maintain the engine and after-treatment control device (if any) according to the manufacturer's emission-related written instructions or develop a maintenance plan which shall provide to the extent practicable for the maintenance and operation of the engine in a manner consistent with good air pollution control practice for minimizing emissions.
- g) Pursuant to 40 CFR 63.6625(h), the permittee shall minimize the engine's time spent at idle during startup and minimize the engine's startup time to a period needed for appropriate and safe loading of the engine, not to exceed 30 minutes.
- h) Pursuant to 40 CFR 63.6640(f), the permittee shall operate the engine according to the requirements in paragraphs (i) through (iii) below. Any operation other than emergency operation, maintenance and testing, and operation in non-emergency situations for 50 hours per year for each engine is prohibited. If the permittee does not operate the engine according to the requirements in paragraphs (i) through (iii) below, the engine will not be considered an emergency engine under 40 CFR Subpart ZZZZ and will need to meet all requirements for non-emergency engines.
  - (i) There is no time limit on the use of the engine in emergency situations.
  - (ii) The permittee may operate the engine for the purpose of maintenance checks and readiness testing, provided that the tests are recommended by Federal, State or local government, the manufacturer, the vendor, or the insurance company associated with the engine. Maintenance checks and readiness testing is limited to 100 hours per year for each engine. The permittee may petition the Division for approval of additional hours to be used for maintenance checks and readiness testing, but a petition is not required if the permittee records indicating that Federal, State, or local standards require maintenance and testing of each engine beyond 100 hours per year.
  - (iii) The permittee may operate each engine up to 50 hours per year in non-emergency situations, but those 50 hours are counted towards the 100 hours per year provided for maintenance and testing. The 50 hours per year for non-emergency situations cannot be used for peak shaving or to generate income for a facility to supply

**SECTION B - EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)**

power to an electric grid or otherwise supply power as part of a financial arrangement with another entity; except that the permittee may operate the emergency engine for a maximum of 15 hours per year as part of a demand response program if the regional transmission organization or equivalent balancing authority and transmission operator has determined there are emergency conditions that could lead to a potential electrical blackout, such as unusually low frequency, equipment overload, capacity or energy deficiency, or unacceptable voltage level. The engine may not be operated for more than 30 minutes prior to the time when the emergency condition is expected to occur, and the engine operation must be terminated immediately after the facility is notified that the emergency condition is no longer imminent. The 15 hours per year of demand response operation are counted as part of the 50 hours of operation per year provided for non-emergency situations. The supply of emergency power to another entity or entities pursuant to financial arrangement is not limited by this paragraph, as long as the power provided by the financial arrangement is limited to emergency power.

***Compliance Demonstration Method:***

Compliance shall be demonstrated by monitoring, recordkeeping and reporting of operational data. See 4. Specific Monitoring Requirements, 5. Specific Recordkeeping Requirements, and 6. Specific Reporting Requirements in this section.

**2. Emission Limitations:**

NA

**3. Testing Requirements:**

Testing shall be conducted at such times as may be requested by the cabinet in accordance with 401 KAR 59:005, Section 2(2) and 401 KAR 50:045, Section 4.

**4. Specific Monitoring Requirements:**

- a) Pursuant to 40 CFR 63.6625(f), the permittee shall install a non-resettable hour meter if one is not already installed.
- b) Pursuant to 401 KAR 52:020, Section 10, the permittee shall monitor fuel usage (gallons) a monthly basis.

**5. Specific Record Keeping Requirements:**

- a) Pursuant to 40 CFR 63.6655, the permittee shall keep the following records:
  1. A copy of each notification and report to comply with 40 CFR 63, Subpart ZZZZ.
  2. Records of the occurrence and duration of each malfunction of operation ( *i.e.*, process equipment) or the air pollution control and monitoring equipment.
  3. Records of all required maintenance performed on the air pollution control and monitoring equipment.

**SECTION B - EMISSION POINTS, EMISSION UNITS, APPLICABLE REGULATIONS, AND OPERATING CONDITIONS (CONTINUED)**

4. Records of actions taken during periods of malfunction to minimize emissions in accordance with 40 CFR 63.6605(b), including corrective actions to restore malfunctioning process and air pollution control and monitoring equipment to its normal or usual manner of operation.
  - b) Pursuant to 40 CFR 63.10(b)(1) and 40 CFR 63.6660(a), the permittee shall maintain records in a form suitable and readily available for expeditious review as specified in 40 CFR 63.10(b)(1). The permittee shall keep each record in hard copy or electronic form for at least 5 years following the date of each occurrence, measurement, maintenance, corrective action, report, or record.
  - c) Pursuant to 40 CFR 63.6655(e), the permittee shall keep records of the maintenance conducted to demonstrate that the permittee operated and maintained the engine and after-treatment control device (if any) according to its own maintenance plan.
  - d) Pursuant to 40 CFR 63.6655(f), the permittee shall keep records of the hours of operation of the engine that is recorded through the non-resettable hour meter. The permittee shall document how many hours are spent for emergency operation, including what classified the operation as emergency and how many hours are spent for non-emergency operation. If the engines are used for demand response operation, the permittee shall keep records of the notification of the emergency situation, and the time the engine was operated as part of demand response.
  - e) Pursuant to 401 KAR 52:020, Section 10, the records of fuel usage and hours of operation shall be maintained.
  - f) Refer to Section F, Monitoring, Recordkeeping and Reporting Requirements.
6. **Specific Reporting Requirements:**
  - a) Pursuant to 40 CFR 63.6640(b), the permittee shall report each instance in which it did not meet the operating limitations in this permit. These instances are deviations from operating limitations in 40 CFR 63 Subpart ZZZZ and shall be reported in accordance with 40 CFR 63.6650.
  - b) Pursuant to 40 CFR 63.6650(f), the permittee shall report all deviations in the semiannual monitoring report required by 40 CFR 70.6 (a)(3)(iii)(A) or 40 CFR 71.6(a)(3)(iii)(A).
  - c) Refer to Section F, Monitoring, Recordkeeping and Reporting Requirements.

**SECTION C - INSIGNIFICANT ACTIVITIES**

The activities within this group have been determined to be insignificant activities for this source pursuant to 401 KAR 52:020 Section 6. While these activities are designated as insignificant the permittee must comply with the applicable regulation and some minimal level of periodic monitoring may be necessary. Process and emission control equipment at each insignificant activity subject to a general applicable regulation shall be inspected monthly and qualitative visible emission evaluation made. The results of the inspections and observations shall be recorded in a log, noting color, duration, density (heavy or light), cause and any corrective actions taken for any abnormal visible emissions.

<u>Description</u>		<u>Generally Applicable Regulation</u>
1.	Main fuel oil storage tank, 500,000 gallons capacity, point 05-01.	NA
2.	Fuel oil day tank, 40,000 gallons capacity, point 05-02.	NA
3.	Landfill garage fuel oil tank, capacity 6,000 gallons, point 05-03.	NA
4.	Landfill portable fuel oil tank, 2,000 gallons capacity, point 05-04.	NA
5.	Landfill garage portable fuel oil tank (yellow) 500 gallons capacity, point 05-06.	NA
6.	Emergency diesel generator fuel oil tank, 500 gallons capacity, point 05-20.	NA
7.	Diesel powered fire pump fuel oil tank, 500 gallons capacity, point 05-21.	NA
8.	FGD fixing plant portable gasoline tank (red) 250 gallons capacity, point 06-07.	NA
9.	Coal yard gasoline tank, 500 gallons capacity, point 06-09.	NA
10.	Flyash handling operations, pneumatic dry enclosed transfer, point 09 (08).	401 KAR 59:010/401KAR63:010
11.	Lime handling operations, other than point 14 (04).	401 KAR 59:010 and/or 401 KAR 63:010
12.	Wet ash and ponded ash handling and management.	401 KAR 63:010
13.	Vessels storing lubricating oils, hydraulic oils, machining oils and machining fluids.	NA
14.	The following equipment related to manufacturing and repair activities not resulting in the emission of hazardous air pollutants: brazing equipment, cutting torches, soldering equipment, welding equipment.	401 KAR 63:010
15.	Activities associated with the treatment of wastewater streams with an oil and grease content less than or equal to one percent by volume.	NA
16.	Activities associated with the transportation and treatment of sanitary sewage, provided discharge to the treatment plant is under the control of the owner/operator, which is on-site sewage treatment facility.	NA

**SECTION C - INSIGNIFICANT ACTIVITIES (CONTINUED)**

	<u>Description</u>	<u>Generally Applicable Regulation</u>
17.	Operations using aqueous solutions containing less than one percent volatile organic compounds excluding hazardous air pollutants.	NA
18.	Maintenance activities associated with the repair of electrostatic precipitators, and scrubbers, and replacement of bags in baghouses, and replacement of filters, and repair of other filtration equipment.	401 KAR 63:010
19.	Maintenance activities associated with heat exchanger cleaning and repair.	NA
20.	Paved and unpaved roads and parking lots with public access.	401 KAR 63:010
21.	Laboratory fume hoods and vents used exclusively for chemical or physical analyses.	NA
22.	Combustion source flame safety purging on startup.	NA
23.	Water based adhesives that are less than or equal to five percent by volume volatile organic compounds, excluding hazardous air pollutants.	NA
24.	Unit 2 Mechanical draft cooling tower.	401 KAR 63:010

**SECTION D - SOURCE EMISSION LIMITATIONS AND TESTING REQUIREMENTS**

1. As required by Section 1b of the *Cabinet Provisions and Procedures for Issuing Title V Permits* incorporated by reference in 401 KAR 52:020, Section 10; compliance with annual emissions and processing limitations contained in this permit, shall be based on emissions and processing rates for any twelve (12) consecutive months.
2. Particulate, sulfur dioxide, nitrogen oxides, and visible (opacity) emissions, measured by applicable reference methods, or an equivalent or alternative method specified in 40 C.F.R. Chapter I, or by a test method specified in the state implementation plan shall not exceed the respective limitations specified herein.



