2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

FEDERAL CCR RULE

WESTLAND ASH MANAGEMENT FACILITY CELL B, DICKERSON, MARYLAND

GenOn MD Ash Management LLC
25100 Chalk Point Road
Aquasco, Maryland 20608

January 2020

Prepared by:

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1. INTRODUCTION

The Federal Coal Combustion Residuals (CCR) Rule (40 Code of Federal Regulations [CFR] Part 257.90(e)) (USEPA, 2015) requires owners and/or operators of existing CCR landfills to prepare a Groundwater Monitoring and Corrective Action Report (Report) no later than 31 January 2020. Geosyntec Consultants (Geosyntec) has prepared this Report for Cell B at the Westland Ash Management Facility in Dickerson, Maryland (Site). This Report summarizes the groundwater monitoring activities conducted pursuant to the CCR Rule through December 31, 2019.

2. SITE DESCRIPTION

2.1 Site Description

The Site is located in Dickerson, Montgomery County, Maryland (**Figure 1**) and is operated by GenOn MD Ash Management LLC (MD Ash). The Site is a dry ash management operation and does not have CCR surface impoundments (SI) as defined in the CCR Rule. The Site encompasses 180 acres of which approximately 64.4 acres have been used to manage CCR at landfill Cell B. Cell C is located downgradient of Cell B and is inactive and therefore not regulated by the Federal CCR Rule. Part of Cell B was constructed with a geosynthetic bottom liner and associated leachate collection system that directs leachate to Pond 003 located to the west of Cell C. The remaining portion of Cell B is not lined but does include a leachate collection layer constructed using bottom ash. Leachate collected from the unlined areas of Cell B is also directed to Pond 003. All leachate is conveyed to a wastewater treatment plant adjacent to Pond 003, which stores the treated leachate prior to discharge through a NPDES outfall. Non-contact storm water runoff is directed to Pond 002. Ponds 002 and 003, which are used to manage storm water and leachate (not wet ash), respectively, are also exempt from the Federal CCR Rule. Features of the Site and their locations are presented on **Figure 2**.

2.2 Regional Physiographic Setting

The Site is located in the Culpepper Basin portion of the Piedmont province of Maryland and was previously used for agricultural purposes. Fractured sandstones and siltstones of the Poolesville Member of the Manassas Sandstone (referred to as the New Oxford Formation by others), with interbedded shale layers, form the upper aquifer at the Site. The overlying saprolite soils are unsaturated. Bedrock bedding planes strike north-south and dip 10-20 degrees to the west.

The groundwater table in the upper aquifer generally follows topography and flows along bedding planes toward the west but is locally influenced by Big Stream to the south and flows along bedrock strike. The hydraulic conductivity of the more fractured interbedded thin shale layers is greater than that of the massive sandstones that comprise most of the bedrock stratigraphic sequence. Therefore, CCR constituent migration in groundwater is predominately along the shale horizons. Groundwater monitoring wells are screened in the shale layers.

3. GROUNDWATER MONITORING SYSTEM

This section describes the groundwater monitoring well network for the CCR Rule at Cell B. This network utilizes monitoring wells initially installed as part of a separate site-wide hydrogeologic investigation. As described in the *Basis for Groundwater Monitoring Network* (Geosyntec, 2017a), the groundwater monitoring network around Cell B was designed to comply with 40 CFR 257.91. No monitoring wells were installed or decommissioned during 2019.

Groundwater quality is monitored around Cell B through a network of ten monitoring wells. As shown on **Figure 2**, there are three upgradient monitoring wells (D-2, D-3 and D-4) that are used to measure background conditions and seven downgradient monitoring wells (MW-03, MW-09, MW-10S, MW-12, MW-13, D-6R, and Core-2S) that are used as compliance wells.

Federal CCR Rule compliance and background monitoring wells at the Site are designed to monitor the upper aquifer conditions. Monitoring well construction and soil boring logs were provided in Geosyntec (2017a). Compliance and background monitoring well construction details are summarized in **Table 1**.

4. CCR RULE GROUNDWATER MONITORING COMPLETED – 2019

4.1 Groundwater Monitoring

The baseline monitoring program was completed in September 2017 and the Site transitioned to detection monitoring in October 2017. Assessment monitoring began in February 2018. Groundwater monitoring was conducted in accordance with the *Sampling and Analysis Plan* (SAP) provided in Geosyntec (2018). **Table 2** summarizes the history of baseline, detection, and assessment monitoring events through 2019.

4.1.1 Detection Monitoring Program

In October 2017, the first detection monitoring program samples were collected. In accordance with 40 CFR 257.94(a) of the CCR Rule, samples were analyzed for Appendix III list parameters only. Prior to sampling, synoptic rounds of groundwater measurements were collected from the compliance and background monitoring wells. Groundwater elevation data and analytical results are presented in the *2017 Annual Groundwater Monitoring and Corrective Action Report* (Geosyntec, 2018a). Analytical data for Appendix III constituents in background and compliance wells are summarized in **Table 4** and **Table 5**, respectively. Detection monitoring did not take place during 2019.

4.1.2 Assessment Monitoring Program

An assessment monitoring program was triggered at the Site in January 2018 when statistically significant increases (SSIs) were detected in the detection monitoring results from the October

2017 groundwater monitoring samples. In February 2018, samples were collected for the full Appendix IV list of constituents for the first semi-annual assessment monitoring program. In accordance with 40 CFR 257.95(a) of the CCR Rule, samples were analyzed for all Appendix III and IV list parameters. Resampling for the Appendix IV constituents detected in the February 2018 assessment monitoring samples was conducted in May 2018. The third, fourth and fifth semi-annual assessment monitoring events were completed in Augusts 2018, February 2019 and August 2019. Prior to sampling, a synoptic round of groundwater measurements was conducted which included compliance and background monitoring wells. Groundwater elevation data are presented in **Table 3**. Analytical data for Appendix IV constituents in background and compliance monitoring wells are summarized in **Table 6** and **Table 7**, respectively. The Site remains in assessment monitoring.

4.1.3 Groundwater Elevation and Flow Velocities

Groundwater elevation monitoring was conducted in February and August 2019. A synoptic round of water level measurements was made at the start of each monitoring event. Groundwater elevation measurements were collected in accordance with the SAP. Potentiometric surface maps based on the elevations measured during the February and August 2019 monitoring events are presented on **Figure 3** and **Figure 4**, respectively. Groundwater elevation data are summarized in **Table 3**. As shown on **Figure 3** and **Figure 4**, groundwater around Cell B flows from northeast to southwest. The groundwater elevations and flow directions are very stable across the multiple monitoring events.

The average hydraulic gradient around Cell B ranges from 0.0451 ft/ft between monitoring wells D-2 and MW-09 to 0.0312 ft/ft between monitoring wells D-2 and MW-3. The groundwater flow velocity calculation submitted in the *2019 Annual Groundwater Monitoring and Corrective Action Report* is provided in **Appendix A** (Geosyntec, 2019). **Table A-2** shows groundwater flow velocities at the Site ranged from $2.15X10^{-5}$ centimeters per second (cm/sec) (22.2 inches/month; 22.2 feet/year) between monitoring wells D-2 and MW-3 to $4.45\ X10^{-6}$ cm/sec (4.6 inches/month; 4.6 feet/year) between monitoring wells D-2 and MW-13.

4.2 Data Usability

Upon receipt of laboratory analytical reports, the data were evaluated for usability. Analytical data were checked for the following:

- Samples were analyzed within the method-specified hold times;
- Samples were received within holding temperature;
- The chain of custody was complete;
- Precision was within SAP control limits using relative percent differences of blind duplicate samples;

- Matrix spike and matrix spike duplicate recoveries and laboratory control samples were within the SAP control limits; and
- Potential for positive bias was evaluated using method blanks concentrations.

Upon completion of the data usability assessment the data were qualified as needed and added to the data tables. All data received were considered complete and usable.

4.3 Statistically Significant Increases Comparison Test

The baseline monitoring data collected from the three background wells (D-2, D-3, and D-4) between 2015 and 2017 were previously used to select statistical methods for calculating the range of background concentrations for Appendix III constituents. These data are discussed and presented in Geosyntec (2018b). The resulting background concentrations are summarized in **Table 5** based upon upper prediction limit (UPL) methods.

In January 2018, the calculated background concentrations were compared to the results of the detection monitoring event in October 2017. The comparison of those data to the calculated background concentrations resulted in SSIs over background and triggered the initiation of an assessment monitoring program. Comparison of Appendix III parameters in Cell B compliance wells continued for the February and August 2019 assessment monitoring events and is presented in **Table 5**.

4.4 Statistically Significant Levels Test

The baseline and assessment monitoring data collected from the background wells were used to calculate background concentration limits for detected Appendix IV constituents. Groundwater protection standards (GWPS) were established for each detected Appendix IV constituent as the greater of background or the maximum contaminant level (MCL) or the EPA Regional Screening Level for cobalt, lead, lithium, and molybdenum that do not have MCLs. The baseline and assessment monitoring data collected from the compliance wells between 2015 and 2018 were used to calculate the 95% lower confidence limit (LCL) of the mean concentration for each well for each Appendix IV constituent that exceeded the GWPS in one or more samples. These data are discussed and presented in Geosyntec (2018b). Those LCL concentrations were then compared to the GWPS for each Appendix IV constituent. The comparison of those LCLs and the GWPS resulted in statistically significant levels (SSLs) on September 4, 2018 and triggered an Assessment of Corrective Measures (ACM).

4.5 Assessment of Corrective Measures

In accordance with 40 CFR 257.96(a), an ACM was initiated at the Site on December 3, 2018, as required by the Federal CCR Rule when SSLs of Appendix IV constituents are detected above their respective GWPS. The assessment monitoring program continued during the ACM.

