

**2022 ANNUAL GROUNDWATER
MONITORING AND CORRECTIVE
ACTION REPORT
FEDERAL CCR RULE**

**BRANDYWINE ASH MANAGEMENT FACILITY
PHASE II, BRANDYWINE, MARYLAND**

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



January 2023

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EXECUTIVE SUMMARY

This Groundwater Monitoring and Corrective Action Report (Report) has been prepared by Geosyntec Consultants, Inc. (Geosyntec) on behalf of GenOn MD Ash Management LLC (MD Ash) to summarize the groundwater monitoring activities conducted at the Phase II CCR landfill unit of the Brandywine Ash Management Facility (Site) in Brandywine, Maryland pursuant to the Coal Combustion Residuals (CCR) Rule (40 Code of Federal Regulations [CFR] § 257.90(e)) through 31 December 2022. This executive summary has been included in this Report to meet the requirements of 40 CFR § 257.90(e)(6).

In the first quarter and the third quarter of 2022, the Phase II CCR unit was monitored under a detection monitoring program in accordance with 40 CFR § 257.94. Two semi-annual groundwater monitoring events (January and August) were completed during 2022 to assess which, if any, constituents listed within Appendix III to 40 CFR Part 257 were detected at concentrations that were statistically significant increases (SSIs) over background concentrations. An SSI was detected for fluoride at compliance well B38 above the background upper prediction limit (UPL) in January 2022 and August 2022. Subsequent Alternative Source Demonstrations concluded that the SSI was not due to a release from the Phase II CCR Unit. Additionally, an SSI was detected for sulfate at compliance well B37 in January 2022. A verification sample was collect in May 2022 at compliance well B37 and the verification sample disconfirms the result from January 2022. Therefore, the Site remains in detection monitoring.

1. INTRODUCTION

The Federal Coal Combustion Residuals (CCR) Rule (40 Code of Federal Regulations [CFR] § 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 2023. Geosyntec Consultants (Geosyntec) has prepared this Report for the Phase II CCR landfill unit at the Brandywine Ash Management Facility in Brandywine, Maryland (Site). This Report summarizes the groundwater monitoring activities conducted pursuant to the CCR Rule through 31 December 2022.

2. SITE DESCRIPTION

2.1 Site Description

The Site is located in Brandywine, Prince George's 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 217 acres of which approximately 29 acres have been used to manage CCR at the Phase II landfill cell. Phase I, Historical Area 1, and Historical Area 2 landfills are located adjacent to Phase II, are inactive, and therefore are not regulated by the Federal CCR Rule. Phase II was constructed with a geosynthetic bottom liner and associated leachate collection system that directs leachate to Pond 006, located directly to the east. All water impounded in Pond 006 is routed to Pond 004 at Phase I, which is the location of the Site wastewater treatment system (WWTS) installed in 2017. Water routed to Pond 004 is treated by the WWTS and discharged through a single national pollutant discharge elimination system (NPDES) permitted outfall, Outfall 004. Non-contact stormwater runoff is directed away from Phase II through perimeter ditches. In addition to leachate, Pond 006 is used to manage contact stormwater.

Pond 006 is 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 on the Atlantic Coastal Plain province of Maryland and was previously used for sand and gravel mining operations. The sand and gravel unit is the upper aquifer at the Site as defined in the CCR Rule. A regional aquitard (the Calvert Formation) underlies the sand and gravel.

Regional groundwater flow in the upper aquifer in the Site vicinity is to the north/northeast toward the Mataponi Creek that is considered to be the discharge location for shallow groundwater in the upper aquifer. The Mataponi Creek is incised into the Calvert Formation confining unit. Groundwater flow directions are locally variable and are influenced by nearby tributaries to Mataponi Creek that are localized groundwater discharge zones.

3. GROUNDWATER MONITORING SYSTEM

This section describes the groundwater monitoring well network for the CCR Rule at Phase II. This network utilizes several monitoring wells initially installed as part of a separate site-wide hydrogeologic investigation in addition to wells installed explicitly for the CCR Rule. As described in the *Basis for Groundwater Monitoring Network* (Geosyntec, 2017a), the groundwater monitoring network around Phase II was designed to comply with 40 CFR § 257.91. No monitoring wells were installed or decommissioned during 2022.

Groundwater quality is monitored around Phase II through a network of eleven monitoring wells. As shown on **Figure 3**, there are seven compliance monitoring wells (B15S, B16, B26, B27, B37, B38, and B39) and four background monitoring wells (B34, B35, B36, and B41). These background locations were selected in consultation with Maryland Department of Environment (MDE) under a separate regulatory program. Monitoring well construction and soil boring logs were provided in *Basis for Groundwater Monitoring Network* (Geosyntec, 2017a). Compliance and background monitoring well construction details are summarized in **Table 1**.

4. CCR RULE GROUNDWATER MONITORING COMPLETED – 2022

4.1 Groundwater Monitoring

The baseline monitoring program was completed in August 2017 and the Site transitioned to detection monitoring beginning in October 2017. Groundwater monitoring continued in 2022 and was conducted in accordance with the *Sampling and Analysis Plan* (SAP) provided in Geosyntec (2015). Detection monitoring is performed on a semi-annual basis during the first and third quarters.

4.1.1 *Detection Monitoring Program*

Table 2 summarizes the history of baseline and detection monitoring events through 2022. Sampling occurred in January and August of 2022. Since October 2017 a total of eleven detection monitoring events have been conducted at the Site. In accordance with 40 CFR § 257.94(a) of the CCR Rule, samples were analyzed for Appendix III list constituents only. Prior to sampling, a synoptic round of groundwater measurements was conducted which included the compliance and background monitoring wells. Groundwater elevation data are presented in **Table 3**. Analytical results for background and compliance wells are summarized in **Table 4** and **Table 5**, respectively.

4.1.2 *Groundwater Elevation and Flow Velocities*

Potentiometric surface maps based on the elevations measured during the January and August 2022 monitoring events are presented on **Figure 4** and **Figure 5**, respectively. Groundwater under the eastern half of Phase II flows from west to east. A groundwater divide is present near the western half of Phase II. The groundwater elevations and flow directions are very stable among the various monitoring events.

The average hydraulic gradient around Phase II ranged from 0.027 ft/ft between monitoring wells B16 and B28 to 0.0086 ft/ft between monitoring wells B16 and B27. Groundwater gradients between monitoring wells B26 and B27 and B26 and B28 were similar to the gradient mentioned above. The groundwater flow velocity calculation package is provided in **Appendix A. Table A-2** shows groundwater flow velocities at the Site ranges from 1.41×10^{-4} centimeters per second (cm/sec) (146 inches/month; 146 feet/year) between monitoring wells B16 and B28 to 4.46×10^{-6} cm/sec (4.62 inches/month; 4.62 feet/year) between monitoring wells B26 and B27.