**SECTION E - SOURCE CONTROL EQUIPMENT REQUIREMENTS**

Pursuant to 401 KAR 50:055, Section 2(5), at all times, including periods of startup, shutdown and malfunction, owners and operators shall, to the extent practicable, maintain and operate any affected facility including associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Division which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source.

## SECTION F - MONITORING, RECORDKEEPING, AND REPORTING REQUIREMENTS

1. Pursuant to Section 1b-IV-1 of the *Cabinet Provisions and Procedures for Issuing Title V Permits* incorporated by reference in 401 KAR 52:020, Section 10, when continuing compliance is demonstrated by periodic testing or instrumental monitoring, the permittee shall compile records of required monitoring information that include:
  - a. Date, place as defined in this permit, and time of sampling or measurements;
  - b. Analyses performance dates;
  - c. Company or entity that performed analyses;
  - d. Analytical techniques or methods used;
  - e. Analyses results; and
  - f. Operating conditions during time of sampling or measurement.
2. Records of all required monitoring data and support information, including calibrations, maintenance records, and original strip chart recordings, and copies of all reports required by the Division for Air Quality, shall be retained by the permittee for a period of five (5) years and shall be made available for inspection upon request by any duly authorized representative of the Division for Air Quality [Sections 1b-IV-2 and 1a-8 of the *Cabinet Provisions and Procedures for Issuing Title V Permits* incorporated by reference in 401 KAR 52:020, Section 10].
3. In accordance with the requirements of 401 KAR 52:020, Section 3(1)h, the permittee shall allow authorized representatives of the Cabinet to perform the following during reasonable times:
  - a. Enter upon the premises to inspect any facility, equipment (including air pollution control equipment), practice, or operation;
  - b. To access and copy any records required by the permit;
  - c. Sample or monitor, at reasonable times, substances or parameters to assure compliance with the permit or any applicable requirements.Reasonable times are defined as during all hours of operation, during normal office hours; or during an emergency.
4. No person shall obstruct, hamper, or interfere with any Cabinet employee or authorized representative while in the process of carrying out official duties. Refusal of entry or access may constitute grounds for permit revocation and assessment of civil penalties.
5. Summary reports of any monitoring required by this permit shall be submitted to the Regional Office listed on the front of this permit at least every six (6) months during the life of this permit, unless otherwise stated in this permit. For emission units that were still under construction or which had not commenced operation at the end of the 6-month period covered by the report and are subject to monitoring requirements in this permit, the report shall indicate that no monitoring was performed during the previous six months because the emission unit was not in operation [Sections 1b-V-1 of the *Cabinet Provisions and Procedures for Issuing Title V Permits* incorporated by reference in 401 KAR 52:020, Section 10].
6. The semi-annual reports are due by January 30th and July 30th of each year. All reports shall be certified by a responsible official pursuant to 401 KAR 52:020, Section 23. If continuous emission and opacity monitors are required by regulation or this permit, data shall be

**SECTION F - MONITORING, RECORDKEEPING, AND REPORTING REQUIREMENTS (CONTINUED)**

reported in accordance with the requirements of 401 KAR 59:005, General Provisions, Section 3(3). All deviations from permit requirements shall be clearly identified in the reports.

7. In accordance with the provisions of 401 KAR 50:055, Section 1, the owner or operator shall notify the Regional Office listed on the front of this permit concerning startups, shutdowns, or malfunctions as follows:
  - a. When emissions during any planned shutdowns and ensuing startups will exceed the standards, notification shall be made no later than three (3) days before the planned shutdown, or immediately following the decision to shut down, if the shutdown is due to events which could not have been foreseen three (3) days before the shutdown.
  - b. When emissions due to malfunctions, unplanned shutdowns and ensuing startups are or may be in excess of the standards, notification shall be made as promptly as possible by telephone (or other electronic media) and shall be submitted in writing upon request.
8. The owner or operator shall report emission related exceedances from permit requirements including those attributed to upset conditions (other than emission exceedances covered by Section F.7 above) to the Regional Office listed on the front of this permit within 30 days. Deviations from permit requirements, including those previously reported under F.7 above, shall be included in the semiannual report required by F.6 [Sections 1b-V, 3 and 4 of the *Cabinet Provisions and Procedures for Issuing Title V Permits* incorporated by reference in 401 KAR 52:020, Section 10].
9. Pursuant to 401 KAR 52:020, Title V permits, Section 21, the permittee shall annually certify compliance with the terms and conditions contained in this permit, by completing and returning a Compliance Certification Form (DEP 7007CC) (or an alternative approved by the regional office) to the Regional Office listed on the front of this permit and the U.S. EPA in accordance with the following requirements:
  - a. Identification of the term or condition;
  - b. Compliance status of each term or condition of the permit;
  - c. Whether compliance was continuous or intermittent;
  - d. The method used for determining the compliance status for the source, currently and over the reporting period.
  - e. For an emissions unit that was still under construction or which has not commenced operation at the end of the 12-month period covered by the annual compliance certification, the permittee shall indicate that the unit is under construction and that compliance with any applicable requirements will be demonstrated within the timeframes specified in the permit.
  - f. The certification shall be postmarked by January 30th of each year. Annual compliance certifications shall be mailed to the following addresses:

Division for Air Quality  
Florence Regional Office  
8020 Veterans Memorial Drive  
Suite 110  
Florence, Kentucky 41042

U.S. EPA Region 4  
Air Enforcement Branch  
Atlanta Federal Center  
61 Forsyth St.  
Atlanta, GA 30303-8960

**SECTION F - MONITORING, RECORDKEEPING, AND REPORTING  
REQUIREMENTS (CONTINUED)**

10. In accordance with 401 KAR 52:020, Section 22, the permittee shall provide the Division with all information necessary to determine its subject emissions within 30 days of the date the Kentucky Emissions Inventory System (KYEIS) emissions survey is mailed to the permittee.

**SECTION G - GENERAL PROVISIONS**1. General Compliance Requirements

- a. The permittee shall comply with all conditions of this permit. Noncompliance shall be a violation of 401 KAR 52:020, Section 3(1)(b), and a violation of Federal Statute 42 USC 7401 through 7671q (the Clean Air Act). Noncompliance with this permit is grounds for enforcement action including but not limited to termination, revocation and reissuance, revision or denial of a permit [Section 1a-3 of the *Cabinet Provisions and Procedures for Issuing Title V Permits* incorporated by reference in 401 KAR 52:020, Section 10].
- b. The filing of a request by the permittee for any permit revision, revocation, reissuance, or termination, or of a notification of a planned change or anticipated noncompliance, shall not stay any permit condition [Section 1a-6 of the *Cabinet Provisions and Procedures for Issuing Title V Permits* incorporated by reference in 401 KAR 52:020, Section 10].
- c. This permit may be revised, revoked, reopened and reissued, or terminated for cause in accordance with 401 KAR 52:020, Section 19. The permit will be reopened for cause and revised accordingly under the following circumstances:
  - (1) If additional applicable requirements become applicable to the source and the remaining permit term is three (3) years or longer. In this case, the reopening shall be completed no later than eighteen (18) months after promulgation of the applicable requirement. A reopening shall not be required if compliance with the applicable requirement is not required until after the date on which the permit is due to expire, unless this permit or any of its terms and conditions have been extended pursuant to 401 KAR 52:020, Section 12;
  - (2) The Cabinet or the United States Environmental Protection Agency (U. S. EPA) determines that the permit must be revised or revoked to assure compliance with the applicable requirements;
  - (3) The Cabinet or the U. S. EPA determines that the permit contains a material mistake or that inaccurate statements were made in establishing the emissions standards or other terms or conditions of the permit;
  - (4) New requirements become applicable to a source subject to the Acid Rain Program.