5. DETECTION MONITORING STATISTICS

In accordance with 40 CFR 257.94(e), detection monitoring statistics were used to evaluate groundwater concentrations of Appendix III parameters collected during the October 2017, February 2018, and August 2018 detection monitoring events. In 2019, SSIs above background groundwater concentrations were detected at seven compliance monitoring wells for concentrations of all Appendix III constituents except fluoride.

Table 5 provides a comparison of the Appendix III detection monitoring results to the calculated background concentrations. The calculations are documented and certified by a P.E. as being appropriate for the background data set in Geosyntec (2017b).

6. ASSESSMENT MONITORING STATISTICS

In accordance with 40 CFR 257.95(g) assessment monitoring statistics were used to evaluate if concentrations of Appendix IV constituents in Cell B compliance wells were SSLs above their respective GWPS. Statistical analysis was completed for Appendix IV parameters detected during the February and August 2019 assessment monitoring events. **Table 8** summarizes the SSLs of Appendix IV parameters. The data indicate SSLs for lithium, molybdenum, and selenium at five of seven Cell B compliance wells.

7. PROBLEMS ENCOUNTERED AND RESOLUTIONS

The following section discusses problems encountered and their resolution.

Problem 1: SSIs of Appendix III constituents were detected in samples from Cell B compliance wells in January 2018.

Resolution 1: An Assessment Monitoring program was established at the Site in February 2018 to monitor concentrations of Appendix III and Appendix IV constituents.

Problem 2: SSLs of Appendix IV constituents were detected in Cell B compliance wells in September 2018.

Resolution 2: An Assessment of Corrective Measures was initiated in December 2018.

8. STATUS OF MONITORING PROGRAM

As of 31 December 2019, the Site is undergoing assessment monitoring and an Assessment of Corrective Measures has been completed to address SSLs of Appendix IV constituents detected in groundwater.

9. PLANNED KEY ACTIVITIES FOR 2020

The following section outlines the activities planned for 2020.

January 31, 2020: The 2019 Annual Groundwater Monitoring and Corrective Action Report will be entered into the facility's operating record and notification will be sent to the Maryland Department of Environment (MDE)**.**

February 2020: Collection of semi-annual assessment groundwater monitoring samples.

March 2, 2020: The 2019 Annual Groundwater Monitoring and Corrective Action Report will be posted to the public internet site.

May/June 2020: SSI and SSL testing of the February 2020 assessment monitoring samples.

August 2020: Collection of semi-annual assessment groundwater monitoring samples.

December 2020: SSI and SSL testing of the August 2020 assessment monitoring samples.

December 2020: Preparation of the 2020 Annual Groundwater Monitoring and Corrective Action Report will begin.

10. RECOMMENDATIONS

The Site should continue Assessment Monitoring in 2020.

11. REFERENCES

Driscoll, F.G., 1986. Groundwater and Wells, Second Edition. St. Paul, Minnesota, H.M. Smyth Company.

Geosyntec Consultants, Inc., 2017a. Basis for Groundwater Monitoring Network, Westland Ash Management Facility, Dickerson, MD, October.

Geosyntec Consultants, Inc. 2017b. Statistical Analysis Calculations Package for Background Groundwater - Cell B, Westland Ash Storage Facility, Dickerson, MD.

Geosyntec Consultants, Inc., 2018a. Sampling and Analysis Plan, Assessment Monitoring Program, Federal CCR Rule, Westland Ash Management Facility, Cell B, Dickerson, MD, January.

Geosyntec Consultants, Inc., 2018b. 2017 Annual Groundwater Monitoring and Corrective Action Report, Westland Ash Management Facility, Dickerson, MD.

Geosyntec Consultants, Inc. 2018c. Statistical Analysis Calculation Package for Appendix IV Constituents in Background Groundwater – Cell B, Westland Ash Storage Facility, Dickerson, MD, September.

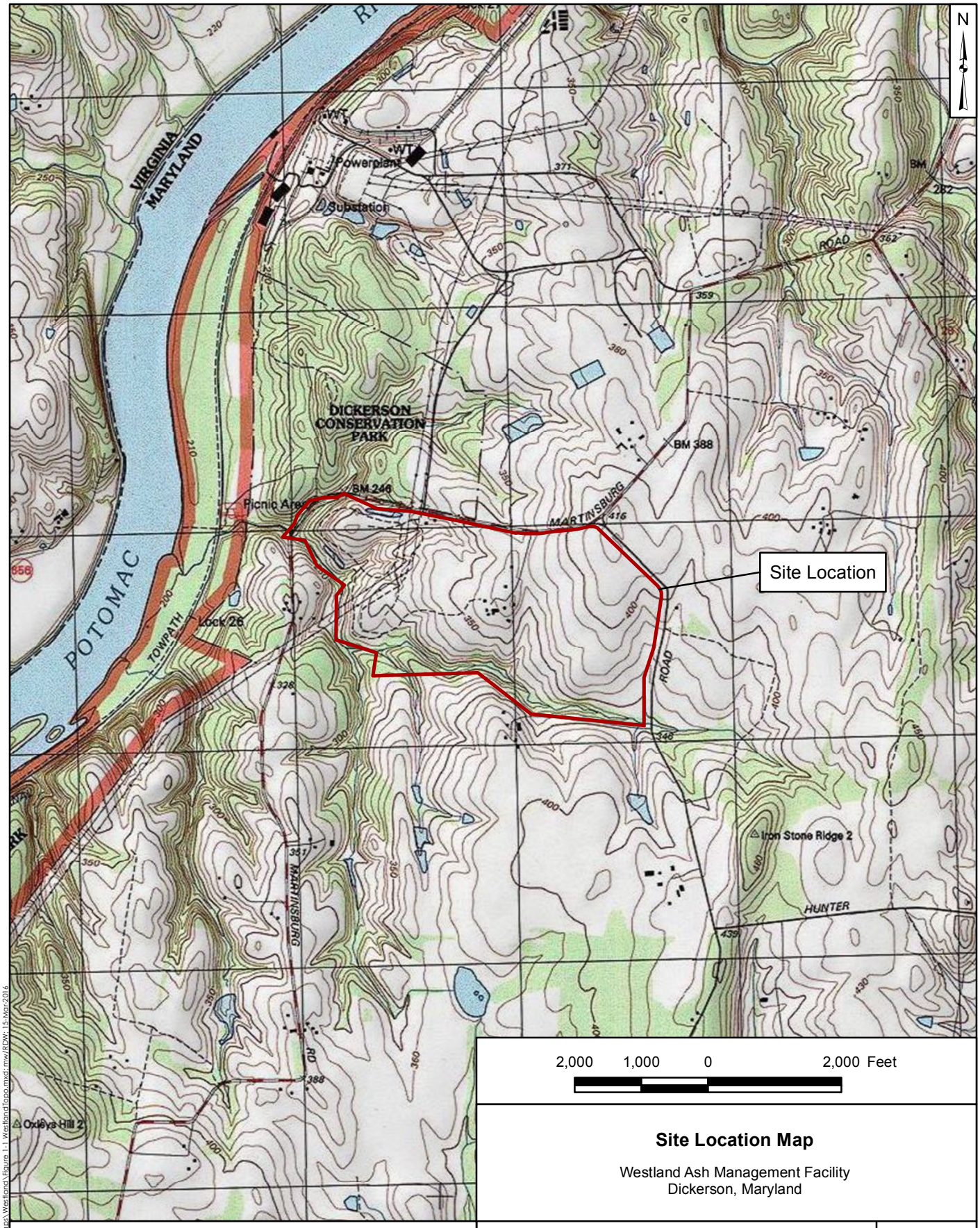
Geosyntec Consultants, Inc. 2018c. Statistical Analysis Calculation Package for Compliance Well Appendix IV Monitoring Data – Cell B, Westland Ash Storage Facility, Dickerson, MD, September.

Geosyntec Consultants, Inc., 2019. 2018 Annual Groundwater Monitoring and Corrective Action Report, Westland Ash Management Facility, Dickerson, MD.

U.S. EPA, 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities - Unified Guidance, March.

U.S. EPA, 2015. Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities (Final Rule). Fed. Reg. 80 FR 21301, pp. 21301-21501, 40 CFR Parts 257 and 261, April.

FIGURES



Site Location Map

Westland Ash Management Facility
Dickerson, Maryland

Source:
USGS Topographic Quadrangle - Dickerson, Maryland, provided by the National Geographic Society, i-cubed. © 2011 National Geographic Society, i-cubed

Geosyntec consultants

Columbia, Maryland | January 2020

Figure 1

Path: P:\GIS\NRG\GeoOnxMaps\Westland\Figure 1-1 Westland Topo.mxd: mw/RDW: 15-Mar-2016

N

LEGEND

- PROPERTY BOUNDARY
- APPROXIMATE CELL LIMIT
- GRADE CONTOUR (FEET, MSL)
- PAVED / UNPAVED ROAD
- BUILDING
- WATER / CHANNEL LINE
- WET AREA
- LEACHATE COLLECTION / TRANSMISSION LINE
- TREELINE
- MONITORING WELL USED FOR WATER LEVELS ONLY
- SURFACE WATER STATION USED FOR WATER LEVELS ONLY
- BACKGROUND MONITORING WELL
- COMPLIANCE MONITORING WELL
- CCB MANAGEMENT UNITS NOT REGULATED UNDER THE CCR RULE (APPROXIMATE LIMITS)
- CCB MANAGEMENT UNIT REGULATED BY THE CCR RULE (APPROXIMATE LIMITS)

NOTES:

1. EXISTING CONDITIONS COMPILED BY PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY DATED 28 DECEMBER 2013 EXCEPT AS FOLLOWS. EXISTING LEACHATE TRANSMISSION PIPES WITHIN CELLS B, B-1A, AND B-1B OBTAINED FROM FLORA SURVEYING ASSOCIATES, INC. BASED ON FIELD-RUN SURVEY DATED 2010; LOCATIONS OF OTHER LEACHATE TRANSMISSION LINES ARE APPROXIMATE.