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.
- 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.

5. DETECTION MONITORING STATISTICS

The baseline monitoring data from the four background wells (B34, B35, B36, and B41) 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 the *2017 Annual Groundwater Monitoring and Corrective Action Report* (Geosyntec, 2018a).

In January 2018, the calculated background concentrations were compared to the results of the first Detection Monitoring Event conducted in October 2017. Comparison of those data to the calculated background upper prediction limits (UPLs) resulted in statistically significant increases (SSIs) over background and an alternate source demonstration (ASD) was completed. ASDs and supplemental ASDs (SASDs) that were completed and successful in years prior are discussed in previous versions of the *Annual Groundwater Monitoring and Corrective Action Report*.

5.1 Transition to Intra-Well Statistical Analysis

After the ASD and SASD were completed and an alternate source for CCB constituents in Phase II compliance well groundwater was demonstrated, the Site statistical analysis was transitioned from inter-well to intra-well statistical analysis (Geosyntec, 2018d). The intra-well statistical analysis

compared groundwater concentrations from each monitoring well against the baseline data collected from the respective well. The intra-well statistical analysis was certified by a Professional Engineer. New background concentrations for each Appendix III constituent were calculated for use in the 2018 Annual Groundwater Monitoring and Corrective Action Report (Geosyntec, 2019). The new background concentrations are presented in **Table 6**. Subsequent monitoring results have been compared to the calculated intra-well background UPLs.

5.2 2022 Intra-well Detection Monitoring Statistics

In accordance with 40 CFR § 257.93(b)(2), intra-well detection monitoring statistics were used to evaluate groundwater concentrations of Appendix III constituents collected during January and August 2022 detection monitoring events. **Table 7** provides a comparison of the Appendix III detection monitoring results to the calculated background concentrations. There were no SSIs above background detected at compliance wells during the 2022 monitoring period, except for sulfate at monitoring well B37 and fluoride at monitoring well B38. It should be noted that fluoride detected at monitoring well B26 is not considered an SSI because the statistic uses the double quantification rule (DQR) where all baseline background data were non-detects. However, starting in Fall 2021, a new laboratory was used that has a lower reporting limit for fluoride. Hence, fluoride was detected in these samples due to the lower reporting limit. Those detections do not constitute an SSI.

In January 2022, an SSI for sulfate was identified at monitoring well B37. Sulfate was detected at a concentration of 950 mg/l during this event, which exceeded the background UPL of 779 mg/L at B38. A verification sample was collected by Geosyntec in May 2022. The verification sample disconfirmed the original detection from the January 2022 monitoring event, and the Site remains in detection monitoring.

An SSI for fluoride was identified at monitoring well B38 following the January 2022 and August 2022 monitoring events. Fluoride was detected at a concentration of 1.20 mg/L during January 2022, which exceeded the background UPL of 1.04 mg/l at B37. An ASD was completed in June 2022 and is provided as **Appendix B**. Fluoride was detected at a concentration of 1.40 mg/L during August 2022, which exceeded the background UPL of 1.04 mg/l at B37. An ASD was completed in December 2022 and is provided as **Appendix C**. Both ASDs were completed within 180 days of the SSI trigger date and certified by a Professional Engineer.

6. ASSESSMENT MONITORING STATISTICS

Based on the results of the detection monitoring statistics the Site is not in assessment monitoring.

7. PROBLEMS ENCOUNTERED AND RESOLUTIONS

The following section discusses problems encountered during the detection monitoring program and their resolution.

Problem 1: SSI of an Appendix III constituent (sulfate) was detected during the January 2022 detection monitoring event in downgradient compliance well B37.

Resolution 1: A verification sample was collected in May 2022, which disconfirmed the original detection in January 2022.

Problem 2: SSI of an Appendix III constituent (fluoride) was detected during the January 2022 detection monitoring event in downgradient compliance well B38.

Resolution 2: An ASD was prepared in June 2022 which successfully demonstrated that the SSI was not due to a release of CCR leachate from the Phase II CCR unit.

Problem 3: SSI of an Appendix III constituent (fluoride) was detected during the August 2022 detection monitoring event in downgradient compliance well B38.

Resolution 3: An ASD was prepared in December 2022 which successfully demonstrated that the SSI was not due to a release of CCR leachate from the Phase II CCR unit.

8. STATUS OF MONITORING PROGRAM

As of 31 December 2022, the Site is currently undergoing detection monitoring and has successfully demonstrated an alternate source of Appendix III constituents in groundwater detected in Phase II compliance wells.

9. PLANNED KEY ACTIVITIES FOR 2022

The following section discusses the planned activities for 2022.

January 2023: This 2022 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 the Environment (MDE).

January/February 2023: Completion of semi-annual detection groundwater monitoring.

March 2023: The 2022 Annual Groundwater Monitoring and Corrective Action Report will be posted to the public internet site.

May/June 2023: SSI testing of the January/February 2023 groundwater monitoring results.

August 2023: Completion of semi-annual detection groundwater monitoring.

November/December 2023: SSI testing of the August 2023 groundwater monitoring results.