Proceedings to reopen and reissue a permit shall follow the same procedures as apply to Renewal permit issuance and shall affect only those parts of the permit for which cause to reopen exists. Reopenings shall be made as expeditiously as practicable. Reopenings shall not be initiated before a notice of intent to reopen is provided to the source by the Division, at least thirty (30) days in advance of the date the permit is to be reopened, except that the Division may provide a shorter time period in the case of an emergency.

- d. The permittee shall furnish information upon request of the Cabinet to determine if cause exists for modifying, revoking and reissuing, or terminating the permit; or to determine compliance with the conditions of this permit [Sections 1a- 7 and 8 of the *Cabinet Provisions and Procedures for Issuing Title V Permits* incorporated by reference in 401 KAR 52:020, Section 10].
- e. Emission units described in this permit shall demonstrate compliance with applicable requirements if requested by the Division [401 KAR 52:020, Section 3(1)(c)].

**SECTION G - GENERAL PROVISIONS (CONTINUED)**

- f. The permittee, upon becoming aware that any relevant facts were omitted or incorrect information was submitted in the permit application, shall promptly submit such supplementary facts or corrected information to the permitting authority [401 KAR 52:020, Section 7(1)].
- g. Any condition or portion of this permit which becomes suspended or is ruled invalid as a result of any legal or other action shall not invalidate any other portion or condition of this permit [Section 1a-14 of the *Cabinet Provisions and Procedures for Issuing Title V Permits* incorporated by reference in 401 KAR 52:020, Section 10].
- h. The permittee shall not use as a defense in an enforcement action the contention that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance [Section 1a-4 of the *Cabinet Provisions and Procedures for Issuing Title V Permits* incorporated by reference in 401 KAR 52:020, Section 10].
- i. All emission limitations and standards contained in this permit shall be enforceable as a practical matter. All emission limitations and standards contained in this permit are enforceable by the U.S. EPA and citizens except for those specifically identified in this permit as state-origin requirements. [Section 1a-15 of the *Cabinet Provisions and Procedures for Issuing Title V Permits* incorporated by reference in 401 KAR 52:020, Section 10].
- j. This permit shall be subject to suspension if the permittee fails to pay all emissions fees within 90 days after the date of notice as specified in 401 KAR 50:038, Section 3(6) [Section 1a-10 of the *Cabinet Provisions and Procedures for Issuing Title V Permits* incorporated by reference in 401 KAR 52:020, Section 10].
- k. Nothing in this permit shall alter or affect the liability of the permittee for any violation of applicable requirements prior to or at the time of permit issuance [401 KAR 52:020, Section 11(3) 2.].
- l. This permit does not convey property rights or exclusive privileges [Section 1a-9 of the *Cabinet Provisions and Procedures for Issuing Title V Permits* incorporated by reference in 401 KAR 52:020, Section 10].
- m. Issuance of this permit does not relieve the permittee from the responsibility of obtaining any other permits, licenses, or approvals required by the Cabinet or any other federal, state, or local agency.
- n. Nothing in this permit shall alter or affect the authority of U.S. EPA to obtain information pursuant to Federal Statute 42 USC 7414, Inspections, monitoring, and entry [401 KAR 52:020, Section 11(3) 4.].
- o. Nothing in this permit shall alter or affect the authority of U.S. EPA to impose emergency orders pursuant to Federal Statute 42 USC 7603, Emergency orders [401 KAR 52:020, Section 11(3) 1.].

**SECTION G - GENERAL PROVISIONS (CONTINUED)**

- p. This permit consolidates the authority of any previously issued PSD, NSR, or Synthetic Minor source preconstruction permit terms and conditions for various emission units and incorporates all requirements of those existing permits into one single permit for this source.
- q. Pursuant to 401 KAR 52:020, Section 11, a permit shield shall not protect the owner or operator from enforcement actions for violating an applicable requirement prior to or at the time of permit issuance. Compliance with the conditions of this permit shall be considered compliance with:
- (1) Applicable requirements that are included and specifically identified in this permit; and
  - (2) Non-applicable requirements expressly identified in this permit.
2. Permit Expiration and Reapplication Requirements
- a. This permit shall remain in effect for a fixed term of five (5) years following the original date of issue. Permit expiration shall terminate the source's right to operate unless a timely and complete renewal application has been submitted to the Division at least six (6) months prior to the expiration date of the permit. Upon a timely and complete submittal, the authorization to operate within the terms and conditions of this permit, including any permit shield, shall remain in effect beyond the expiration date, until the renewal permit is issued or denied by the Division [401 KAR 52:020, Section 12].
  - b. The authority to operate granted shall cease to apply if the source fails to submit additional information requested by the Division after the completeness determination has been made on any application, by whatever deadline the Division sets [401 KAR 52:020, Section 8(2)].
3. Permit Revisions
- a. A minor permit revision procedure may be used for permit revisions involving the use of economic incentive, marketable permit, emission trading, and other similar approaches, to the extent that these minor permit revision procedures are explicitly provided for in the State Implementation Plan (SIP) or in applicable requirements and meet the relevant requirements of 401 KAR 52:020, Section 14(2).
  - b. This permit is not transferable by the permittee. Future owners and operators shall obtain a new permit from the Division for Air Quality. The new permit may be processed as an administrative amendment if no other change in this permit is necessary, and provided that a written agreement containing a specific date for transfer of permit responsibility coverage and liability between the current and new permittee has been submitted to the permitting authority within ten (10) days following the transfer.
4. Construction, Start-Up, and Renewal Compliance Demonstration Requirements  
No construction authorized by this permit.

**SECTION G - GENERAL PROVISIONS (CONTINUED)****5. Testing Requirements**

- a. Pursuant to 401 KAR 50:045, Section 2, a source required to conduct a performance test shall submit a completed Compliance Test Protocol form, DEP form 6028, or a test protocol a source has developed for submission to other regulatory agencies, in a format approved by the cabinet, to the Division's Frankfort Central Office a minimum of sixty (60) days prior to the scheduled test date. Pursuant to 401 KAR 50:045, Section 7, the Division shall be notified of the actual test date at least thirty (30) days prior to the test.
- b. Pursuant to 401 KAR 50:045, Section 5, in order to demonstrate that a source is capable of complying with a standard at all times, any required performance test shall be conducted under normal conditions that are representative of the source's operations and create the highest rate of emissions. If [When] the maximum production rate represents a source's highest emissions rate and a performance test is conducted at less than the maximum production rate, a source shall be limited to a production rate of no greater than 110 percent of the average production rate during the performance tests. If and when the facility is capable of operation at the rate specified in the application, the source may retest to demonstrate compliance at the new production rate. The Division for Air Quality may waive these requirements on a case-by-case basis if the source demonstrates to the Division's satisfaction that the source is in compliance with all applicable requirements.
- c. Results of performance test(s) required by the permit shall be submitted to the Division by the source or its representative within forty-five days or sooner if required by an applicable standard, after the completion of the fieldwork.

**6. Acid Rain Program Requirements**

- a. If an applicable requirement of Federal Statute 42 USC 7401 through 7671q (the Clean Air Act) is more stringent than an applicable requirement promulgated pursuant to Federal Statute 42 USC 7651 through 7651o (Title IV of the Act), both provisions shall apply, and both shall be state and federally enforceable.
- b. The permittee shall comply with all applicable requirements and conditions of the Acid Rain Permit and the Phase II permit application (including the Phase II NOx compliance plan and averaging plan, if applicable) incorporated into the Title V permit issued for this source. The source shall also comply with all requirements of any revised or future acid rain permit(s) issued to this source.