2. HORIZONTAL CONTROL IS MARYLAND STATE PLAN COORDINATE SYSTEM, NAD27; VERTICAL CONTROL IS NGVD29.

0 250' 500'
SCALE IN FEET

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
10211 WINCOPIN CIRCLE, 4TH FLOOR
COLUMBIA MARYLAND 21044 USA
PHONE: 410.381.4333

GenOn

TITLE:
SITE FEATURES AND GROUNDWATER MONITORING WELL NETWORK

PROJECT:
2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
FEDERAL CCR RULE

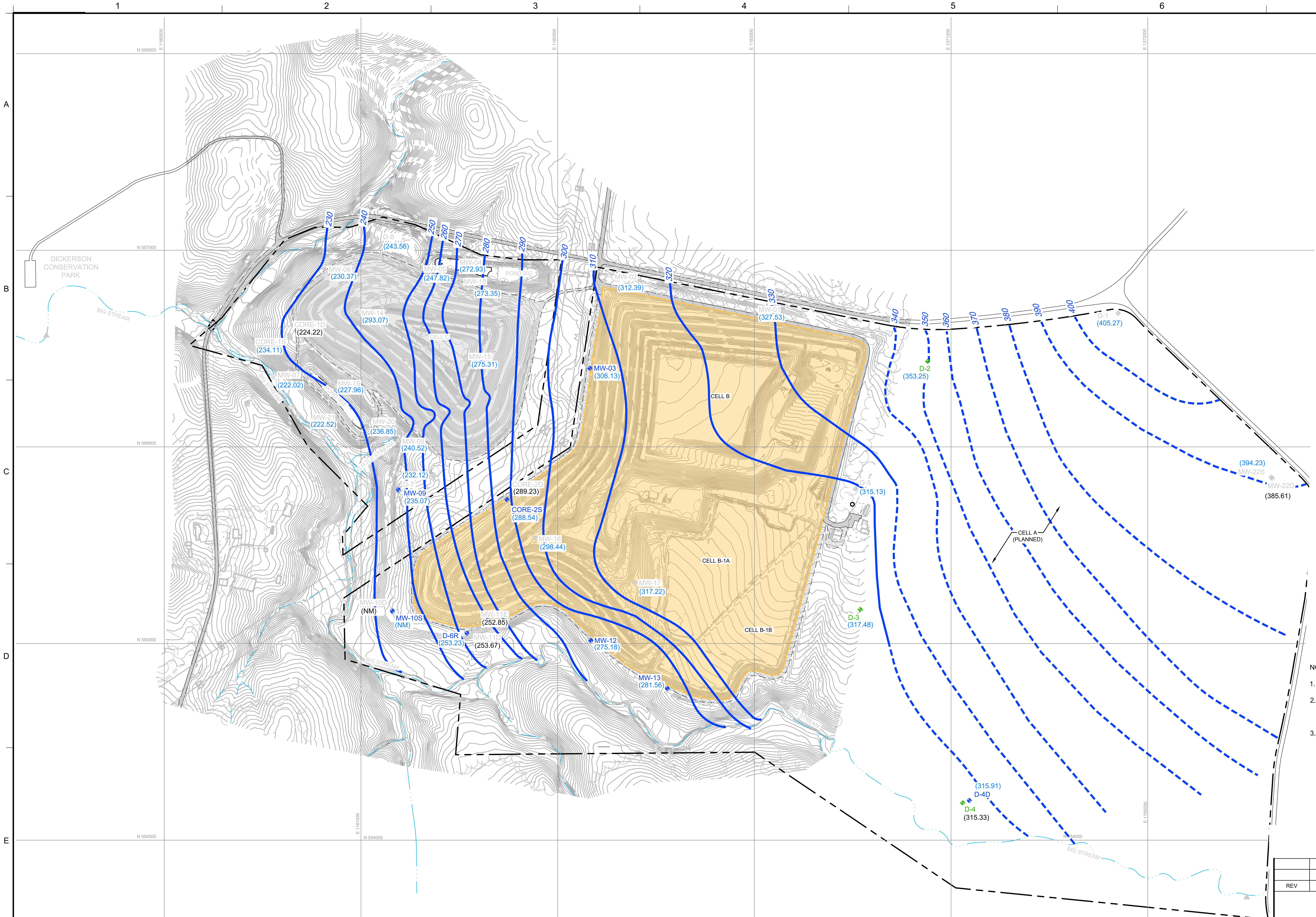
SITE:
WESTLAND ASH MANAGEMENT FACILITY, CELL B
DICKERSON, MARYLAND

NOT FOR CONSTRUCTION

SIGNATURE

DATE

DESIGN BY:	MB	DATE:	JANUARY 2020
DRAWN BY:	JOC	PROJECT NO.:	MEM0823I
CHECKED BY:	KWH	FILE:	FIG 2
REVIEWED BY:	MB	FIGURE NO.:	2
APPROVED BY:	RWG		



LEGEND

- PROPERTY BOUNDARY
- APPROXIMATE CELL LIMIT
- 170 GRADE CONTOUR (FEET, MSL)
- PAVED / UNPAVED ROAD
- STRUCTURE
- STREAM
- L LEACHATE COLLECTION / TRANSMISSION LINE
- TREELINE
- MONITORING WELL USED FOR WATER LEVELS ONLY
- BACKGROUND MONITORING WELL
- COMPLIANCE MONITORING WELL
- 300 POTENTIOMETRIC SURFACE CONTOUR (NOTE 2)
- INFERRED POTENTIOMETRIC SURFACE CONTOUR
- (398.33) MEASURED GROUNDWATER ELEVATION (FEET-MSL) (NOTE 2)
- (367.1) MEASURED GROUNDWATER ELEVATION (FEET-MSL) (NOTE 3)
- CCB MANAGEMENT UNITS NOT REGULATED UNDER THE CCR RULE (APPROXIMATE LIMITS)
- CCB MANAGEMENT UNIT REGULATED BY THE CCR RULE (APPROXIMATE LIMITS)

NOTES:

1. SEE FIGURE 2 FOR GENERAL NOTES.
2. POTENTIOMETRIC SURFACE DATA COLLECTED BY GEOSYNTEC CONSULTANTS ON 13 FEBRUARY 2019. MEASURED ELEVATION PROVIDED ADJACENT TO EACH MONITORING WELL ID IN FEET-MEAN SEA LEVEL.
3. MEASURED ELEVATION OF GROUNDWATER IN THIS DEEP WELL WAS NOT USED TO DEVELOP THE POTENTIOMETRIC SURFACE.

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
10211 WINCOPIN CIRCLE, 4TH FLOOR
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TITLE: GROUNDWATER POTENTIOMETRIC SURFACE - FEBRUARY 2019

PROJECT: 2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT FEDERAL CCR RULE