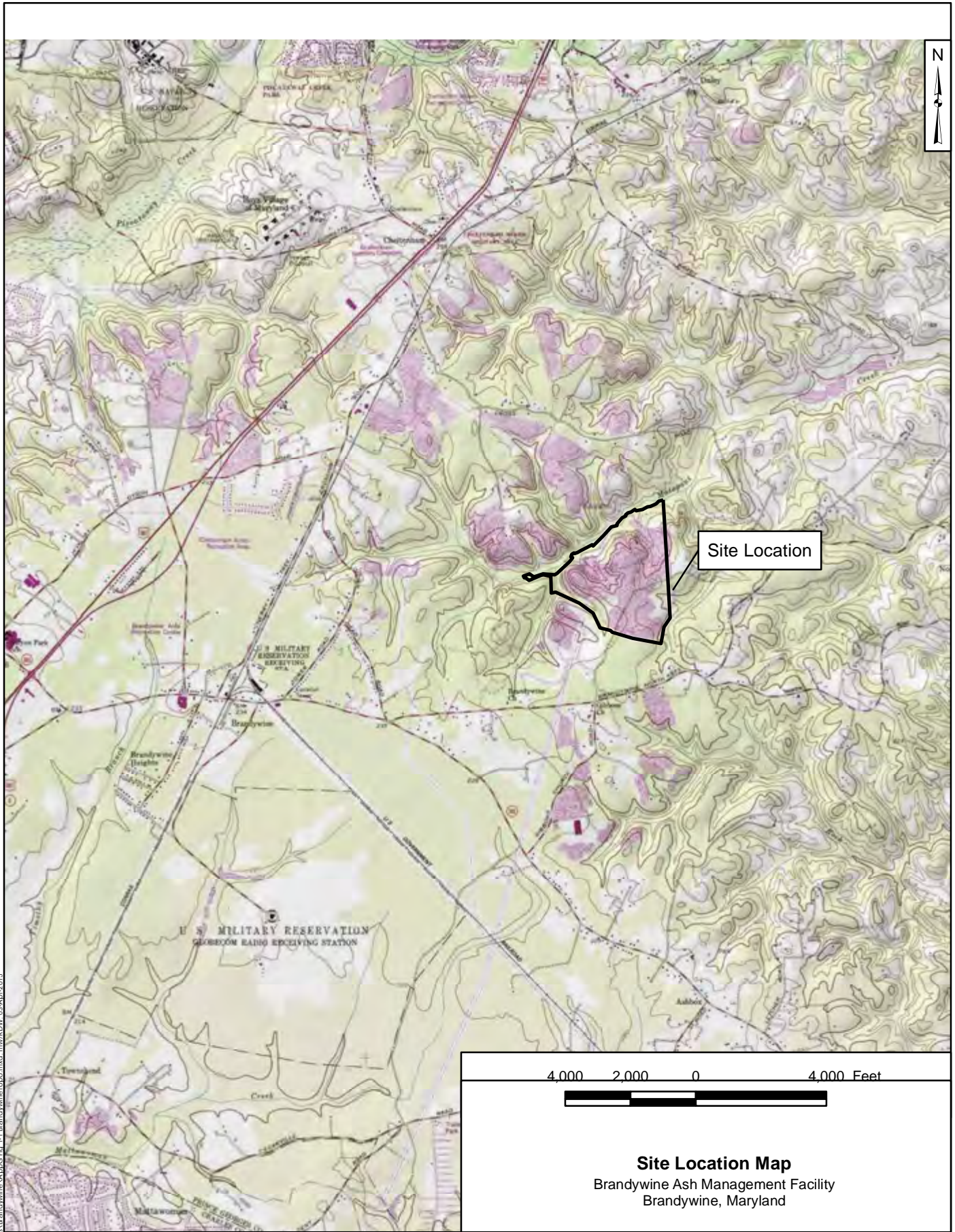
December 2023: Preparation of the 2023 Annual Groundwater Monitoring and Corrective Action Report will begin.

10. REFERENCES

- Driscoll, F.G., 1986. Groundwater and Wells, Second Edition. St. Paul, Minnesota, H.M. Smyth Company.
- Geosyntec Consultants, Inc., 2015. Sampling and Analysis Plan, Brandywine Ash Management Facility, Brandywine Maryland, September.
- Geosyntec Consultants, Inc., 2017a. Basis for Groundwater Monitoring Network, Brandywine Ash Management Facility, Brandywine, Maryland, October.
- Geosyntec Consultants, Inc. 2017b. Statistical Analysis Calculations Package for Background Groundwater – Phase II, Brandywine Ash Storage Facility, Brandywine, MD
- Geosyntec Consultants, Inc., 2018a. 2017 Annual Groundwater Monitoring and Corrective Action Report – Federal CCR Rule, Brandywine Ash Management Facility Phase II, Brandywine, MD
- Geosyntec Consultants, Inc., 2018b. Alternate Source Demonstration Report – Federal CCR Rule, Brandywine Ash Management Facility, Phase II, Brandywine, MD
- Geosyntec Consultants, Inc., 2018c. Supplemental Alternate Source Demonstration Report – Federal CCR Rule, Brandywine Ash Management Facility, Phase II, Brandywine, MD
- Geosyntec Consultants, Inc., 2018d. Intra-Well Statistical Analysis Calculation Package for Background Groundwater - Phase II, Brandywine Ash Management Facility, Brandywine, MD
- Geosyntec Consultants, Inc., 2019. 2018 Annual Groundwater Monitoring and Corrective Action Report – Federal CCR Rule, Brandywine Ash Management Facility Phase II, Brandywine, MD
- Geosyntec Consultants, Inc., 2020a. 2019 Annual Groundwater Monitoring and Corrective Action Report – Federal CCR Rule, Brandywine Ash Management Facility Phase II, Brandywine, MD
- Geosyntec Consultants, Inc., 2021. 2020 Annual Groundwater Monitoring and Corrective Action Report – Federal CCR Rule, Brandywine Ash Management Facility Phase II, Brandywine, MD
- Geosyntec Consultants, Inc., 2022. 2021 Annual Groundwater Monitoring and Corrective Action Report – Federal CCR Rule, Brandywine Ash Management Facility Phase II, Brandywine, 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