**7. Emergency Provisions**

- a. Pursuant to 401 KAR 52:020, Section 24(1), an emergency shall constitute an affirmative defense to an action brought for the noncompliance with the technology-based emission limitations if the permittee demonstrates through properly signed contemporaneous operating logs or relevant evidence that:
  - (1) An emergency occurred and the permittee can identify the cause of the emergency;
  - (2) The permitted facility was at the time being properly operated;
  - (3) During an emergency, the permittee took all reasonable steps to minimize levels of emissions that exceeded the emissions standards or other requirements in the permit;and



**SECTION G - GENERAL PROVISIONS (CONTINUED)**

- (4) Pursuant to 401 KAR 52:020, 401 KAR 50:055, and KRS 224.01-400, the permittee notified the Division as promptly as possible and submitted written notice of the emergency to the Division when emission limitations were exceeded due to an emergency. The notice shall include a description of the emergency, steps taken to mitigate emissions, and corrective actions taken.
    - (5) This requirement does not relieve the source of other local, state or federal notification requirements.
  - b. Emergency conditions listed in General Condition G.7.a above are in addition to any emergency or upset provision(s) contained in an applicable requirement [401 KAR 52:020, Section 24(3)].
  - c. In an enforcement proceeding, the permittee seeking to establish the occurrence of an emergency shall have the burden of proof [401 KAR 52:020, Section 24(2)].
8. Ozone Depleting Substances
  - a. The permittee shall comply with the standards for recycling and emissions reduction pursuant to 40 CFR 82, Subpart F, except as provided for Motor Vehicle Air Conditioners (MVACs) in Subpart B:
    - (1) Persons opening appliances for maintenance, service, repair, or disposal shall comply with the required practices contained in 40 CFR 82.156.
    - (2) Equipment used during the maintenance, service, repair, or disposal of appliances shall comply with the standards for recycling and recovery equipment contained in 40 CFR 82.158.
    - (3) Persons performing maintenance, service, repair, or disposal of appliances shall be certified by an approved technician certification program pursuant to 40 CFR 82.161.
    - (4) Persons disposing of small appliances, MVACs, and MVAC-like appliances (as defined at 40 CFR 82.152) shall comply with the recordkeeping requirements pursuant to 40 CFR 82.166
    - (5) Persons owning commercial or industrial process refrigeration equipment shall comply with the leak repair requirements pursuant to 40 CFR 82.156.
    - (6) Owners/operators of appliances normally containing 50 or more pounds of refrigerant shall keep records of refrigerant purchased and added to such appliances pursuant to 40 CFR 82.166.
  - b. If the permittee performs service on motor (fleet) vehicle air conditioners containing ozone-depleting substances, the source shall comply with all applicable requirements as specified in 40 CFR 82, Subpart B, *Servicing of Motor Vehicle Air Conditioners*.
9. Risk Management Provisions
  - a. The permittee shall comply with all applicable requirements of 401 KAR Chapter 68, Chemical Accident Prevention, which incorporates by reference 40 CFR Part 68, Risk Management Plan provisions. If required, the permittee shall comply with the Risk Management Program and submit a Risk Management Plan to:
    - RMP Reporting Center
    - P.O. Box 1515
    - Lanham-Seabrook, MD 20703-1515.
  - b. If requested, submit additional relevant information to the Division or the U.S. EPA.

**SECTION H - ALTERNATE OPERATING SCENARIOS**

None

**SECTION I - COMPLIANCE SCHEDULE**

None

**SECTION J – ACID RAIN PERMIT**

**TITLE IV PHASE II ACID RAIN**

**ACID RAIN PERMIT CONTENTS**

- 1) Statement of Basis
- 2) SO<sub>2</sub> allowances allocated under this permit and NO<sub>x</sub> requirements for each affected unit.
- 3) Comments, notes and justifications regarding permit decisions and changes made to the permit application forms during the review process, and any additional requirements or conditions.
- 4) The permit application submitted for this source. The owners and operators of the source must comply with the standard requirements and special provisions set forth in the Phase II application, the Phase II NO<sub>x</sub> Compliance Plan, and the Phase II NO<sub>x</sub> Averaging Plan.
- 5) Summary of Actions

**1. Statement of Basis:**

**Statutory and Regulatory Authorities:** In accordance with KRS 224.10-100 and Titles IV and V of the Clean Air Act, the Kentucky Environmental and Public Protection Cabinet, Division for Air Quality issues this permit pursuant to 401 KAR 52:020, Permits, 401 KAR 52:060, Acid Rain Permit, and Federal Regulation 40 CFR Part 76.

**PERMIT (Conditions)**

<b>Plant Name:</b> East Bend Station
<b>Affected Unit:</b> 2

**2. SO<sub>2</sub> Allowance Allocations and NO<sub>x</sub> Requirements for the affected unit:**

SO <sub>2</sub> Allowances	Year				
	2012	2013	2014	2015	2016
<b>Tables 2, 3 or 4 of 40 CFR Part 73</b>	18,354*	18,354*	18,354*	18,354*	18,354*
<b>NO<sub>x</sub> Requirements</b>					
<b>NO<sub>x</sub> Limits</b>	Pursuant to 40 CFR Part 76, the Kentucky Division for Air Quality approves the NO <sub>x</sub> emissions averaging plan for this unit. Under this plan, this unit's NO <sub>x</sub> emissions shall not exceed the annual average alternative contemporaneous emissions limitation (ACEL) of 0.40 lb/MMBtu. In addition, this unit shall not have an annual heat input less than 50,700,000 MMBtu.				

\*The number of allowances allocated to Phase II affected units by U. S. EPA may change under 40 CFR 73. In addition, the number of allowances actually held by an affected source in a unit may differ from the number allocated by U.S.EPA. Neither of the aforementioned conditions necessitate a revision to the unit SO<sub>2</sub> allowance allocations identified in this permit (See 40 CFR 72.84).

**SECTION J – ACID RAIN PERMIT (CONTINUED)****3. Comments, Notes, and Justifications:**

1. Affected unit is one (1) dry bottom wall-fired boiler.
2. A NO<sub>x</sub> Permit application for these units was received on June 16, 2003.
3. All previously issued Acid Rain permits are hereby null and void

**4. Permit Application:** Attached

The Phase II Permit Application the Phase II NO<sub>x</sub> Compliance Plan, and the Phase II NO<sub>x</sub> Averaging Plans are part of this permit and the source must comply with the standard requirements and special provisions set forth in the Phase II Application, the revised Phase II NO<sub>x</sub> Compliance Plan, and the revised Phase II NO<sub>x</sub> Averaging Plan.

**SECTION K – CLEAN AIR INTERSTATE RULE (CAIR)****1. Statutory and Regulatory Authority:**

In accordance with KRS 224.10-100, the Kentucky Energy and Environmental Cabinet issues this permit pursuant to 401 KAR 52:020, Title V permits, 401 KAR 51:210, CAIR NO<sub>x</sub> Annual Trading Program, 401 KAR 51:220, CAIR NO<sub>x</sub> ozone season trading program, and 401 KAR 51:230, CAIR SO<sub>2</sub> Trading Program.

**2. Application and Requirements:**

The CAIR application for the electrical generating unit was submitted to the Division and received on February 9, 2012. The standard requirements and special provisions set forth in the application are hereby incorporated into and made part of this CAIR Permit. [401 KAR 51:210, 401 KAR 51:220, and 401 KAR 51:230]. Pursuant to 401 KAR 52:020, Section 3, the source shall operate in compliance with those requirements.

**3. Unit Description**

The affected unit is a dry bottom, wall fired boiler rated at 6,313 MMBtu/hour (Emission Unit 02). This unit has a capacity to generate 25 megawatts or more of electricity, which is offered for sale. This unit uses coal as the primary fuel source, and is used as base load electric generating unit.

**4. Summary of Actions**

The CAIR Permit is being issued as part of the Title V permit for this source. Public, affected state and U.S. EPA review will follow procedures specified in 401 KAR 52:100.

**SECTION L – TRANSPORT RULE**

On July 6, 2011, the U.S. EPA finalized the Cross-State Air Pollution Rule (CSAPR) "to identify and limit NO<sub>x</sub> and SO<sub>2</sub> emissions within 32 states in the eastern, midwestern, and southern United States that affect the ability of downwind states to attain and maintain compliance with the 1997 and 2006 PM<sub>2.5</sub> NAAQS and the 1997 ozone NAAQS."<sup>[1]</sup> On August 21, 2012, the United States Court of Appeals for the D.C. Circuit issued a decision vacating the Cross-State Air Pollution Rule (CSAPR), ruling that EPA exceeded its statutory authority in promulgating the rule.

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<sup>[1]</sup> *Federal Register*, August 8, 2011 (FR 48217)

**APPENDIX 7**

**DUKE ENERGY STANDARD OPERATING PROCEDURES**

**EAST BEND STATION**

**EAST LANDFILL**



**Duke Energy  
Coal Combustion Products**

**Quality Assurance and Quality Control of HDPE Pipe  
Butt Fusion Joints**

Procedure Number:

CCP-ENGSTD-NA-QA-004

Revision Number:

3

Effective Date:

07/08/2019



## DOCUMENT REVISION DESCRIPTION

<u>REVISION</u>	<u>Pages or sections revised and description</u>
000	Initial Issue
001	Removed language related to requesting relief from using hydraulic machines (5.1.7). Added requirement for inspection photos in fusion data recorder report (5.2.2.4 and 6.1.5).
002	Added references to pipe and fitting manufacturing standards. Added section 4.2 Materials to require manufacture of pipe and fittings to specific standards. Added paragraph 4.3.6 to require qualification of procedures other than ASTM F2620. Added paragraph 5.1.6 to emphasize fit-up requirements. Added paragraph 5.2.4 to include Microwave inspection requirements. Included requirements for data logger photos to be color (5.2.2.4, 6.1.5)
003	<p>Added the following:</p> <ul style="list-style-type: none"> <li>• 4.3.5 provides clarity in applying ASTM F2620 requirements to dual containment pipe,</li> <li>• 4.3.6 contains requirements for field work instructions,</li> <li>• 5.1 requires a pre-construction meeting,</li> <li>• 5.2.7 provides requirements for dual containment centralizers,</li> <li>• 5.3.2.5 requires documentation of hydraulic hose extensions in data logger reports,</li> <li>• 6.1.9 requires owner review of data logger reports for below grade pipe prior to backfilling,</li> <li>• Attachment 1 is the meeting agenda and checklist for on-boarding fusion contractors.</li> </ul>

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**1. PURPOSE**

- 1.1 This standard provides direction on procedure and operator qualification as well as inspection and recordkeeping requirements for high density polyethylene (HDPE) pipe butt fusion joints.