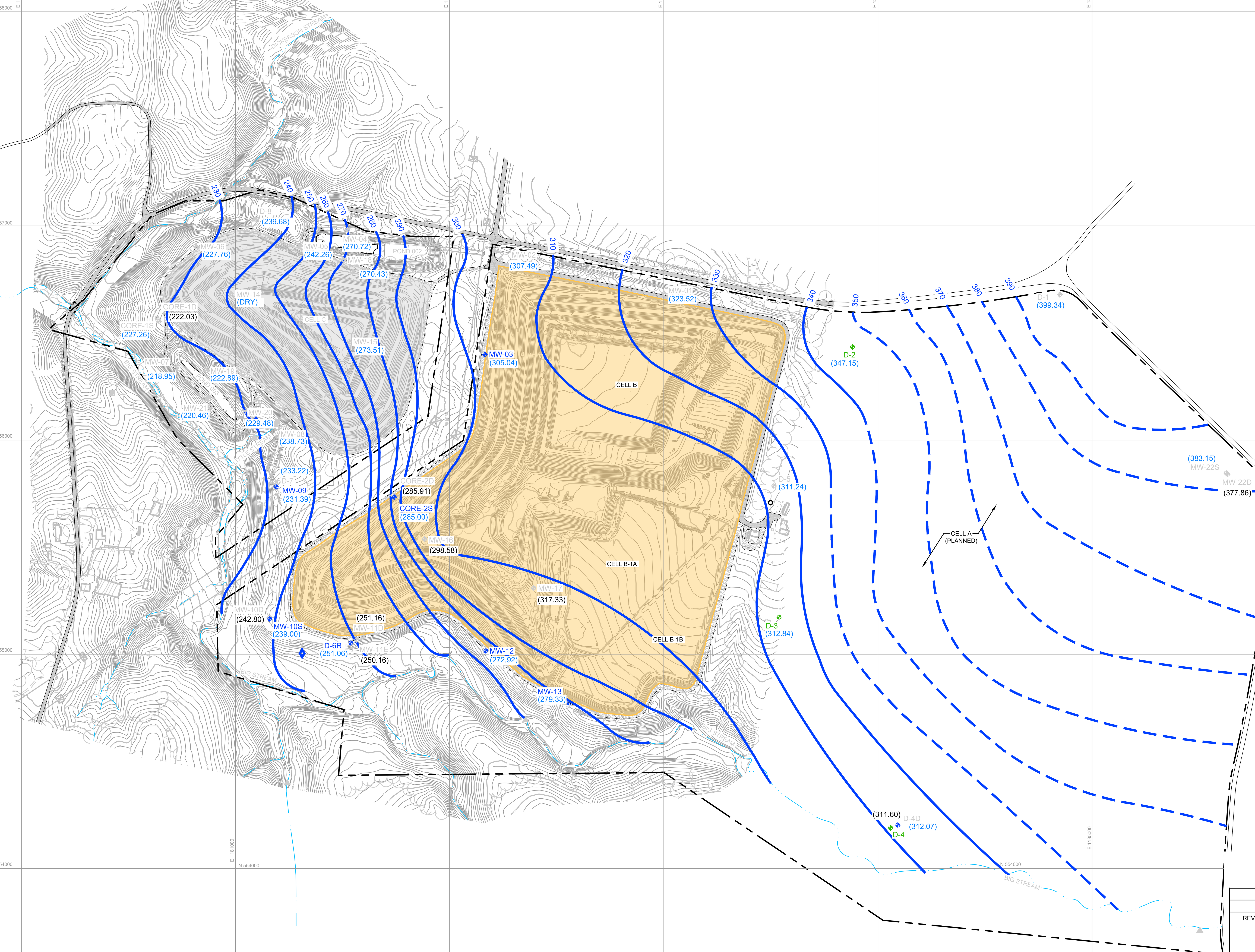
SITE: WESTLAND ASH MANAGEMENT FACILITY, CELL B DICKERSON, MARYLAND

NOT FOR CONSTRUCTION

SIGNATURE

DATE

DESIGN BY:	MB	DATE:	JANUARY 2020
DRAWN BY:	AM	PROJECT NO.:	MEM0823I
CHECKED BY:	KWH	FILE:	FIG 3
REVIEWED BY:	MB	FIGURE NO.:	3
APPROVED BY:	RMG		



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LEGEND

- PROPERTY BOUNDARY
- APPROXIMATE CELL LIMIT
- 170 — GRADE CONTOUR (FEET, MSL)
- PAVED / UNPAVED ROAD
- STRUCTURE
- STREAM
- L — LEACHATE COLLECTION / TRANSMISSION LINE
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- MONITORING WELL USED FOR WATER LEVELS ONLY
- BACKGROUND MONITORING WELL
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- CCB MANAGEMENT UNIT REGULATED BY THE CCR RULE (APPROXIMATE LIMITS)

NOTES:

1. SEE FIGURE 2 FOR GENERAL NOTES.
2. POTENTIOMETRIC SURFACE DATA COLLECTED BY GEOSYNTEC CONSULTANTS ON 29 AUGUST 2019. MEASURED ELEVATION PROVIDED ADJACENT TO EACH MONITORING WELL ID IN FEET-MEAN SEA LEVEL.
3. MEASURED ELEVATION OF GROUNDWATER IN THIS DEEP WELL WAS NOT USED TO DEVELOP THE POTENTIOMETRIC SURFACE.

0 250' 500'
SCALE IN FEET

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
10211 WINCOPIN CIRCLE, 4TH FLOOR
COLUMBIA, MARYLAND 21044 USA
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GenOn

TITLE:
GROUNDWATER POTENTIOMETRIC SURFACE - AUGUST 2019

PROJECT:
2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
FEDERAL CCR RULE

SITE:
WESTLAND ASH MANAGEMENT FACILITY, CELL B
DICKERSON, MARYLAND

NOT FOR CONSTRUCTION
SIGNATURE
DATE

DESIGN BY:	SLC	DATE:	JANUARY 2020
DRAWN BY:	BGF	PROJECT NO.:	MEM0823I
CHECKED BY:	KWH	FILE:	FIG 4
REVIEWED BY:	MB	FIGURE NO.:	
APPROVED BY:	RMG		4

TABLES

TABLE 1
WELL CONSTRUCTION DETAILS

FEDERAL CCR RULE - 2019 ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT
Westland Ash Management Facility, Cell B - MD

Well ID	Compliance / Background	Permit Number	Installation Date	Northing (feet) Maryland State Plane 1900 NAD 1983	Easting (feet) Maryland State Plane 1900 NAD 1983	Ground Surface Elevation (ft msl)	Top of Casing Elevation (ft msl)	Inner Casing Diameter (inches)	Top of Sand Pack (ft bgs)	Screen Interval (ft bgs)	Screen Length (feet)	Screen Slot Size (inch)
CORE-2S	Compliance	MO-15-0119	6/30/2015	555694.88	1181659.23	298.07	300.82	2	33.0	35-45	10	0.010
D-2	Background	Unknown	6/1981	556397.52	1183798.46	358.37	366.03	4	32.0	110-120	10	0.010
D-3	Background	Unknown	6/1981	555135.30	1183455.78	359.32 [1]	361.82	4	40.0	86-96	10	0.010
D-4	Background	Unknown	6/1981	554151.88	1183976.22	335.41 [1]	337.91	4	Unknown	125-135	10	0.010
D-6R	Compliance	Unknown	6/2002	555014.92	1181455.87	277.90	281.075	4	51.0	55-70	15	Unknown
MW-03	Compliance	MO-15-0078	7/2/2015	556361.94	1182081.25	309.96	312.48	2	48.0	50-60	10	0.010
MW-09	Compliance	MO-15-0084	8/4/2015	555744.29	1181107.48	271.00	273.9	2	58.0	60-70	10	0.010
MW-10S	Compliance	MO-15-0100	6/29/2015	555127.15	1181077.31	268.29	271.03	2	36	38-48	10	0.010
MW-12	Compliance	MO-15-0106	8/6/2015	554978.07	1182086.13	293.26	296.11	2	32.0	34-44	10	0.010
MW-13	Compliance	MO-15-0107	8/7/2015	554733.88	1182475.50	308.02	310.77	2	48.0	50-60	10	0.010

Notes:

ft msl feet above mean sea level

ft bgs feet below ground surface

[1] Elevation is an estimated value

TABLE 2
SUMMARY OF 2015-2019 MONITORING EVENTS

FEDERAL CCR RULE - 2019 ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT
Westland Ash Management Facility, Cell B - MD

Monitoring Program:	Baseline Monitoring																				
Monitoring Event:	3Q 2015			4Q 2015			1Q 2016			2Q 2016			3Q 2016			4Q 2016			1Q 2017		
Sample Date:	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17
Well ID																					
Background Wells																					
D-2			III,IV			III,IV		III,IV		III,IV				III,IV		III,IV			III,IV		
D-3			III,IV			III,IV		III,IV		III,IV				III,IV		III,IV			III,IV		
D-4			III,IV			III,IV		III,IV		III,IV				III,IV		III,IV			III,IV		
Compliance Wells																					
CORE-2S			III,IV [1,2]			III,IV [1,2]		III,IV [1,2]		III,IV				III,IV		III,IV			III,IV		
D-6R			III,IV			III,IV		III,IV		III,IV				III,IV		III,IV			III,IV		
MW-03			III,IV			III,IV		III,IV		III,IV				III,IV		III,IV			III,IV		
MW-09			III,IV			III,IV		III,IV		III,IV				III,IV		III,IV			III,IV		
MW-10S			III,IV			III,IV		III,IV		III,IV				III,IV		III,IV			III,IV		
MW-12			III,IV			III,IV		III,IV		III,IV				III,IV		III,IV			III,IV		
MW-13			III,IV			III,IV		III,IV		III,IV				III,IV			III,IV		III,IV		

Monitoring Program:	Baseline Monitoring							Detection Monitoring				Assessment Monitoring							
Monitoring Event:	2Q 2017			3Q 2017			Total Baseline Sampling Events [4]	4Q 2017			Total Detection Sampling Events	1Q 2018		2Q 2018			3Q 2018		
Sample Date:	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17		Oct-17	Nov-17	Dec-17		Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18
Well ID																			
Background Wells																			
D-2	III,IV						8	III			1		III,IV			III,IV			III,IV
D-3	III,IV							III			1		III,IV			III,IV			III,IV
D-4	III,IV						8	III			1		III,IV			III,IV			III,IV
Compliance Wells																			
CORE-2S	III,IV	III,IV [3]			III,IV [3]	III,IV [3]	11	III			1		III,IV			III,IV			III,IV
D-6R	III,IV						8	III			1		III,IV			III,IV			III,IV
MW-03	III,IV						8	III			1		III,IV			III,IV			III,IV
MW-09	III,IV						8	III			1		III,IV			III,IV			III,IV
MW-10S	III,IV						8	III			1		III,IV			III,IV			III,IV
MW-12	III,IV						8	III			1		III,IV			III,IV			III,IV
MW-13	III,IV						8	III			1		III,IV			III,IV			III,IV

TABLE 2
SUMMARY OF 2015-2019 MONITORING EVENTS

FEDERAL CCR RULE - 2019 ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT
Westland Ash Management Facility, Cell B - MD

Monitoring Program:	Assessment Monitoring															
Monitoring Event:	4Q 2018			1Q 2019			2Q 2019			3Q 2019			4Q 2019			Total Assessment Sampling Events
Sample Date:	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	
Well ID																
Background Wells																
D2						III,IV							III,IV			5
D3						III,IV						III,IV				5
D4						III,IV							III,IV			5
Compliance Wells																
CORE-2S						III,IV							III,IV			5
D-6R						III,IV							III,IV			5
MW-03						III,IV							III,IV			5
MW-09						III,IV							III,IV			5
MW-10S						III,IV							III,IV			5
MW-12						III,IV							III,IV			5
MW-13						III,IV							III,IV			5

Notes:

III Groundwater samples collected for laboratory analysis of 40 CFR 257 Appendix III parameters.

IV Groundwater samples collected for laboratory analysis of 40 CFR 257 Appendix IV parameters.