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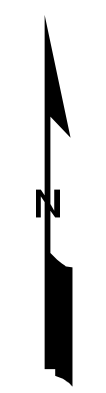
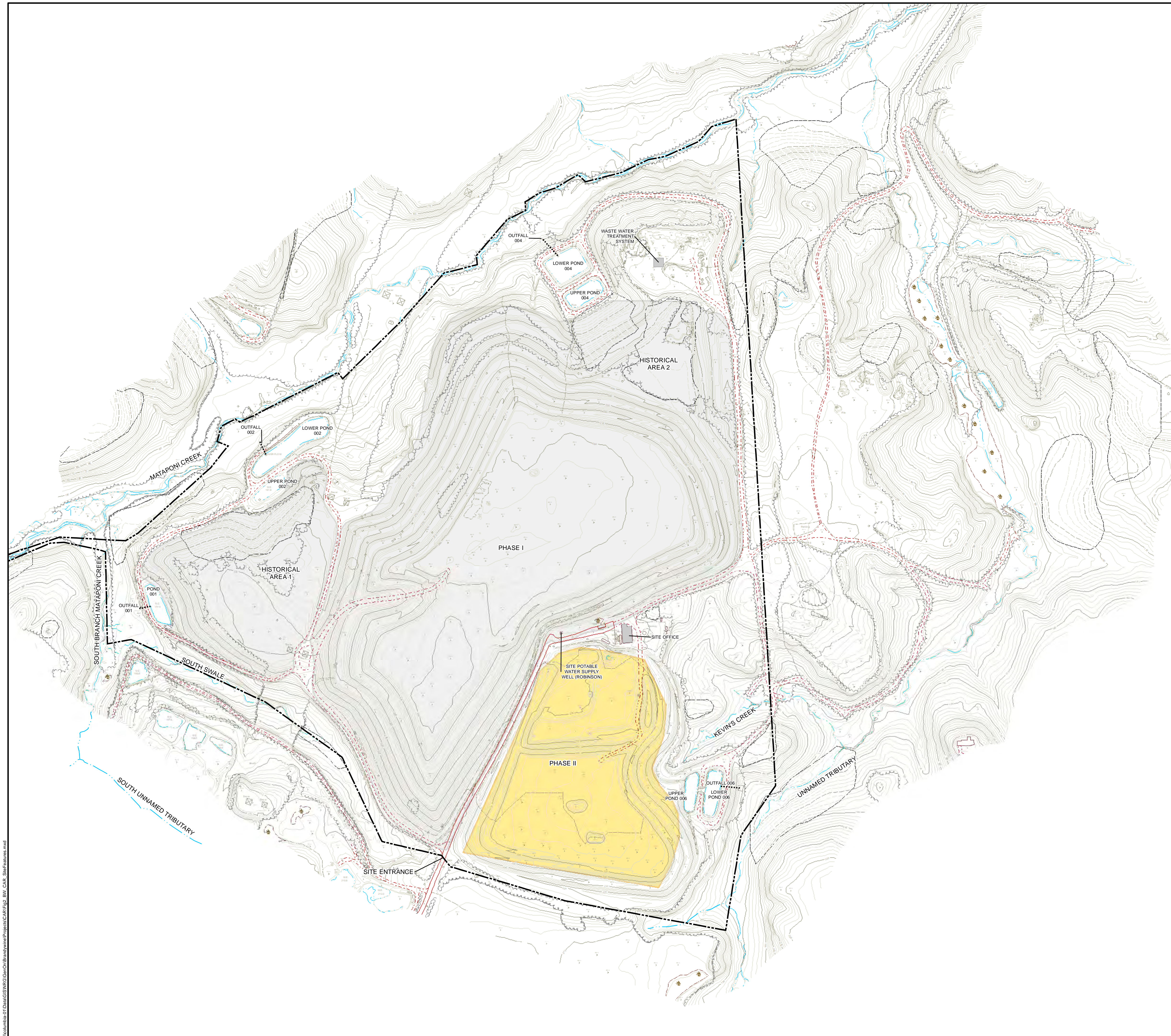
Site Location Map
 Brandywine Ash Management Facility
 Brandywine, Maryland

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

Geosyntec
 consultants January 2023

Figure

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Legend

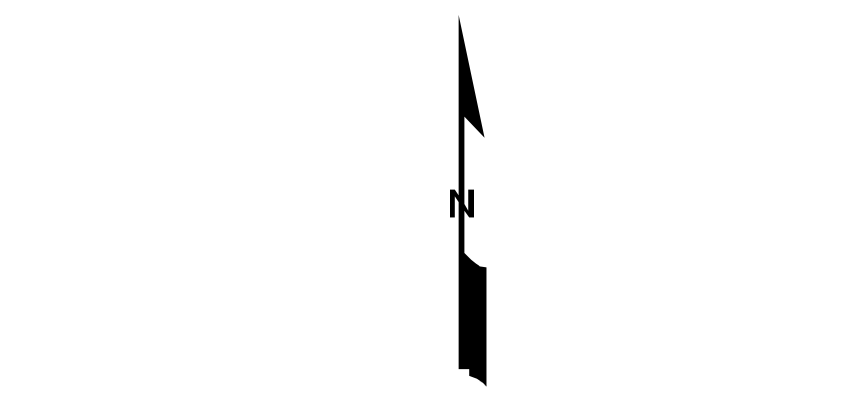
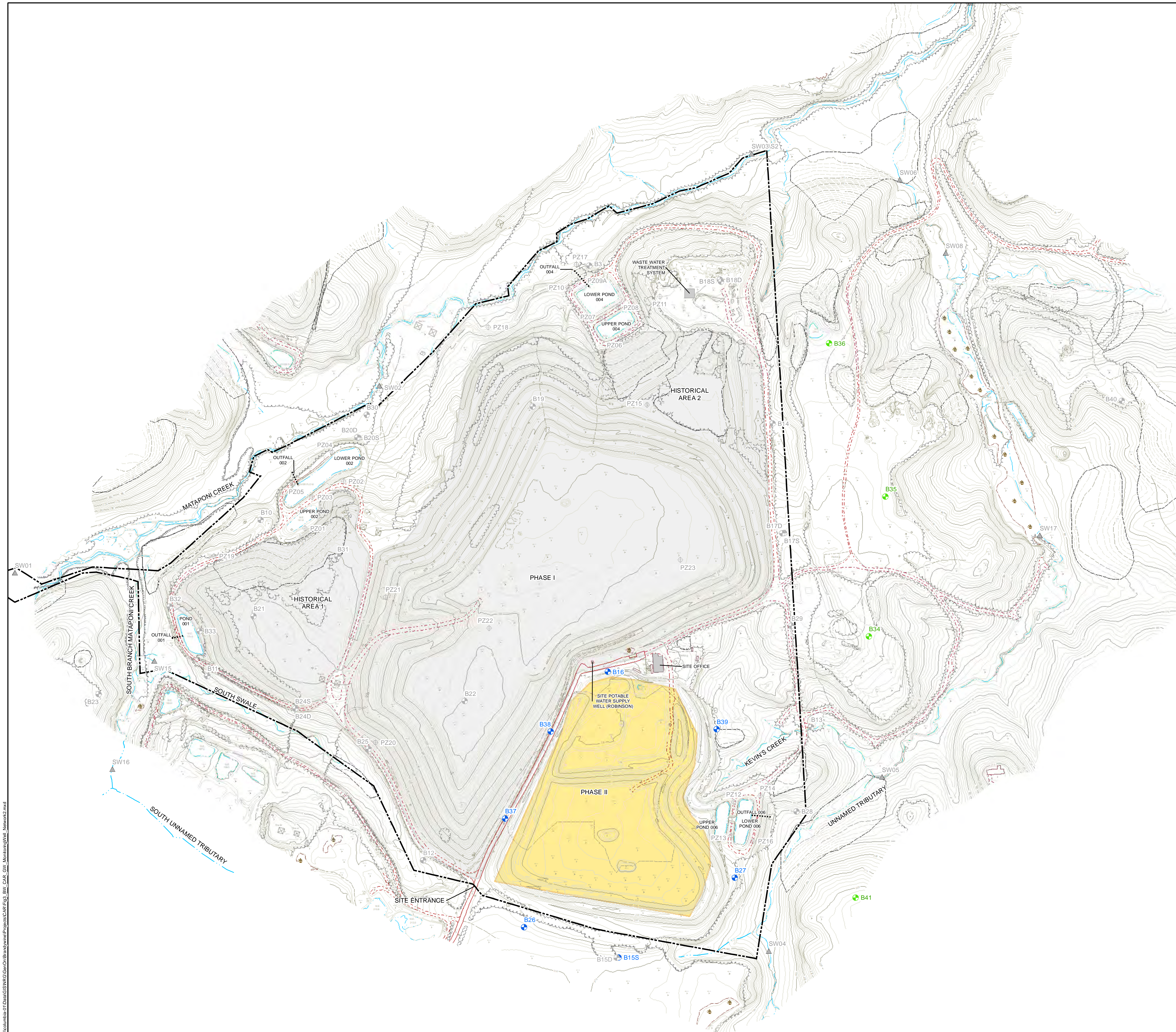
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- UNPAVED ROAD
- NPDES OUTFALL
- CCB MANAGEMENT UNITS NOT REGULATED UNDER THE CCR RULE (APPROXIMATE LIMITS)
- CCB MANAGEMENT UNITS REGULATED UNDER THE CCR RULE (APPROXIMATE LIMITS)