**2. SCOPE**

- 2.1 This standard is applicable to butt fusion joining of HDPE pipe and fittings.
- 2.2 The Owner may elect to exclude specific pipe lines from any or all requirements of this standard based on pipe service conditions, fluid conveyed, pipe location, expected service duration, and/or environmental risk.

**3. REFERENCES**

- 3.1 HDPE Fusion Bonding shall be in conformance with the applicable provisions of the following standards.
- 3.2 Unless otherwise specified, references to documents shall mean the latest published edition of the referenced document in effect at the contract award date of the project.
- 3.3 Applicable Standards:
- 3.3.1 ASME B31.3 Process Piping
  - 3.3.2 ASTM D2122 – Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
  - 3.3.3 ASTM D3261 – Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
  - 3.3.4 ASTM E3101 – Standard Practice for Microwave Examination of Polyethylene Butt Fusion Joints
  - 3.3.5 ASTM F2620 – Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings
  - 3.3.6 ASTM F3124 – Standard Practice for Data Recording the Procedure used to Produce Heat Butt Fusion Joints in Plastic Piping Systems or Fittings
  - 3.3.7 ASTM F3190 – Standard Practice for Heat Fusion Equipment (HFE) Operator Qualification on Polyethylene (PE) and Polyamide (PA) Pipe and Fittings.
  - 3.3.8 ASTM F714 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter.

3.3.9 Pipe Fabrication Institute ES-48 – Random Examination

#### **4. TECHNICAL REQUIREMENTS**

##### 4.1 Submittals

4.1.1 Submittals shall be approved before installation may begin.

##### 4.1.2 Required Submittals:

4.1.2.1 Contractor's fusion joining procedures.

4.1.2.2 Contractor's field work instructions.

4.1.2.3 Pipe manufacturer's recommendations, and fusion equipment supplier's recommendations, as available.

4.1.2.4 Fusion personnel qualification records. Qualification records shall include a qualification card or training certificate meeting the requirements of ASTM F3190 paragraph 6.7.

4.1.2.5 Material certifications or certificates of conformance from the manufacturer certifying that materials meet the requirements of section 4.2.

##### 4.2 Material

4.2.1 Pipe for use in heat-fused polyethylene pipe systems shall meet the requirements of ASTM F714.

4.2.2 Fittings for use in heat-fused polyethylene pipe systems shall meet the requirements of ASTM D3261.

4.2.3 Measurements for verification of dimensional requirements shall be made in accordance with ASTM D2122.

4.2.4 Pipe and fittings manufactured to equivalent standards by other standards organizations may be acceptable with Owner approval.

##### 4.3 Fusion Procedures

4.3.1 Contractor shall prepare written fusion procedures to provide direction to the fusing operator making production joints.

4.3.2 The fusion procedure shall include the use of an electronic data recording device in accordance with ASTM F3124 unless otherwise permitted in this specification.

- 4.3.3 The fusion procedure shall be in accordance with ASTM F2620, pipe manufacturer's recommendations and the fusion equipment supplier's recommendations except as allowed by 4.3.7.
- 4.3.4 In the event of a conflict between the manufacturer's recommendations, the fusion equipment supplier's recommendations, and the ASTM standards, the conflict shall be brought to the attention of the Owner for resolution.
- 4.3.5 Simultaneous fusion procedures for dual containment pipe shall meet the requirements of ASTM F2620 with the following clarifications:
- 4.3.5.1 Fusion pressures shall be calculated using the combined interfacial area of both pipes or by the data recording device using the Dual Containment option where available.
  - 4.3.5.2 Bead up time shall be performed in accordance with the larger diameter (containment) pipe.
  - 4.3.5.3 Minimum heat soak time shall be performed in accordance with parameters of the larger diameter (containment) pipe, or the thicker wall pipe, whichever results in the longer heat soak time.
  - 4.3.5.4 Heater plate removal (Open/Close) times shall not be longer than the maximum required for the pipe with the thinner wall (shorter maximum time).
  - 4.3.5.5 Cooling time under fusion pressure shall be calculated by adding together the ASTM F2620 fusion cooling times for the carrier and containment pipes.
- 4.3.6 Work instructions shall be available to fusion operators in the field.
- 4.3.6.1 Work instructions shall specifically identify required gauge pressures, bead up times, heat soak times, open/close times and fusion/cool times for each type, size, and DR of pipe and for each fusion machine being operated.
  - 4.3.6.2 For single wall pipe fused to ASTM F2620, the data logger calculations and prompts may be used as work instructions.
  - 4.3.6.3 For all other procedures, including dual containment joints, specific work instructions must be approved by the owner and provided to the operator in the field.

4.3.7 Fusion procedures submitted containing joining parameters (heater temperatures, interfacial pressures, heating times, open/close times, cool times, etc.) that fall outside of ASTM F2620 recommendations or this standard shall be approved by the pipe manufacturer or qualified by destructive testing. Number of test joints and destructive test methods shall be approved by the Owner.

#### 4.4 Fusion Operator Qualifications

4.4.1 Fusion operator qualification shall be in accordance with ASTM F3190.

4.4.2 The performance exam under ASTM F3190 shall include the use of an electronic data recording device that meets ASTM F3124.

4.4.3 Fusion operator qualification shall be for one specific manufacturer's fusion machine or a size range of that manufacturer's hydraulic fusion machines or equipment that all operate in the same manner with the same hydraulic design and controls and the same heater and facer design.

### 5. EXECUTION

5.1 A pre-construction meeting shall be conducted prior to beginning fusion activities. The Owner, Owner's CQA Representative, Engineer of Record, and the Contractor shall be in attendance, as applicable. The meeting should follow the agenda and checklist provided in Attachment 1.

#### 5.2 Fusion Joining

5.2.1 The free ends of the pipe should be covered during cold temperatures or windy conditions to prevent cooling of the heater plate by internal drafts.

5.2.2 Pipe fusion below 32°F shall follow all recommendations of ASTM F2620 Annex A1 Cold Weather Procedures.

5.2.3 When pipe fusion is performed in strong wind, snow, blowing dust, rain, or other conditions that may introduce contamination to the joint, shield pipe fusion area and fusion tools by using a canopy, enclosure, or similar device.

5.2.4 Before installing pipe in the fusion machine, clean the pipe ends, OD and ID, in accordance with recommendations in ASTM F2620 paragraph X1.7.1.

5.2.5 No additional solvent cleaning should take place after the final face-off to prevent solvent contamination. Do not touch the pipe ends with bare hands to prevent oil or dirt contamination of the joint.

- 5.2.6 The maximum OD high-low misalignment allowed is to be less than 10% of the pipe minimum wall thickness as required by ASTM F2620 paragraph 8.3.4.
  - 5.2.7 For field cut dual containment joints, centralizers shall be installed at the pipe ends to maintain alignment of carrier and containment pipes. Only appropriately sized centralizers supplied by the pipe manufacturer shall be used. Fit-up should be checked and installation shall be in accordance with manufacturer's recommendations.
  - 5.2.8 The pipe shall not move in the fusion machine clamps during the fusion process. Observation or evidence of pipe movement in the clamps, such as scrapes on the pipe left by the clamps slipping along the pipe, shall be cause for rejection of the joint.
  - 5.2.9 All pipe 2 inches in diameter and larger shall be fused on hydraulic fusion machines. Hydraulically operated heat fusion machines shall be fitted with an electronic data recording device that meets ASTM F3124.
  - 5.2.10 Manually operated heat fusion machines shall be operated with a calibrated torque wrench to ensure proper force is applied. The contractor's fusion procedures shall include the calculation method for determining appropriate torque wrench readings for a given pipe size and the machine being used. The procedure shall also provide the specific torque wrench reading for the specific fusion machines, torque wrenches, pipe sizes, and wall thickness in use on the project.
- 5.3 Inspection and Examination
- 5.3.1 This section defines inspection requirements and acceptance criteria.
  - 5.3.2 Data Recorder Review
    - 5.3.2.1 Contractor shall review all data recorder reports for compliance with approved fusion procedures, ASTM F2620, and this standard.
    - 5.3.2.2 Data reports and time-pressure graphs that indicate parameters outside of approved fusion procedures shall be cause to reject the joint.
    - 5.3.2.3 Data recorder shall be in calibration at the time the fusion joint was made. Joint reports produced on out-of-calibration logging equipment shall be cause to reject the joint.