[1] Fluoride inadvertantly omitted.

[2] Radium inadvertantly omitted.

[3] Location was sampled for fluoride and radium, only.

[4] All background and compliance monitoring wells met the minimum number of samples collected. Monitoring well Core-2S was sampled on 11 different sampling events, which resulted in 8 complete sample sets.

TABLE 3
GROUNDWATER ELEVATION MEASUREMENTS

FEDERAL CCR RULE - 2019 ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT
Westland Ash Management Facility, Cell B - MD

Well ID	Top of Casing Elevation [1] (ft msl)	Depth to Water Measurement Date	Depth to Water (ft btoic)	Groundwater Elevation (ft msl)
CORE-2S	300.82	2/12/2019	12.28	288.54
		8/29/2019	15.82	285.00
D-2	366.03	2/12/2019	12.78	353.25
		8/29/2019	18.88	347.15
D-3	361.82	2/12/2019	44.34	317.48
		8/29/2019	48.98	312.84
D-4	337.91	2/12/2019	22.58	315.33
		8/29/2019	26.31	311.60
D-6R	281.08	2/12/2019	27.85	253.23
		8/29/2019	30.02	251.06
MW-03	312.48	2/12/2019	6.35	306.13
		8/29/2019	7.44	305.04
MW-09	273.90	2/12/2019	38.83	235.07
		8/29/2019	42.51	231.39
MW-10S	271.03	2/12/2019	NM	NM
		8/29/2019	32.03	239.00
MW-12	296.11	2/12/2019	20.93	275.18
		8/29/2019	23.19	272.92
MW-13	310.77	2/12/2019	29.21	281.56
		8/29/2019	31.44	279.33

Notes:

ft msl feet above mean sea level
ft btoic feet below top of inner case
NM Not Measured

TABLE 4
MONITORING PROGRAM APPENDIX III ANALYTICAL DATA - BACKGROUND WELLS

FEDERAL CCR RULE - 2019 ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT
Westland Ash Management Facility, Cell B - MD

	Analyte:	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	TDS
Well ID	Sample Date	µg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L
D-2	2/6/2018	<10.1 U	36.6	12.1	<0.25 U	7.7	16.7	189
	5/3/2018	<10.1 U	39.4	11.3	<0.25 U	7.8	16.9	207
	8/8/2018	<12 U	39.5	14.1	<0.25 U	8.0	15.3	174
	2/18/2019	16.7 J	37.8	10.3	<0.25 U	7.9	15.0	190
	9/4/2019	11.6 J	40.2	12.3 J	<0.25 U	8.0	15.3	196
D-3	2/6/2018	<10.1 U	47.4	15.0	<0.25 U	7.9	23.6	241
	5/4/2018	<10.1 U	54.4	17.5	<0.25 U	8.1	24.9	241
	8/8/2018	<12.0 U	51.7	14.0	<0.25 U	8.1	22.9	262
	2/19/2019	<12.0 U	52.2	13.3	<0.25 U	8.3	21.2	259
	8/30/2019	<5.0 UJ	50.6	15.5	<0.25 U	7.7	25.9	238
D-4	2/6/2018	27.7 J	NS	9.7	<0.25 U	7.4	15.3	221
	5/4/2018	27.1 J	52.9	12.0	<0.25 U	8.2	15.9	239
	5/4/2018 [1]	12.9 J	51.5	8.7	<0.25 U	8.2	14.5	221
	8/9/2018	<12.0 U	51.0	10.5	<0.25 U	8.3	16.1	192
	2/15/2019	12.4 J	52.1	7.4	<0.25 U	8.1	11.4	199
	9/4/2019	16.3 J	51.3	10.7 J	<0.25 U	7.9	13.1 J	209

Notes:

µg/L micrograms per Liter
mg/L milligrams per Liter
S.U. Standard Units
J Constituent detected below reportable quantitation limit; result is an estimated value.
U Constituent not detected above method detection limit.
NS Not Sampled
N.D. The sample result is non-detect.
[1] Duplicate sample collected.

TABLE 5
MONITORING PROGRAM APPENDIX III ANALYTICAL DATA - COMPLIANCE WELLS

FEDERAL CCR RULE - 2019 ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT
Westland Ash Management Facility Cell B - MD

	Analyte:	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	TDS
	UPL [1]	25	53.4	17.5	[2]	7.02 - 8.45	25.4	325
Well ID	Sample Date	µg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L
Core-2S	10/26/2017	317	199	181	<0.25 U	7.6	228	1,030
	2/14/2018	421	228	206	<0.25 U	7.6	232	1,040
	5/4/2018	371	234	195	<0.25 U	8.0	227	1,140
	8/8/2018	242	198	182	<0.25 U	7.9	202	728
	2/14/2019	256	191	188	<0.25 U	8.1	189	638
	9/5/2019	374	241	225	<0.25 U	7.8	246	842
D-6R	10/27/2017	5,180	676	338	<0.25 U	7.3	1,330	2,860
	2/6/2018	5,410	657	309	<0.25 U	7.4	1,330	2,280
	5/3/2018	5,650	648	288	<0.25 U	7.3	1,170	2,730
	8/10/2018	5,490	733	280	<0.25 U	7.6	1,250	2,230
	2/14/2019	5,430	628	413	<0.25 U	7.8	1,180	2,100
	9/5/2019	4,060	482	257	<0.25 U	7.8	852	1,810
MW-03	10/26/2017	10,700	494	362	<0.25 U	6.7	1,330	2,640
	2/13/2018	9,750	463	264	<0.25 U	7.1	1,301	2,700
	2/13/2018 [3]	9,390	443	302	<0.25 U	7.1	1,350	2,370
	5/4/2018	9,980	460	209	<0.25 U	7.0	1,130	2,380
	8/13/2018	8,510	341	165	<0.25 U	7.6	980	1,460
	2/15/2019	7,340	274	101	<0.25 U	7.2	567	562
	9/4/2019	13,800	406	160	<0.25 U	7.5	989	1,900
MW-09	10/26/2017	2,580	276	95.2	<0.25 U	7.4	505	1,410
	2/14/2018	2,660	289	92.9	<0.25 U	7.5	244	1,220
	5/3/2018	2,760	292	85.5	<0.25 U	7.8	475	1,280
	8/9/2018	2,680	287	91.4	<0.25 U	7.6	498	1,050
	2/19/2019	2,710	279	91.8	<0.25 U	7.9	447	996
	9/4/2019	2,780	261	76.6	<0.25 U	7.9	387	1,030
MW-10S	10/26/2017	311	353	86.5	<0.25 U	7.3	608	1,290
	2/14/2018	331	351	81.4	<0.25 U	7.4	587	1,260
	5/3/2018	310	334	54.9	<0.25 U	7.7	409	1,190
	5/3/2018 [3]	314	341	68.0	<0.25 U	7.6	522	1,260
	8/10/2018	305	327	66.9	<0.25 U	7.7	516	1,240
	2/18/2019	309	307	68.3	<0.25 U	7.9	498	1,030
	9/3/2019	411	367	77.4	<0.25 U	7.6	556	1,340
MW-12	10/26/2017	1,990	371	101	<0.25 U	6.7	991	1,990
	2/14/2018	8,050	378	107	<0.25 U	6.8	912	1,810
	5/4/2018	6,280	386	90.2	<0.25 U	7.0	885	1,850
	8/13/2018	5,450	323	67.3	<0.25 U	7.6	716	1,410
	2/19/2019	7,620	376	66.0	<0.25 U	7.6	872	1,680
	9/5/2019	9,290	445	65.7	<0.25 U	7.2	890	1,780
MW-13	10/30/2017	<10.1 U	44.5	11.0	<0.25 U	7.4	24.9	256
	10/30/2017 [3]	<10.1 U	45.1	10.7	<0.25 U	7.6	24.6	221
	2/13/2018	<10.1 U	49.6	12.6	<0.25 U	8.0	31.4	371
	5/4/2018	21.3 J	50.7	11.3	<0.25 U	8.1	30.8	225
	8/13/2018	<12.0 U	48.4	11.5	<0.25 U	8.2	27.9	221
	2/19/2019	15.8 J	53.2	14.2	<0.25 U	7.9	38.1	284
	9/5/2019	35.6 J	51.3	11.3	<0.25 U	8.0	27.7	243
	9/5/2019 [3]	16.8 J	47.3	10.8	<0.25 U	8.0	24.4	244

Notes:

Concentration is a statistically significant increase (SSI) over the background concentration

UPL Upper prediction limit

µg/L micrograms per Liter

mg/L milligrams per Liter

S.U. Standard Units

J Constituent detected below reportable quantitation limit; result is an estimated value.

U Constituent not detected above method detection limit.

[1] Subject to change as additional data are generated. Calculations provided in Statistical Analysis Calculations Package for Background Groundwater – Cell B, Westland Ash Storage Facility, Dickerson, MD (Geosyntec, 2017).

[2] The Double Quantification Rule (DQR) is used for background data sets with no detections.

[3] Duplicate sample collected.