- NOTES:**
1. EXISTING CONDITIONS FROM GROUND CONTROL SURVEY DATED 28 DECEMBER 2013 BY L. ROBERT KIMBALL INC. AND FROM AERIAL PHOTOGRAPHY DATED 13 DECEMBER 2012 BY AIR PHOTOGRAPHICS INC.
 2. HORIZONTAL CONTROL IS BASED ON NAD83 MARYLAND STATE PLANE DATUM; VERTICAL CONTROL IS BASED ON NAVD88 DATUM.
 3. PROPERTY BOUNDARIES ACCESSED VIA TOWSON UNIVERSITY'S ARCGIS SERVER AT [HTTP://MDIMAP.TOWSON.EDU/ARCGIS/SERVICES](http://mdimap.towson.edu/arcgis/services) ON 26 AUGUST 2014.
 4. GROUND SURFACE SURVEY PERFORMED BY BEN DYER AND ASSOCIATES, INC. WEEK OF 19 OCTOBER 2015.



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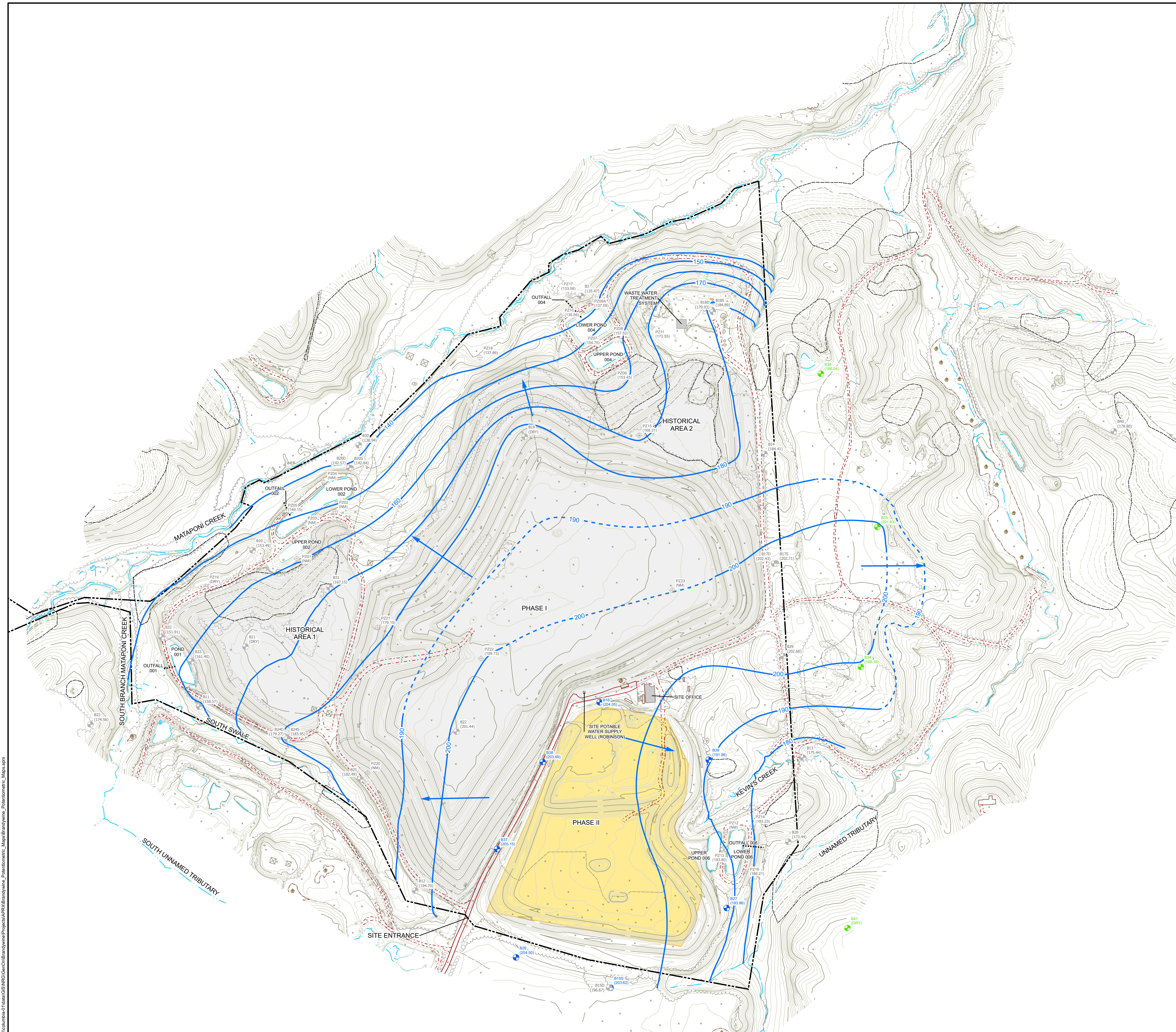
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 - EXISTING PIEZOMETER
 - MONITORING WELL USED FOR WATER LEVELS ONLY
 - BACKGROUND MONITORING WELL
 - COMPLIANCE MONITORING WELL
 - SURFACE WATER STATION
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 - GROUND SURFACE SURVEY PERFORMED BY BEN DYER AND ASSOCIATES, INC. WEEK OF 19 OCTOBER 2015.