- 5.3.2.4 Data recorder logs and time versus pressure graphs for completed joints shall:
- A. Depict the complete fusion cycle.
  - B. Indicate that initial heater contact was made at fusion pressure. For 14 inch and larger pipes, data shall show initial heating (bead up) at fusion pressure for a time interval consistent with pipe size and ambient temperature.
  - C. Depict heat soak in accordance with procedures. Shortened heat soak times, heat soak performed at a pressure greater than drag pressure, and improper shift sequence shall be cause to reject the joint.
  - D. Indicate proper heater removal. The graph shall show that opening of the machine, removing the heater, and bringing the pipe ends together was performed within the maximum time allowed by the procedure. Pressure variations recorded during heater removal that may indicate the carriage was closed against the heater under fusion pressure prior to opening, or that pipe ends were brought in to contact with each other or with the heater and pulled apart again, shall be investigated and may be cause for rejection.
  - E. Indicate that fusion pressure was maintained within specified range. Pressure spikes above, or drops below, specified fusion pressure ranges after heater removal shall be investigated and may be cause for rejecting the joint.
  - F. Depict a fusion time (cool time at fusion pressure) that meets requirements of the procedure.
  - G. Include color photos of joint fit-up in the machine and of the completed joint taken with the data recording device.
- 5.3.2.5 Use of hydraulic extension hoses for in-ditch fusion shall be noted in the comments section of the joint report.
- 5.3.2.6 Failure of recorder to operate properly during the fusion process, and to record the complete fusion cycle shall cause removal and replacement of the fused joint. Aborted joints shall be indicated on the joint report.



- 5.3.3 Visual Inspection
- 5.3.3.1 Contractor shall perform 100% visual examination of all joints.
  - 5.3.3.2 Joints shall meet visual acceptance criteria defined in ASTM F2620 (including guidelines in Appendix X2) and recommendations provided by the pipe manufacturer or supplier.
- 5.3.4 Non-Destructive Examination (NDE)
- 5.3.4.1 The owner may elect to perform non-destructive examination to verify joint integrity. The decision to perform NDE should be made prior to the start of pipe fabrication.
  - 5.3.4.2 NDE shall be performed in accordance with ASTM E3101 Standard practice for Microwave Examination of Polyethylene Butt Fusion Joints. Selection of reference standards shall be by agreement with the owner.
  - 5.3.4.3 The extent of examination shall be in accordance with ASME B31.3, paragraph 341.4.1(b), with progressive sampling in accordance with paragraph 341.3.4. Random examination shall be performed on a lot basis. Guidance for selection of lots can be found in PFI ES-48 Random Examination. Lot selection methodology shall be by agreement with the owner.
  - 5.3.4.4 Acceptance criteria should be determined by agreement with the owner prior to fabrication.

## 6. RECORDKEEPING

- 6.1 Joining Records and Reporting
- 6.1.1 Each fusion joint shall be uniquely identified by line number and joint number.
  - 6.1.2 Each fusion operator shall be assigned a unique identification symbol, ID number, or designator.
  - 6.1.3 Each fusion joint shall be permanently marked with the joint number, date, and the identification symbol of the fusion operator.
  - 6.1.4 Each joint shall be traceable to the fusion operator by ID, to the fusion machine by serial number, and to the data recorder report. Traceability shall be maintained in a log and recorded on a pipe drawing (weld map).

- 6.1.5 For hydraulic heat fusion machines, the critical parameters of each fusion joint shall be recorded by an electronic data logging device in accordance with ASTM F3124. Color photos of joint fit-up prior to fusing and of the completed joint shall be included in the report.
- 6.1.6 For manual heat fusion equipment all joining parameters identified in ASTM F3124 shall be manually recorded for each joint fused.
- 6.1.7 Heater plate temperature shall be measured on both sides and recorded prior to heating each joint. A calibrated pyrometer or non-contact thermometer shall be used.
- 6.1.8 The ambient temperature shall be measured with a local temperature indicator at the fusion location. Ambient temperature and a description of weather conditions shall be recorded on the joint report.
- 6.1.9 Data logger reports shall be reviewed by the Owner prior to backfilling below-grade joints or making joints otherwise inaccessible for inspection or repair.
- 6.1.10 Data logger reports for accessible above grade pipe shall be available for owner review upon request.
- 6.1.11 Upon project completion, the Contractor shall turnover all weld maps and data logger reports.
- 6.1.12 Contractor shall produce periodic reports of data recorder review and visual inspection results. The report should include the following:
- 6.1.12.1 Number of joints completed during report period,
  - 6.1.12.2 Number of joints rejected during report period,
  - 6.1.12.3 Total number of joints completed on project,
  - 6.1.12.4 Total number of joints rejected on project,
  - 6.1.12.5 Reject rate for the reporting period and
  - 6.1.12.6 Cumulative reject rate for the project.

**Quality Assurance and Quality Control of HDPE Pipe Butt Fusion Joints**  
**Attachment 1: HDPE Fusion Contractor Onboarding Checklist and Kickoff**  
**Meeting Agenda**

<b>Topic: Submittals</b> (Kickoff Meeting to be held after submittals are provided, reviewed and accepted.)		
No.	Item	Comments
1	Contractor has submitted fusion procedures and work instructions (4.1.2.1 and 4.1.2.2): <ul style="list-style-type: none"> <li>A. For single-wall HDPE pipe fusion, ASTM F2620 and data logger calculations as work instructions may be used to guide fusion operators in the field.</li> <li>B. For dual containment HDPE fusion, specific work instructions shall be submitted identifying appropriate fusion pressures, bead up times, heat soak times, open/close times, and cool times. Procedures shall be available to operators in the field. (See 4.3.5 for fusion procedure requirements.)</li> </ul>	
2	Fusion Operator Qualification records submitted identifying the following (4.1.2.4): <ul style="list-style-type: none"> <li>A. Name of the training organization.</li> <li>B. Name of the qualified operator.</li> <li>C. Specific manufacturer of the fusion equipment and the size range of the fusion equipment the operator is qualified to operate.</li> <li>D. The specific heat fusion procedure or standard to which the operator was qualified.</li> <li>E. The beginning and expiration dates of the qualifications.</li> </ul> <b>Approval of Operator qualification is contingent upon Owner witnessing operator performance.</b>	
3.	Material Certifications or Certificates of Conformance for pipe and fitting materials have been submitted or submittal schedule is agreed-to prior to using materials (4.1.2.5).	

**Quality Assurance and Quality Control of HDPE Pipe Butt Fusion Joints**  
**Attachment 1: HDPE Fusion Contractor Onboarding Checklist and Kickoff**  
**Meeting Agenda**

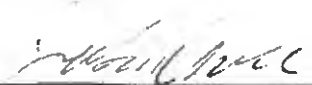
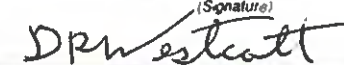

Topic: Basic Project Information		
No.	Item	Comments
1	Discuss scope of project (number of joints, types, and sizes of fusions to be performed, project schedule). Record notes in the comments section.	
2	Discuss manufacturer and model of fusion equipment to be used on project. Record notes in comments section.	
3	Discuss expected number of operators. Record in the comments section.	
4	Discuss special access requirements, project specific difficulties, or conditions that may impact quality of joints (joints inaccessible to hydraulic equipment, need for in-ditch fusion, hose extension kits, in-place fusion of immobilized/restrained pipe sections, etc.).	