TABLE 6
MONITORING PROGRAM APPENDIX IV ANALYTICAL DATA - BACKGROUND WELLS

FEDERAL CCR RULE - 2019 ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT
Westland Ash Management Facility, Cell B - MD

	Analyte:	Antimony		Arsenic		Barium	Beryllium		Cadmium		Chromium		Cobalt [1]		Fluoride		Lead	
Well ID	**Sample Date**	µg/L		µg/L		µg/L	µg/L		µg/L		µg/L		µg/L		mg/L		µg/L	
D-2	2/14/2018	<0.45	U	0.84	J	329	<0.071	U	<0.15	U	<0.87	U	<1.7	U	<0.25	U	0.34	J
	5/3/2018	<0.45	U	<0.72	U	356	<0.071	U	<0.15	U	0.88	J	NS		<0.25	U	1.1	
	8/8/2018	<0.41	U	<0.68	U	360	<0.091	U	<0.15	U	<0.70	U	<1.5	U	<0.25	U	<1.1	U
	2/18/2019	<0.41	U	<0.68	U	337	<0.091	U	<0.15	U	0.88	J	<1.5	U	<0.25	U	<1.1	U
	9/5/2019	0.42	J	<0.68	U	361	<0.091	U	<0.15	U	0.76	J	<1.5	U	<0.25	U	<1.1	U
D-3	2/6/2018	<0.45	U	0.74	J	86.1	<0.071	U	<0.15	U	<0.87	U	<1.7	U	<0.25	U	1.1	
	5/4/2018	0.46	J	<0.72	U	93	<0.071	U	<0.15	U	<0.87	U	NS		<0.25	U	0.95	J
	8/8/2018	<0.41	U	<0.68	U	95	<0.091	U	<0.15	U	0.78	J	<1.5	U	<0.25	U	<1.1	U
	2/19/2019	0.7	J	<0.68	U	105	<0.091	U	<0.15	U	0.77	J	<1.5	U	<0.25	U	1.5	J
	8/30/2019	0.54	J	<0.68	U	81.5	<0.091	U	<0.15	U	<0.7	U	<1.5	U	<0.25	U	<1.1	U
D-4	2/6/2018	<0.45	U	<0.72	U	401	<0.071	U	<0.15	U	<0.87	U	<1.7	U	<0.25	U	0.13	J
	5/4/2018	<0.45	U	<0.72	U	428	<0.071	U	<0.15	U	1.3	J	NS		<0.25	U	1.8	
	5/4/2018 [4]	<0.45	U	<0.72	U	426	<0.71	U	<0.15	U	1.8	J	NS		<0.25	U	1.8	
	8/9/2018	<0.41	U	<0.68	U	468	<0.091	U	<0.15	U	0.92	J	<1.5	U	<0.25	U	<1.1	U
	2/15/2019	<0.41	U	<0.68	U	428	<0.091	U	<0.15	U	<0.70	U	<1.5	U	<0.25	U	<1.1	U
	9/4/2019	<0.41	U	<0.68	U	422	<0.091	U	<0.15	U	0.95	J	<1.5	U	<0.25	U	<1.1	U

TABLE 6
MONITORING PROGRAM APPENDIX IV ANALYTICAL DATA - BACKGROUND WELLS

FEDERAL CCR RULE - 2019 ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT
Westland Ash Management Facility, Cell B - MD

	Analyte:	Lithium		Mercury		Molybdenum		Selenium		Thallium [1]		Radium-226 [2]		Radium-228 [2]		Radium (226+228) [3]	
Well ID	**Sample Date**	µg/L		µg/L		µg/L		µg/L		µg/L		pCi/L		pCi/L		pCi/L	
D-2	2/14/2018	<9.0	U	<0.05	U	<3.4	U	<0.50	U	<0.12	U	<0.184	U	<0.0905	U	<2.0	U
	5/3/2018	<9.0	U	<0.05	U	<3.4	U	<0.50	U	<0.12	U	1.23		<0.908	U	2.73	J
	8/8/2018	<11.0	U	<0.05	U	<2.0	U	<0.65	U	<0.12	U	3.08		<0.537	U	4.58	J
	2/18/2019	<11.0	U	<0.05	U	<2.0	U	<0.65	U	<0.11	U	0.440	J	<0.574	U	1.94	J
	9/4/2019	<13.0	U	<0.05	U	<2.0	U	<0.65	U	<0.11	U	0.567	J	<0.806	U	2.07	J
D-3	2/6/2018	11	J	<0.05	U	<3.4	U	<0.50	U	<0.12	U	<0.137	U	<0.96	U	<2.0	U
	5/4/2018	<9.0	U	<0.05	U	<3.4	U	<0.50	U	NS	U	0.217	J	<-0.0388	U	1.72	J
	8/8/2018	<11.0	U	<0.05	U	<2.0	U	<0.65	U	<0.12	U	<0.284	U	<0.541	U	<2.0	U
	2/19/2019	<11.0	U	<0.05	U	<2.0	U	<0.65	U	<0.11	U	<-0.103	U	<1.07	U	<2.0	U
	8/30/2019	14.4	J	<0.05	U	<2.0	U	<0.65	U	<0.11	U	1.01		<0.640	U	1.01	J
D-4	2/6/2018	<9.0	U	<0.05	U	<3.4	U	<0.50	U	<0.12	U	<0.271	U	<-0.143	U	<2.0	U
	5/4/2018	<9.0	U	<0.05	U	<3.4	U	<0.50	U	NS		1.11		<0.844	U	2.61	J
	5/4/2018 [4]	<9.0	U	NS		<3.4	U	<0.50	U	NS		11.6		<0.350	U	13.1	
	8/9/2018	<11.0	U	<0.05	U	<2.0	U	<0.65	U	<0.11	U	2.7		<1.75	U	4.2	J
	2/15/2019	17.4	J	<0.05	U	<2.0	U	<0.65	U	<0.11	U	0.460	J	<0.378	U	1.96	J
	9/4/2019	<13.0	U	<0.05	U	<2.0	U	<0.65	U	<0.11	U	<0.221	U	<0.269	U	<2.0	U

Notes:

µg/L micrograms per Liter

mg/L milligrams per Liter

pCi/L picocurie per Liter

NS Not Sampled

J Constituent detected below reportable quantitation limit; result is an estimated value.

U Constituent not detected above method detection limit.

[1] Appendix IV constituents not detected in the February 2018 and February 2019 Assessment Monitoring events. Full Appendix IV list analytes were not analyzed in the May 2018 resampling event, nor the August 2018 and September 2019 semi-annual events.

[2] Radium values shown are the 'result' reported by lab, including non-detects shown with '<'.

[3] The sum of Radium-226 + Radium-228 uses one-half the reporting limit (data not shown) for non-detect (<) values.

[4] Duplicate sample collected.

TABLE 7
MONITORING PROGRAM APPENDIX IV ANALYTICAL DATA - COMPLIANCE WELLS

FEDERAL CCR RULE - 2019 ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT
Westland Ash Management Facility, Cell B - MD

	Analyte:	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Fluoride	Lead
Well ID	Sample Date	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L
Core-2S	2/14/2018	<0.45 U	<0.72 U	61.4	0.074 J	<0.15 U	1.2 J	<1.70 U	<0.25 U	0.19 J
	5/4/2018	<0.45 U	0.9 J	88.7	<0.091 U	<0.15 U	1.6 J	NS	<0.25 U	0.63 J
	8/8/2018	<0.41 U	<0.68 U	76.8	<0.071 U	<0.15 U	<0.70 U	<1.50 U	<0.25 U	<1.10 U
	2/14/2019	<0.41 U	<0.68 U	77.3	<0.091 U	<0.15 U	2.5 J	<1.50 U	<0.25 U	<1.10 U
	9/5/2019	<0.41 U	<0.68 U	73.5	<0.091 U	<0.15 U	0.91 J	<1.30 U	<0.25 U	<1.10 U
D-6R	2/6/2018	<0.45 U	1.3 J	26.5	<0.071 U	<0.15 U	<0.87 U	<1.7 U	<0.25 U	<0.11 U
	5/3/2018	0.86 J	<0.72 U	28.6	<0.071 U	<0.15 U	<0.87 U	NS	<0.25 U	<0.11 U
	8/10/2018	1.1 J	<0.68 U	26.6	<0.091 U	<0.15 U	<0.70 U	<1.50 U	<0.25 U	<1.10 U
	2/14/2019	2.5	<0.68 U	46.0	<0.091 U	<0.15 U	<0.70 U	<1.5 U	<0.25 U	<1.10 U
	9/5/2019	3.5	<0.68 U	66.5	<0.091 U	<0.15 U	0.92 J	<1.3 U	<0.25 U	<1.1 U
MW-03	2/13/2018	0.94 J	2.0 J	68.6	0.25 J	0.28 J	10.1	<1.7 U	<0.25 U	1.8
	5/3/2018	0.62 J	0.88 J	42.3	<0.071 U	0.33 J	4.2	NS	<0.25 U	0.28 J
	8/13/2018	<0.41 U	0.98 J	38.2	<0.091 U	<0.15 U	3.2 J	<1.5 U	<0.25 U	<1.1 U
	2/15/2019	<0.41 U	<0.68 U	26.3	<0.091 U	<0.15 U	1.9 J	<1.5 U	<0.25 U	<1.1 U
	9/4/2019	0.54 J	1.2 J	56.9	0.1 J	<0.15 U	4.4	<1.3 U	<0.25 U	<1.1 U
MW-09	2/14/2018	1.9	<0.72 U	48.0	<0.071 U	<0.15 U	1.4 J	<1.7 U	<0.25 U	0.27 J
	5/3/2018	2.0	<0.72 U	42.4	<0.071 U	<0.15 U	1.1 J	NS	<0.25 U	0.16 J
	8/9/2018	1.1 J	<0.68 U	64.0	<0.091 U	<0.15 U	1.0 J	<1.5 U	<0.25 U	<1.1 U
	2/19/2019	0.74 J	<0.68 U	64.1	0.11 J	<0.15 U	2.4 J	<1.5 U	<0.25 U	<1.1 U
	9/4/2019	1.7 J	0.8 J	66.3	0.12 J	<0.15 U	4.0 J	1.7 J	<0.25 U	1.1 J
MW-10S	2/14/2018	<0.45 U	0.81 J	67.4	<0.071 U	<0.15 U	2.2	<1.7 U	<0.25 U	<0.11 U
	5/3/2018	<0.45 U	<0.72 U	81.8	<0.071 U	<0.15 U	1.6 J	NS	<0.25 U	<0.11 U
	5/3/2018 [1]	<0.45 U	<0.72 U	76.8	<0.71 U	<0.15 U	1.7 J	NS	<0.25 U	<0.11 U
	8/10/2018	<0.41 U	<0.68 U	87.9	<0.091 U	<0.15 U	1.5 J	<1.5 U	<0.25 U	<1.10 U
	2/18/2019	<0.41 U	<0.68 U	101	<0.091 U	<0.15 U	1.6 J	<1.5 U	<0.25 U	<1.10 U
	9/3/2018	<0.41 U	<0.68 U	61.4	<0.091 U	<0.15 U	1.3 J	<1.3 U	<0.25 U	<1.10 U
MW-12	2/14/2018	0.47 J	<0.72 U	45.0	0.11 J	0.16 J	8.6	<1.7 U	<0.25 U	0.17 J
	5/4/2018	0.48 J	<0.72 U	43.8	<0.071 U	0.21 J	8.4	NS	<0.25 U	<0.11 U
	8/13/2018	0.48 J	<0.68 U	51.8	<0.091 U	<0.15 U	8.1	<1.5 U	<0.25 U	<1.10 U
	2/19/2019	0.58 J	<0.68 U	45.0	<0.091 U	<0.15 U	12.5	<1.5 U	<0.25 U	<1.10 U
	9/5/2019	0.45 J	<0.68 U	44.5	<0.091 U	<0.15 U	9.6	<1.3 U	<0.25 U	<1.10 U
MW-13	2/13/2018	<0.45 U	<0.72 U	54.1	<0.071 U	<0.15 U	0.93 J	<1.7 U	<0.25 U	<0.11 U
	5/4/2018	<0.45 U	<0.72 U	50.3	<0.071 U	<0.15 U	<0.87 U	NS	<0.25 U	<0.11 U
	8/13/2018	<0.41 U	<0.68 U	56.9	<0.091 U	<0.15 U	<0.70 U	<1.5 U	<0.25 U	<1.10 U
	2/19/2019	<0.41 U	1.5 J	155	0.91	<0.15 U	9.5	3.5 J	<0.25 U	4.1
	9/5/2019	<0.41 U	<0.68 U	50.7	0.092 J	<0.15 U	1.9 J	<1.3 U	<0.25 U	<1.1 U
	9/5/19 [1]	<0.41 U	<0.68 U	50.8	0.16 J	<0.15 U	4.0 J	<1.3 U	<0.25 U	<1.1 U