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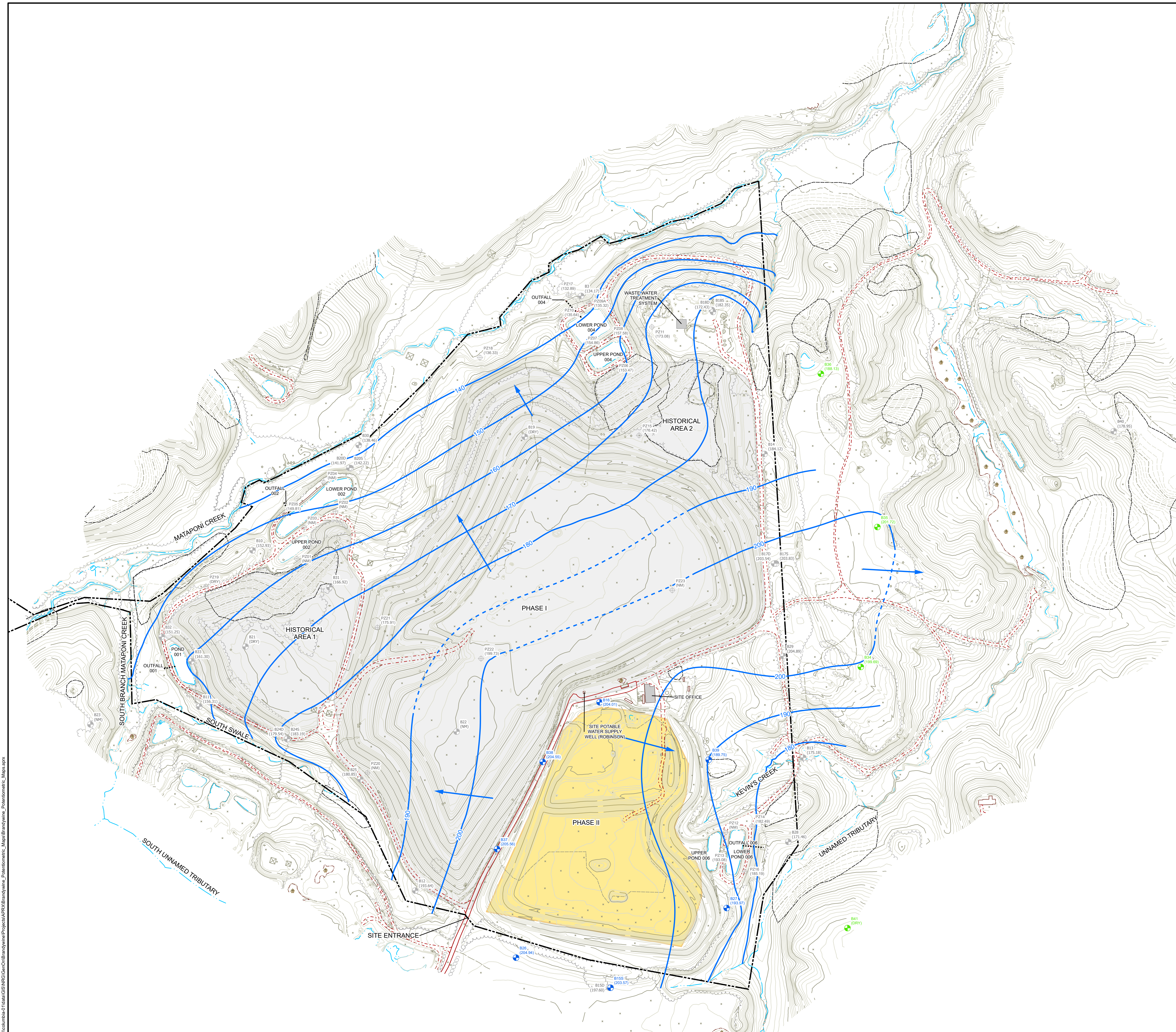
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 - COMPLIANCE MONITORING WELL
 - INFERRED CONTOUR
 - POTENTIOMETRIC SURFACE
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 - CCB MANAGEMENT UNITS REGULATED UNDER THE CCR RULE (APPROXIMATE LIMITS)
 - NM NOT MEASURED
 - DRY MONITORING WELL DRY AT TIME OF MEASUREMENT

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 - GROUND SURFACE SURVEY PERFORMED BY BEN DYER AND ASSOCIATES, INC. WEEK OF 19 OCTOBER 2015.
 - GROUNDWATER ELEVATION DATA FROM SYNOPTIC WATER LEVEL MEASUREMENTS ON 25 JANUARY 2022.
 - DEEP MONITORING WELLS WERE NOT USED TO DEVELOP THE POTENTIOMETRIC SURFACE.
 - NO SURVEY DATA PRESENT FOR B40 AND B41. LOCATION AND GROUNDWATER ELEVATIONS ARE APPROXIMATE.



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 - BACKGROUND MONITORING WELL
 - COMPLIANCE MONITORING WELL
 - INFERRED CONTOUR
 - POTENTIOMETRIC SURFACE
 - FLOW DIRECTION
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 - GROUND SURFACE SURVEY PERFORMED BY BEN DYER AND ASSOCIATES, INC. WEEK OF 19 OCTOBER 2015.
 - GROUNDWATER ELEVATION DATA FROM SYNOPTIC WATER LEVEL MEASUREMENTS ON 8 AUGUST 2022.
 - DEEP MONITORING WELLS WERE NOT USED TO DEVELOP THE POTENTIOMETRIC SURFACE.
 - NO SURVEY DATA PRESENT FOR B40 AND B41. LOCATION AND GROUNDWATER ELEVATIONS ARE APPROXIMATE.



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PROJECT: 2022 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT / FEDERAL CCR RULE				
SITE: BRANDYWINE ASH MANAGEMENT FACILITY BRANDYWINE, MARYLAND				
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED. NOT FOR CONSTRUCTION SIGNATURE _____ DATE _____		DESIGN BY: BNM DATE: JANUARY 2023 DRAWN BY: BNM PROJECT NO.: MEM0822K CHECKED BY: TW FILE: <i>Brandywine_Potentiometric_Maps</i> REVIEWED BY: MB FIGURE NO.: APPROVED BY: RMG 5		

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TABLES

**TABLE 1
WELL CONSTRUCTION DETAILS
FEDERAL CCR RULE - 2022 ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT**

Brandywine Ash Management Facility, Phase II - 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)
B15S	Compliance	PG-11-0414	10/20/2015	376978.815	1368413.012	212.71	214.95	2	6.0	7.75 - 17.75	10	0.010
B16	Compliance	PG-11-0431	6/2/2015	378557.6383	1368348.641	233.73	236.11	2	23.5	24.75 - 34.75	10	0.010
B26	Compliance	PG-11-0416	10/21/2015	377144.555	1367902.054	216.00	218.41	2	14.0	16.75 - 26.75	10	0.010
B27	Compliance	PG-11-0417	6/3/2015	377411.8764	1369043.668	212.05	214.77	2	13.0	14.75 - 24.75	10	0.010
B34	Background	PG-11-0437	6/9/2015	378729.3841	1369777.659	212.73	215.34	2	8.0	10.00 - 20.00	10	0.010
B35	Background	PG-11-0438	6/9/2015	379488.9853	1369866.212	204.31	206.82	2	5.0	7.00 - 17.00	10	0.010
B36	Background	PG-11-0439	6/18/2015	380323.7961	1369560.447	204.25	206.68	2	7.6	9.75 - 19.75	10	0.010
B37	Compliance	PG-11-0461	8/12/2015	377761.92	1367808.354	220.29	220.23	2	17.5	19.75 - 29.75	10	0.010
B38	Compliance	PG-11-0460	8/12/2015	378210.411	1368043.469	233.59	233.66	2	27.5	29.75 - 39.75	10	0.010
B39	Compliance	PG-11-0462	8/10/2015	378222.643	1368948.299	200.56	202.71	2	8.5	10.75 - 20.75	10	0.010
B41	Background	PG-14-0171	9/16/2016	377307.030	1369709.911	209.00	211.50 [1]	2	18.0	20.00 - 30.00	10	0.010