**Quality Assurance and Quality Control of HDPE Pipe Butt Fusion Joints**  
**Attachment 1: HDPE Fusion Contractor Onboarding Checklist and Kickoff**  
**Meeting Agenda**

<b>Topic: Contractor Records and Expectations</b>		
Review the following requirements with the contractor.		
No.	Item	Comments
1	Review execution requirements with contractor. (Cleaning, weather, fit-up, etc.) (5.2)	
2	Contractor shall review all data recorder reports for compliance with fusion procedures and Duke standards. Review data logger requirements with contractor (5.3.2). Discuss common errors and basis for rejection of joints (5.3.2.4)	
3	Contractor shall perform 100% visual examination of all joints to ASTM F2620 paragraph 8.3.7.1 and Appendix X2 (5.3.3.1).	
4	Joints shall be uniquely identified and traceable to the operator and to the fusion machine (6.1.1). Weld maps shall be produced (6.1.4).	
5	Contractor shall produce periodic reports of data recorder review and visual inspection results. Frequency of reporting shall be agreed to in this meeting and recorded in the comments section of this checklist (6.1.12)	

<b>Completed and signed checklist will be filed as a project record in accordance with CCP-PRC-NA-AD-003.</b>			
Duke Energy Project Manager	Print	Sign	Date
Duke Energy QC&O Representative	Print	Sign	Date
Contractor Representative	Print	Sign	Date

CCP-PRC-NA-AD-019 Enclosure B - Document Approval Form

Document no.: CCP-ENGSTD-NA-QA-004		Revision no.: 003
Title: Quality Assurance and Quality Control of HDPE Pipe Butt Fusion Joints		
<b>Type of action:</b> <input type="checkbox"/> New <input checked="" type="checkbox"/> Revision <input type="checkbox"/> Cancellation <input type="checkbox"/> Periodic review completed, as required <input type="checkbox"/> Suspend <input type="checkbox"/> Superseded	<b>Type of Document</b> <input type="checkbox"/> Procedure <input type="checkbox"/> OM Manual <input type="checkbox"/> Programmatic Documents <input checked="" type="checkbox"/> Other  Effective date: <u>07/08/2019</u>	
<b>Compliance Applicability: (check is applicable)</b> <input type="checkbox"/> CCR Rule <input type="checkbox"/> CAMA <input type="checkbox"/> Other: _____		
<b>Description of document action or summary of changes:</b> Added the following: <ul style="list-style-type: none"> <li>• 4.3.5 added to provide clarity in applying ASTM F2620 requirements to dual containment pipe,</li> <li>• 4.3.6 requirements for field work instructions and procedures,</li> <li>• 5.1 requirements for pre-construction meeting,</li> <li>• 5.2.2.5 requiring documentation of hydraulic hose extensions in data logger reports,</li> <li>• 5.2.7 to provide requirements for dual containment centralizers;</li> <li>• 6.1.9 requirement for owner to review data logger reports of below grade pipe prior to backfilling,</li> <li>• Attachment 1 meeting agenda and checklist for preconstruction meeting and on-boarding of fusion contractors.</li> </ul>		
<b>Mandatory Reviewers:</b> Training Coordinator Records Management Coordinator		
<b>Reviewers:</b>		
Preparer (print name): Jackson Clark	(Signature) 	(Position): Sr. QA Specialist Date: 06-27-19
Final Approval (print name): Dan Westcott	(Signature) 	(Position): Quality Compliance Manager Date: 6-27-19
Final Approval (print name): Jessica Bednarcik	(Signature) 	(Position): VP Governance and Ops Date: 7/1/19

**COMMONWEALTH OF KENTUCKY**  
**BEFORE THE PUBLIC SERVICE COMMISSION**

In The Matter of:

The Electronic Application of Duke Energy Kentucky, Inc.                    )  
for a Certificate of Public Convenience and Necessity to Close the        )  
East Landfill at the East Bend Generating Station and for Approval        ) Case No. 2021-00290  
to Amend its Environmental Compliance Approval to Amend its                )  
Environmental Compliance Plan for Recovery by Environmental                )  
Surcharge Mechanism    )

**CERTIFICATE OF NOTICE AND PUBLICATION**

Pursuant to the Kentucky Public Service Commission’s Regulation 807 KAR 5:001, Section 16(1)(b)(5), I hereby certify that I am Amy B. Spiller, President of Duke Energy Kentucky, Inc. (Duke Energy Kentucky or Company), a utility furnishing retail electric and gas service within the Commonwealth of Kentucky, which, on or around the 9<sup>th</sup> day of September 2021, will file an application with the Kentucky Public Service Commission requesting an order authorizing Duke Energy Kentucky to recover the environmental compliance costs of the Landfill Closure amending its Environmental Compliance Plan via its environmental surcharge through its Rate Schedule ESM as required by KRS 278.183, and as applicable KRS 278.020(1), and requesting an order granting Duke Energy Kentucky a Certificate of Public Convenience and Necessity for the approval of the construction activities necessary for the closure of the East Landfill located at its East Bend Generating Station. Duke Energy Kentucky is proposing no changes to its Environmental Surcharge Mechanism tariff sheet, K.Y.P.S.C. No. 19, Sheet No. 76 other than to change its issue and effective date; and that notice to the public of the filing of the application is being given in all respects as required by 807 KAR 5:001, Section 17 and 807 KAR 5:001, Sections 8(2)(c) and 9(2), as follows:

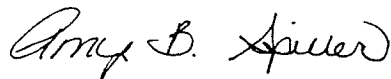
On the 9<sup>th</sup> day of September 2021, the notice to the public was delivered for exhibition and public inspection at the Erlanger Operations Center, 1262 Cox Road, Erlanger, Kentucky 41018

and the same will be kept open to public inspection at said office in conformity with the requirements of 807 KAR 5:001, Section 17(1)(a) and 807 KAR 5:011, Section 8(1)(a).

I further certify that more than twenty (20) customers will be affected by said change by way of an increase in their rates or charges, and that on the 25<sup>th</sup> day of August 2021, there was delivered to the Kentucky Press Association, an agency that acts on behalf of newspapers of general circulation throughout the Commonwealth of Kentucky in which customers affected reside, for publication therein once a week for three consecutive weeks beginning on August 31, 2021, a notice of the filing of Duke Energy Kentucky's application, including its proposed rates, a copy of said notice being attached hereto as Exhibit A, and a list of newspapers of general circulation throughout the Commonwealth of Kentucky in which customers affected reside, a copy of said list being attached hereto as Exhibit B. A certificate of publication of said notice will be furnished to the Kentucky Public Service Commission upon completion of same pursuant to 807 KAR 5:001, Section 17(3)(b).

Also beginning on September 9, 2021, Duke Energy Kentucky posted on its website a complete copy of the Company's application and a hyperlink to the location on the Kentucky Public Service Commission's website where the case documents and tariff filings are available.

Given under my hand this 9<sup>th</sup> day of September 2021.



Amy B. Spiller  
President, Duke Energy Kentucky, Inc.  
139 E. 4<sup>th</sup> Street  
Cincinnati, Ohio 45202

Subscribed and sworn to before me, a Notary Public, in and before said County and State, this 9<sup>th</sup> day of September 2021.



**E. MINNA ROLFES-ADKINS**  
Notary Public, State of Ohio  
My Commission Expires  
July 8, 2022

  
Notary Public

My Commission expires: July 8, 2022



**CERTIFICATE OF SERVICE**

This is to certify that the foregoing electronic filing is a true and accurate copy of the document being filed in paper medium; that the electronic filing was transmitted to the Commission on September 9<sup>th</sup>, 2021; and that there are currently no parties that the Commission has excused from participation by electronic means in this proceeding.

John G. Horne, II  
The Office of the Attorney General  
Utility Intervention and Rate Division  
700 Capital Avenue, Ste 118  
Frankfort, Kentucky 40601

*/s/Rocco D'Ascenzo*

\_\_\_\_\_

Rocco D'Ascenzo

# **Exhibit A**

## **Notice of the Filing**

**NOTICE TO CUSTOMERS OF DUKE ENERGY KENTUCKY, INC.  
RECOVERY BY ENVIRONMENTAL SURCHARGE OF DUKE ENERGY KENTUCKY, INC.'S  
AMENDMENT TO ITS 2018 AMENDED ENVIRONMENTAL COMPLIANCE PLAN**

**PLEASE TAKE NOTICE** that Duke Energy Kentucky, Inc. (Duke Energy Kentucky or Company) is filing with the Kentucky Public Service Commission (Commission) on or around August 27, 2021 in Case No. 2021-00290, an Application pursuant to Kentucky Revised Statute 278.183 for approval of the construction activities necessary for the closure of the East Landfill (Landfill Closure) located at its East Bend Generating Station (East Bend) and an amendment of the Company's Environmental Compliance Plan to include these closure costs and other asset retirement obligations (ARO) through an increase in the environmental surcharge on customers' bills beginning April 1, 2022 under the Company's existing ESM Rider, also known as the environmental surcharge mechanism.

Federal and state environmental regulations require Duke Energy Kentucky to build and upgrade equipment and facilities that produce energy from coal to operate in an environmentally sound manner. Specifically, the Company is seeking Commission approval of a Certificate of Public Convenience and Necessity for the Landfill Closure at East Bend. This project requires an amendment of Duke Energy Kentucky's Amended Environmental Compliance Plan that was approved by the Commission in 2018.