TABLE 7
MONITORING PROGRAM APPENDIX IV ANALYTICAL DATA - COMPLIANCE WELLS

FEDERAL CCR RULE - 2019 ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT
Westland Ash Management Facility, Cell B - MD

	Analyte:	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium-226 [2]	Radium-228 [2]	Radium (226+228) [3]
Well ID	Sample Date	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	pCi/L	pCi/L
Core-2S	2/14/2018	16.4 J	<0.05 U	<3.4 U	48.5	<0.12 U	<0.0263 U	<0.221 U	<2.0 U
	5/4/2018	30.7	NS	<3.4 U	52.8	NS	7.47	<0.218 U	9.47
	8/8/2018	<11.0 U	<0.05 U	2.7 J	47.9	NS	<1.20 U	<0.243 U	<2.0 U
	2/14/2019	<11.0 U	<0.05 U	2.4 J	47.4	<0.11 U	0.238	<1.44 U	1.74 J
	9/5/2019	<13.0 U	<0.05 U	<2.0 U	56.8	NS	<0.190 U	<-1.22 U	<2.0 U
D-6R	2/6/2018	863	0.13 J	38.5	81.3	<0.12 U	<0.204 U	<0.419 U	<2.0 U
	5/3/2018	841	0.09 J	43.7	103	NS	1.01	<1.31 U	2.51 J
	8/10/2018	927	0.39	43.8	96.5	NS	NS	NS	NS
	2/14/2019	854	0.065 J	46.9	78.7	<0.11 U	0.425	<0.728 U	1.93 J
	9/5/2019	1,140	0.15 J	35.8	47.0	NS	<0.270 U	<-0.164 U	<2.0 U
MW-03	2/13/2018	145	1.3	1,030	36.7	<0.12 U	2.98	<0.372 U	4.48 J
	5/3/2018	198	NS	1,290	41.3	NS	7.65	<0.487 U	9.15
	8/13/2018	134	0.46	1,550	32.8	NS	5.96	<0.281 U	7.46
	2/15/2019	108	0.42	1,120	22.2	<0.11 U	<0.186 U	2.26	2.76 J
	9/4/2019	156	0.83	1,380	28.3	NS	0.432	<-0.0823 U	<2.0 U
MW-09	2/14/2018	18.8 J	<0.05 U	4.1 J	82.7	<0.12 U	<0.0758 U	<0.80 U	<2.0 U
	5/3/2018	<9.0 U	NS	<3.4 U	90.6	NS	1.07	<0.0144 U	2.57 J
	8/9/2018	<11.0 U	<0.05 U	5.2 J	81.2	NS	<0.296 U	<0.147 U	<2.0 U
	2/19/2019	<11.0 U	<0.05 U	<2.0 U	73.0	<0.11 U	<-0.0291 U	<0.664 U	<2.0 U
	9/4/2019	<13.0 U	<0.05 U	<2.0 U	70.8	NS	<0.147 U	<0.691 U	<2.0 U
MW-10S	2/14/2018	21.7	<0.05 U	<3.4 U	207	<0.12 U	0.455	<0.613 U	1.95 J
	5/3/2018	<9.0 U	NS	<3.4 U	241	NS	8.12	<-0.352 U	9.62
	5/3/2018 [1]	<0.9 U	NS	<3.4 U	238	NS	12.2	<1.21 U	13.70
	8/10/2018	15.9 J	0.08 J	<2.0 U	223	NS	3.65	<-0.0279 U	5.15
	2/18/2019	<11.0 U	<0.05 U	<2.0 U	215	<0.11 U	<0.00 U	<0.569 U	<2.0 U
	9/3/2018	15.5 J	<0.05 U	<2.0 U	200	NS	<0.427 U	<0.426 U	<2.0 U
MW-12	2/14/2018	206	0.47	748	267	<0.12 U	<0.299 U	<-0.154 U	<2.0 U
	5/4/2018	256	NS	814	303	NS	7.56	<0.234 U	9.06
	8/13/2018	238	0.20	824	297	NS	6.62	<0.415 U	8.12
	2/19/2019	195	0.41	797	254	<0.11 U	<0.225 U	2.21 J	2.71 J
	9/5/2019	293	0.47	999	269	NS	0.752 J	<-1.16 U	2.25 J
MW-13	2/13/2018	<9.0 U	<0.05 U	<3.4 U	1.1 J	<0.12 U	3.52	<0.183 U	5.02
	5/4/2018	<9.0 U	NS	<3.4 U	1.8 J	NS	9.2	<-0.0897 U	10.7
	8/13/2018	<11.0 U	<0.05 U	<2.0 U	1.3 J	NS	5.53	<1.38 U	7.03
	2/19/2019	<11.0 U	<0.05 U	9.7 J	1.7 J	<0.11 U	0.628 J	<1.23 U	2.13 J
	9/5/2019	<13.0 U	<0.05 U	<2.0 U	1.6 J	NS	0.852 J	<-0.371 U	2.35 J
	9/5/19 [1]	<13.0 U	<0.05 U	<2.0 U	1.3 J	NS	<0.078 U	<-0.271 U	<2.0 U

Notes:

µg/L micrograms per Liter

mg/L milligrams per Liter

pCi/L picocurie per Liter

NS Not Sampled

J Constituent detected below reportable quantitation limit; result is an estimated value.

U Constituent not detected above method detection limitt.

[1] Duplicate sample collected

[2] Radium values shown are the 'result' reported by lab, including non-detects shown with '<'.

[3] The sum of Radium-226 + Radium-228 uses one-half the reporting limit (data not shown) for non-detect (<) values.

TABLE 8
STATISTICALLY SIGNIFICANT LEVELS - APPENDIX IV CONSTITUENTS

FEDERAL CCR RULE - 2019 ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT
Westland Ash Management Facility, Cell B - MD

WELL ID	Antimony		Arsenic		Chromium		Cobalt		Lead		Lithium		Molybdenum		Radium (226 + 228)		Selenium	
	GWPS = 6 µg/L		GWPS = 10 µg/L		GWPS = 100 µg/L		GWPS = 6 µg/L		GWPS = 15 µg/L		GWPS = 40 µg/L		GWPS = 100 µg/L		GWPS = 5 pCi/L		GWPS = 50 µg/L	
	SSL	Trend	SSL	Trend	SSL	Trend	SSL	Trend	SSL	Trend	SSL	Trend	SSL	Trend	SSL	Trend	SSL	Trend
CORE-2S																		
D-6R											●	↑					●	-
MW-03											●	-	●	↑				
MW-09																	●	↑
MW-10S																	●	↑
MW-12											●	-	●	-			●	-
MW-13																		

Definitions:

µg/L micrograms per Liter
pCi/L picoCurie per Liter
SSL Statistically Significant Level
SSI Statistically Significant Increase
LCL Lower Confidence Limit
GWPS Groundwater Protection Standard

Legend:

	Not evaluated because no SSI for the constituent in this well.
	No SSL (LCL does not exceed GWPS).
-	Constituent does not have a significant increasing trend in this monitoring well (based on Mann Kendall Trend Analysis).
↑	Increasing trend for the constituent in this monitoring well (based on Mann Kendall Trend Analysis).