Notes:

ft msl feet above mean sea level

ft bgs feet below ground surface

Professional land survey performed week of 19 October 2015 by Ben Dyer and Associates, Inc.

[1] Elevation is an estimated value

**TABLE 2
SUMMARY OF 2015-2022 MONITORING EVENTS
FEDERAL CCR RULE - 2022 ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT**

Brandywine Ash Management Facility, Phase II - MD

Monitoring Program:	Baseline Monitoring																				
	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
Well ID																					
Background Wells																					
B34													III,IV [1,2]					III,IV	III,IV	III,IV	
B35													III,IV [1,2]					III,IV	III,IV	III,IV	
B36													III,IV [1,2]					III,IV	III,IV	III,IV	
B41													[4]			III,IV [1,2]	[3]	III,IV [1]		III,IV [1,2]	III,IV
Compliance Wells																					
B15S			[4]		III,IV			III,IV		III,IV			III,IV					III,IV		III,IV	
B16		III,IV [2]			III,IV		III,IV		III,IV			III,IV						III,IV		III,IV [1]	
B26		[4]			III,IV			III,IV		III,IV			III,IV					III,IV		III,IV	
B27		III,IV			III,IV		III,IV			III,IV			III,IV					III,IV		III,IV	
B37		III,IV			III,IV		III,IV			III,IV			III,IV					III,IV			III,IV
B38		III,IV			III,IV		III,IV			III,IV			III,IV					III,IV			III,IV
B39		III,IV			III,IV			III,IV		III,IV			III,IV					III,IV			III,IV

Monitoring Program:	Baseline Monitoring							Total Baseline Sampling Events [5]	Detection Monitoring													
	2Q 2017			3Q 2017			4Q 2017			1Q 2018			2Q 2018			3Q 2018			4Q 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-19	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18
Well ID																						
Background Wells																						
B34	III,IV	III,IV	III,IV	III,IV	III,IV		≥8	III							III			III				
B35	III,IV	III,IV	III,IV	III,IV	III,IV		≥8	III						III				III				
B36	III,IV	III,IV	III,IV	III,IV	III,IV		≥8	III						III				III				
B41	III,IV	III,IV	III,IV	III,IV	III,IV		≥6	III						III				III				
Compliance Wells																						
B15S	III,IV			III,IV			8	III							III				III			
B16	III,IV						8	III						III				III				
B26	III,IV			III,IV			8	III							III				III			
B27	III,IV						8	III							III				III			
B37	III,IV						8	III							III				III			
B38	III,IV						8	III							III				III			
B39	III,IV						8	III							III				III			

Monitoring Program:	Detection Monitoring																				
	1Q 2019			2Q 2019			3Q 2019			4Q 2019			1Q 2020			2Q 2020			3Q 2020		
	Sample Date:	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20
Well ID																					
Background Wells																					
B34		III						III						III						III	
B35		III						III						III						III	
B36		III						III						III						III	
B41		III						III						III						III	
Compliance Wells																					
B15S		III						III						III						III	
B16		III						III						III						III	
B26		III						III						III						III	
B27		III						III						III						III	
B37		III						III						III						III	
B38		III						III						III						III	
B39		III						III						III						III	

**TABLE 2
SUMMARY OF 2015-2022 MONITORING EVENTS
FEDERAL CCR RULE - 2022 ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT**

Brandywine Ash Management Facility, Phase II - MD

Monitoring Program:	Detection Monitoring																					
	4Q 2020			1Q 2021			2Q 2021			3Q 2021			4Q 2021			1Q 2022			2Q 2022			
	Sample Date:	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22
Well ID																						
Background Wells																						
B34					III						III						III					
B35					III						III						III					
B36					III						III						III					
B41					III						III						III					
Compliance Wells																						
B15S					III						III						III					
B16					III						III						III					
B26					III						III						III					
B27					III						III						III					
B37					III						III						III					
B38					III						III						III					
B39					III						III						III					

Monitoring Program:	Detection Monitoring						Total Detection Sampling Events
	3Q 2022			4Q 2022			
	Sample Date:	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	
Well ID							
Background Wells							
B34		III					11
B35		III					11
B36		III					11
B41		III					11
Compliance Wells							
B15S		III					11
B16		III					11
B26		III					11
B27		III					11
B37		III					11
B38		III					11
B39		III					11

Notes:

- III Groundwater samples collected for laboratory analysis of Appendix III parameters.
- IV Groundwater samples collected for laboratory analysis of Appendix IV parameters.
- [1] Radium was omitted from sampling or the well went dry before sampling of these parameters could be completed.
- [2] Fluoride was omitted from analysis.
- [3] Monitoring well was dry at the time of sampling, no samples were collected.
- [4] Monitoring well not yet installed.
- [5] All background and compliance monitoring wells met the minimum number of samples collected, except for B41, which went dry during sampling and only a partial sample set was collected over nine sampling events, which resulted in 6 complete sample sets.

TABLE 3
2022 GROUNDWATER ELEVATION MEASUREMENTS
FEDERAL CCR RULE - 2022 ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT

Brandywine Ash Management Facility, Phase II - MD

Well ID	Top of Casing Elevation (ft msl)	Depth to Water Measurement Date	Depth to Water (ft btoic)	Groundwater Elevation (ft msl)
B15S	214.95	1/25/2022	11.33	203.62
		8/8/2022	11.38	203.57
B16	236.11	1/25/2022	32.06	204.05
		8/8/2022	32.10	204.01
B26	218.41	1/25/2022	13.91	204.50
		8/8/2022	13.47	204.94
B27	214.77	1/25/2022	20.91	193.86
		8/8/2022	20.80	193.97
B34	215.34	1/25/2022	16.16	199.18
		8/8/2022	15.65	199.69
B35	206.82	1/25/2022	4.11	202.71
		8/8/2022	5.10	201.72
B36	206.68	1/25/2022	20.64	186.04
		8/8/2022	18.55	188.13
B37	220.23	1/25/2022	15.08	205.15
		8/8/2022	14.67	205.56
B38	233.66	1/25/2022	29.97	203.69
		8/8/2022	29.11	204.55
B39	202.71	1/25/2022	10.75	191.96
		8/8/2022	12.96	189.75
B41	211.50 [1]	1/25/2022	NM	NM
		8/8/2022	NM	NM

Notes:

- ft bgs feet below ground surface
- ft msl feet above mean sea level
- ft btoic feet below top of inner case
- NM Not measured
- NA Not Available
- [1] Top of casing elevation is estimated value based on ground elevation.