Additionally, Duke Energy Kentucky is seeking an order approving the recovery of the costs of the Landfill Closure through its Environmental Surcharge tariff. The Landfill Closure is required for the Company to comply with the U.S. Environmental Protection Agency's federal Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities (Federal CCR Rule), and other environmental requirements that apply to Duke Energy Kentucky facilities used in the production of energy from coal. The estimated fully loaded cost of the Landfill Closure for which the Company is seeking recovery at this time is approximately \$22.6 million. Post closure costs related to the Landfill Closure are estimated to be \$234,458 a year for a period of 30-years.

The impact on Duke Energy Kentucky's customers is estimated to be a 1.8% increase in 2022 with a maximum increase of 5.0% in 2023. For a Duke Energy Kentucky residential customer using 1,000 kilowatt hours per month (kWh/mo.), the initial monthly increase is expected to be \$1.78 during 2022, with the maximum monthly increase expected to be \$4.84 during 2023.

The rates contained in this notice are the rates proposed by Duke Energy Kentucky; however, the Kentucky Public Service Commission may order rates to be charged that differ from the proposed rates contained in this notice. Such action may result in rates for consumers other than the rates in this notice.

Any corporation, association, body politic or person with a substantial interest in the matter may, by written request after publication of this notice of the proposed rate changes, request leave to intervene in accordance with the rules, orders, and regulations of the Kentucky Public Service Commission. Such motion shall be submitted to the Kentucky Public Service Commission, P.O. Box 615, 211 Sower Boulevard, Frankfort, Kentucky 40602-0615, and shall set forth the grounds for the request including the status and interest of the party. If the Commission does not receive a written request for intervention within thirty (30) days of the initial publication the Commission may take final action on the application.

Intervenors may obtain copies of the application and other filings made by the Company by requesting same through email at [DEKInquiries@duke-energy.com](mailto:DEKInquiries@duke-energy.com) or by telephone at (513) 287-4366. A copy of the application and other filings made by the Company are available for public inspection through the Commission's website at <http://psc.ky.gov>, at the Commission's office at 211 Sower Boulevard, Frankfort, Kentucky, Monday through Friday, 8:00 a.m. to 4:30 p.m., and at the following Company office: 1262 Cox Road, Erlanger, Kentucky 41018. Comments regarding the application may be submitted to the Public Service Commission through its website, or by mail at the following Commission address.

For further information contact:

PUBLIC SERVICE COMMISSION  
COMMONWEALTH OF KENTUCKY  
P.O. BOX 615  
211 SOWER BOULEVARD  
FRANKFORT, KENTUCKY 40602-0615  
(502) 564-3940

DUKE ENERGY KENTUCKY  
1262 COX ROAD  
ERLANGER, KENTUCKY 41018  
(513) 287-4315

## **Exhibit B**

### **Listing of Newspapers Publishing Notice**

List of Newspapers in Duke Energy Kentucky Territory

Campbell County Recorder  
Covington Kentucky Enquirer  
Falmouth Outlook  
Kenton County Recorder  
Warsaw Gallatin County News  
Williamstown Grant County News

Duke Energy Kentucky, Inc.  
1262 Cox Road  
76  
Erlanger, Kentucky 41018

KY. P.S.C. Electric No. 2  
~~First~~Second Revised Sheet No. 76  
Cancels and Supersedes  
~~Original~~First Revised Sheet No.

Page 1 of 2

## ENVIRONMENTAL SURCHARGE MECHANISM RIDER

### APPLICABILITY

This rider is applicable to all retail sales in the Company's electric service area beginning with the billing month June 2018. Rate RTP program participants utilize the applicable portions of the Baseline Charge and Program Charge, as those terms are defined in Rate RTP, for this rider.

Standard electric rate schedules subject to this schedule are:

Residential: Rate Schedule RS

Non-Residential: Rate Schedules DS, EH, SP, DP, DT, GSFL, TT, SL, TL, UOLS, NSU, SC, SE, and LED

### RATE

The monthly billing amount under each of the schedules to which this rider is applicable, shall be increased or decreased by a percentage factor according to the following formula:

Environmental Surcharge Billing Factor = Jurisdictional E(m) / R(m)

### DEFINITIONS

For all Plans:

E(m) = RORB + OE – EAS + Prior Period Adjustment + (Over)Under Recovery

RORB = (RB/12)\*ROR

RB = the Environmental Compliance Rate Base, defined as electric plant in service for applicable environmental projects adjusted for accumulated depreciation, accumulated deferred taxes, accumulated investment tax credits, CWIP and emission allowance inventory.

ROR = the Rate of Return on the Environmental Compliance Rate Base, designated as the cost of debt and pretax cost of equity for environmental compliance plan projects approved by the Commission.

OE = the Operating Expenses, defined as the monthly depreciation expense, taxes other than income taxes, amortization expense, emission allowance expense and environmental reagent expense.

EAS = proceeds from Emission Allowance Sales.

Issued by authority of an Order of the Kentucky Public Service  
Commission dated April 27, 2020 in Case No. ~~2021-002902019-~~  
~~00274.~~

Issued: ~~May 1, 2020~~September 9, 2021

Effective: ~~May 1, 2020~~October 11, 2021

Issued by Amy B. Spiller, President /s/ Amy B. Spiller

Duke Energy Kentucky, Inc.  
 1262 Cox Road  
 76  
 Erlanger, Kentucky 41018

### DEFINITIONS (Contd.)

Prior Period Adjustment is the amount resulting from the amortization of amounts determined by the Commission during six-month and two-year reviews.

(Over) or Under Recovery is a one-month “true-up” adjustment.

Plans are the environmental surcharge compliance plans submitted to and approved by the Kentucky Public Service Commission.

- (1) Total E(m), (the environmental compliance plan revenue requirement), is multiplied by the Jurisdictional Allocation Factor. Jurisdictional E(m) is adjusted for any (Over)/Under collection or prior period adjustment to arrive at Adjusted Jurisdictional E(m). Adjusted Jurisdictional E(m) is allocated to Residential and Non-Residential on the basis of Revenue as a Percentage of Total Revenue for the 12 months ending with the Current Month.
- (2) Residential R(m) is the average of total monthly residential revenue for the 12 months ending with the current expense month. Total revenue includes residential revenue, including all riders, but excluding environmental surcharge mechanism revenue.
- (3) Non-Residential R(m) is the average of total monthly non-residential revenue for the 12 months ending with the current expense month. Total revenue includes non-residential revenue, including all riders, but excluding environmental surcharge mechanism revenue, base fuel revenue and FAC revenue.
- (4) The current expense month (m) shall be the second month proceeding the month in which the Environmental Surcharge is billed.

### SERVICE REGULATIONS, TERMS AND CONDITIONS

The supplying and billing for service and all conditions applying thereto, are subject to the jurisdiction of the Kentucky Public Service Commission, and to Company's Service Regulations currently in effect, as filed with the Public Service Commission of Kentucky.

Issued by authority of an Order of the Kentucky Public Service  
 Commission dated April 27, 2020 in Case No. ~~2021-002902019-~~  
~~00274.~~

Issued: ~~May 1, 2020~~ September 9, 2021

Effective: ~~May 1, 2020~~ October 11, 2021

Issued by Amy B. Spiller, President /s/ Amy B. Spiller

Duke Energy Kentucky, Inc.  
1262 Cox Road  
Erlanger, Kentucky 41018

KY. P.S.C. Electric No. 2  
Second Revised Sheet No. 76  
Cancels and Supersedes  
First Revised Sheet No. 76  
Page 1 of 2

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### **ENVIRONMENTAL SURCHARGE MECHANISM RIDER**

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Standard electric rate schedules subject to this schedule are:

Residential: Rate Schedule RS

Non-Residential: Rate Schedules DS, EH, SP, DP, DT, GSFL, TT, SL, TL, UOLS, NSU, SC, SE, and LED

#### **RATE**

The monthly billing amount under each of the schedules to which this rider is applicable, shall be increased or decreased by a percentage factor according to the following formula:

Environmental Surcharge Billing Factor = Jurisdictional E(m) / R(m)

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For all Plans:

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EAS = proceeds from Emission Allowance Sales.

Issued by authority of an Order of the Kentucky Public Service  
Commission dated \_\_\_\_\_ in Case No. 2021-00290.

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Issued: September 9, 2021

Effective: October 11, 2021

Issued by Amy B. Spiller, President /s/ Amy B. Spiller



Duke Energy Kentucky, Inc.  
1262 Cox Road  
Erlanger, Kentucky 41018

KY. P.S.C. Electric No. 2  
Second Revised Sheet No. 76  
Cancels and Supersedes  
First Revised Sheet No. 76  
Page 2 of 2

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### DEFINITIONS (Contd.)

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Commission dated \_\_\_\_\_ in Case No. 2021-00290.

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