SSL Legend: Ratio of LCL over GWPS

●	LCL is greater than GWPS by 1 to 2 times
●	LCL is greater than GWPS by >2 to 10 times
●	LCL is greater than GWPS by >10 times

Notes:

[1] Barium, beryllium, cadmium, fluoride, and mercury did not exceed their GWPS in any compliance well in any monitoring event; thus, the LCL was not calculated for these constituents.
[2] Trend analysis was not performed for well/constituent pairs that did not have SSLs.

APPENDIX A

Groundwater Flow Velocity Calculation

Appendix A

Groundwater Velocity Calculation

Westland Ash Management Facility Cell B

Dickerson, Maryland

1. Governing Equation

Groundwater flow velocity at the Site was calculated between several monitoring wells around Cell B. The calculations were performed using the following equation.

$$V_{\eta} = \frac{K}{\eta} \times \frac{\Delta h}{\Delta l}$$

Where:

V_{η} = Groundwater velocity (cm per second)
K = Hydraulic conductivity estimated through aquifer pumping tests (cm per second)
η = Effective porosity % (unitless)
Δh = Change in groundwater elevation between two points (feet)
Δl = Distance between two points (feet)

This equation is for Darcy flow through porous media, but is a reasonable approximation at the site-wide scale for fractured bedrock at Westland.

2. Hydraulic Conductivity

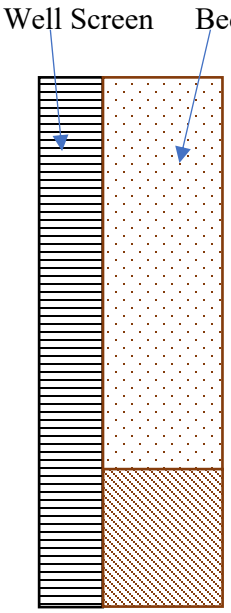
Hydraulic conductivity (*K*) was calculated at select monitoring wells around Phase II. The boreholes for monitoring wells Core 2S, MW-03, MW-09, MW-10S, MW-12, and MW-13 were packer tested prior to well installation. The location of the packer tested wells are shown on **Figure 2**. Straddle packer tests were used to calculate *K* of each monitoring well. The *K* value for each packer test interval within a given borehole was averaged, which generated an average *K* for each test interval. Average *K* values are presented in **Table A-1**. The average of the K value between two monitoring wells is presented in **Table A-2**.

3. Average Porosity

As shown on **Table A-1**, each monitoring well has an average porosity (η) calculated for each screen interval. The averaged η values were obtained from *Groundwater and Wells, Second Edition, Driscoll* [Driscoll, 1986]. A range for η is presented in [Driscoll, 1986] and the average for each η range was used in the calculation. The published η values and the calculated average η values are presented in **Table A-1**.

The averaged η value was then used to estimate an η value for each screen based on the geology observed during the well installation. See diagram below to see how η was estimated for each boring monitoring well screen.

EXAMPLE POROSITY ESTIMATION FOR WELL SCREEN



$$Average\ \eta\ of\ the\ well\ screen = (\eta_{SS} \times 0.8) + (\eta_{MS} \times 0.2)$$

$$Average\ \eta\ of\ the\ well\ screen = (5_{SS} \times 0.8) + (31_{MS} \times 0.2)$$

$$Average\ \eta\ of\ the\ well\ screen = (4) + (6.2)$$

$$Average\ \eta\ of\ the\ well\ screen = 10.2\%$$

The top 8 feet of the screen is screened in unweathered sandstone (SS). The average η of SS is 5%.

The bottom 2 feet of the screen is screened in siltstone (MS). The average η of MS is 31%.

Boring logs were provided in *Basis for Groundwater Monitoring Network* [Geosyntec, 2017a].

After the average η value was calculated for each well screen, the average of the η values between the two monitoring wells along a groundwater flow path was calculated. See **Table A-1** for the calculated average η for each monitoring well screen. The average η value between the two monitoring wells was the η used to calculate the groundwater velocity. Average η value between monitoring wells is presented in **Table A-2**.

4. Monitoring Well Selection

To estimate groundwater velocity, monitoring wells upgradient and downgradient of Cell B were selected. Ideally, monitoring wells should be along a groundwater flow path. Based on that requirement, the groundwater velocity was calculated between D-2 and the downgradient monitoring wells. See **Figure 3** and **Figure 4** for the selected well locations relative to groundwater flow.

5. Groundwater Velocity

Groundwater velocity around Cell B ranged from 2.15 X 10^{-5} centimeters per second (cm/sec) (22.25 feet/year) between monitoring wells D-2 and MW-3 to 4.45 X 10^{-6} cm/sec (4.61 feet/year) between monitoring wells D-2 and MW-13. The average groundwater velocity around Cell B was calculated at 6.81 X 10^{-6} cm/sec (7.04 feet/year). **Table A-2** presents the calculated groundwater velocities. Therefore, to be considered independent samples, groundwater monitoring events should be at least 1.5 months apart for groundwater to completely travel through the 8-inch diameter borehole.

APPENDIX A
TABLE A-1
Groundwater Flow Velocity Variables

Westland CCR Management Facility Cell B
Dickerson, Maryland

Groundwater Velocity Equation

$$V_{\eta} = \frac{K}{\eta} \times \frac{\Delta h}{\Delta l}$$

V_{η} = linear groundwater velocity (cm/sec)
K = hydraulic conductivity (cm/sec)
η = effective porosity (unitless)
Δh = change in head between wells (ft)
Δl = distance between wells (ft)

Well ID:	Average Hydraulic Conductivity (K) (cm/sec) [3]
D-2 [1]	5.73E-05
Core-2S	7.22E-06
D-6R [2]	1.89E-05
MW-3	3.32E-04
MW-09	5.08E-08
MW-10S	1.12E-05
MW-12	2.66E-05
MW-13	5.04E-06

Upgradient Well	Downgradient Well	Δl (ft)	Δh (ft) [6]
D-2	Core-2S	2,220	71.27
D-2	D-6R	2,737	102.97
D-2	MW-3	1,710	53.43
D-2	MW-09	2,772	125.07
D-2	MW-10S	2,997	116.22
D-2	MW-12	2,207	85.62
D-2	MW-13	2,115	79.03

Rock Type	Effective Porosity % (η) [4]	Average η
Sandstone (SS)	5	5
Sandstone (mod. Weathered)	15	15
Sandstone (highly weathered)	30	30
Siltstone (MS)	21 - 41	31

Well Location	Geology Observed in Screened Intreval	Average η of Screen
D-2 [5]	Unknown	27.5
Core-2S	50/50 High-moderate weather SS	22.5
D-6R [5]	Unknown	27.5
MW-3	Highly Weathered SS	30.0
MW-09	Moderately Weathered SS and MS	27.8
MW-10S	Highly/Moderately Weathered SS and MS	24.2
MW-12	Highly Weathered SS	30.0
MW-13	Highly Weathered SS	30.2

Notes:
ft - feet
cm/sec - centimeters per second
[1] - Hydraulic conductivity is an average of the Cell B compliance monitoring wells.
[2] - Hydraulic conductivity is an average of MW-12 and MW-10s, which are located on either side of D-6R.
[3] - Average hydraulic conductivity is the average of the hydraulic conductivity calculated in the interval in which the well is screened.
[4] - Porosity is an average of the rock types observed at the Site.
[5] - Average porosity of the screen is an average of the Cell B compliance well screen porosity values.
[6] - Groundwater elevation used to calculate groundwater velocity from the August 2018 monitoring events.

APPENDIX A
Table A-2
Groundwater Flow Velocity Calculation

Westland CCR Management Facility Cell B
Dickerson, Maryland

Well ID:	Hydraulic Conductivity (K) (cm/sec)	Average Porosity of Screen Interval (%)	Average K (cm/sec) [1]	Average η	Δ h (ft)	Δ l (ft)	Δ h/Δ l	Linear Velocity (cm/sec)	Linear Velocity (inches/month)
Core-2S	7.22E-06	22.5	3.54E-05	0.24975	71.27	2,220	0.0321	**4.56E-06**	**4.71**
D-6R	1.89E-05	27.5	4.13E-05	0.27450	102.97	2,737	0.0376	**5.66E-06**	**5.85**
MW-3	3.32E-04	30.0	1.98E-04	0.28725	53.43	1,710	0.0312	**2.15E-05**	**22.25**
MW-09	5.08E-08	27.8	3.19E-05	0.27625	125.07	2,772	0.0451	**5.20E-06**	**5.38**
MW-10S	1.12E-05	24.2	3.74E-05	0.25825	116.22	2,997	0.0388	**5.62E-06**	**5.82**
MW-12	2.66E-05	30.0	4.51E-05	0.28725	85.62	2,207	0.0388	**6.09E-06**	**6.31**
MW-13	5.04E-06	30.2	3.43E-05	0.28825	79.03	2,115	0.0374	**4.45E-06**	**4.61**

Groundwater Velocity Mean	**6.40E-06 cm/sec**	**6.62**	**inches/month**
Groundwater Velocity Median	**5.62E-06 cm/sec**	**5.82**	**inches/month**

Groundwater Velocity Equation

$$V_\eta = \frac{K}{\eta} \times \frac{\Delta h}{\Delta l}$$

V_η = linear groundwater velocity
K = hydraulic conductivity (cm/sec)
η = effective porosity (unitless)
Δh = change in head between wells (ft)
Δl = distance between wells (ft)
[1] Average hydraulic conductivity is the average hydraulic conductivities between D-2 and identified well.