**TABLE 4
APPENDIX III ANALYTICAL DATA - BACKGROUND WELLS**

**FEDERAL CCR RULE - 2022 ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT
Brandywine Ash Management Facility, Phase II - 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
B34	5/2/2018	<10.1 U	0.64	3.60	<0.25 U	5.20	7.20	49.0 J
	8/3/2018	13.4 J	2.40	2.40	<0.25 U	5.40	6.40	54.0 J
	8/3/2018 [1]	19.3 J	2.34	2.20	NS	NS	6.40	52.5 J
	2/6/2019	12.1 J	1.69	1.40 J	<0.25 U	5.50	14.5	46.5 J
	8/26/2019	<9.90 U	0.36 J	2.50	<0.25 U	5.40	5.40	28.5 J
	8/26/2019 [1]	<9.90 U	0.33 J	2.40	<0.25 U	5.70	5.20	21.0 J
	2/11/2020	<12.0 U	0.38	3.30	<0.25 U	5.60	6.60	25.0 J
	8/17/2020	23.0 J	1.30	1.90 J	<0.25 U	5.50	7.30	46.0
	2/19/2021	12.0 J	1.30	8.90	<0.25 U	5.50	14.0	41.0
	8/24/2021	<50.0 U	0.37 J	3.70	<0.50 U	5.10	5.60	29.0 J
1/28/2022	4.20 J	0.40 J	3.50	0.039 J	5.90	5.50	32.0	
8/12/2022	9.70 J	0.39 J	3.60	0.043 J	5.20	5.70	180 [2]	
8/12/2022 [1]	8.70 J	0.39 J	5.20	0.046 J	5.30	6.50	13.0	
B35	4/30/2018	<10.1 U	2.40	2.90	<0.25 U	5.60	10.7	37.0 J
	8/2/2018	<12.0 U	1.94	3.40	<0.25 U	5.40	7.00	39.0 J
	2/6/2019	<12.0 U	2.10	2.80	<0.25 U	5.70	6.80	34.5 J
	8/26/2019	<9.90 U	1.82	3.60	<0.25 U	5.70	6.20	37.0
	2/10/2020	<12.0 U	2.37	3.50	<0.25 U	5.80	7.60	40.5
	8/17/2020	17.0 J	1.90	3.10	<0.25 U	5.40	4.70 J	51.0
	2/19/2021	<12.0 U	2.40	6.60	<0.25 U	5.60	7.40	37.0
	8/24/2021	<50.0 U	2.00	3.20	<0.50 U	5.40	5.00	37.0
	8/24/2021 [1]	15.0 J	2.20	3.00	<0.50 U	5.40	6.20	40.0
1/31/2022	5.70 J	2.10	2.40	<0.05 U	5.60	5.50	50.0	
8/9/2022	9.80 J	1.90	2.00	<0.05 U	5.60	8.90	61.0	
B36	5/1/2018	15.3 J	4.75	7.00	<0.25 U	5.10	4.70 J	86.5
	8/6/2018	<12.0 U	5.40	7.10	<0.25 U	4.70	16.1	75.5
	2/11/2019	21.1 J	4.95	6.50	<0.25 U	5.50	5.30	67.0
	8/22/2019	13.9 J	4.83	8.10	<0.25 U	4.50	8.50	66.5
	2/10/2020	12.7 J	5.36	6.90	<0.25 U	4.70	6.90	68.0
	8/12/2020	<12.0 U	4.10	6.50 J	<0.25 U	4.70	5.10 J	67.0
	2/22/2021	<12.0 U	3.70	6.70	<0.25 U	4.60	6.40	61.0
	8/24/2021	13.0 J	3.70	6.10	<0.50 U	4.80	4.2 J	61.0
1/31/2022	9.50 J	4.50	5.80	0.035 J	5.10	14.0	69.0	
8/10/2022	<20.0 U	3.40	5.80	<0.05 U	4.70	6.10	57.0	
B41	5/1/2018	<10.1 U	2.93	6.00	<0.25 U	6.00	<1.50 U	47.5 J
	8/6/2018	<12.0 U	4.79	4.70	<0.25 U	3.40 [2] J	21.9	66.0
	2/11/2019	12.2 J	2.74	8.30	<0.25 U	6.70	9.50	51.0 J
	8/22/2019	<9.90 U	1.00	4.70	<0.25 U	5.90	<1.50 U	37.0
	2/10/2020	<12.0 U	2.03	6.20	<0.25 U	6.10	3.20 J	43.0
	8/13/2020	<12.0 U	0.94	4.20	<0.25 U	5.90	6.40	44.0
	2/19/2021	<12.0 U	0.32 J	13.0 J	<0.25 U	5.90	4.50 J	33.0
	8/24/2021	<50.0 U	0.57	6.5	<0.50 U	5.50	3.60 J	34.0
NS	NS	NS	NS	NS	NS	NS	NS	
NS	NS	NS	NS	NS	NS	NS	NS	

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

[1] Duplicate sample collected.

[2] Result is suspected to be erroneous.

TABLE 5
APPENDIX III ANALYTICAL DATA - COMPLIANCE WELLS
FEDERAL CCR RULE - 2022 ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT

Brandywine Ash Management Facility, Phase II - 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
B15S	5/2/2018	14.1 J	1.84	5.40	0.50 U	5.50	16.7	59.5 J
	5/2/2018 [1]	14.5 J	1.81	5.50	0.50 U	5.50	16.8	68.0
	8/1/2018	36.4 J	1.60	4.80	0.31 J	5.70	15.0	60.5
	2/6/2019	13.6 J	2.18	3.60	0.50 U	5.70	30.2	77.0
	8/23/2019	18.9	1.17	3.80	0.50 U	6.00	9.10	44.0
	2/10/2020	17.7 J	2.34	2.10	0.50 U	6.70	19.2	139
	5/11/2020	NS	NS	NS	NS	NS	NS	96.5
	8/12/2020	25.0 J	2.50	4.00	0.53	5.70	27.0 J	90.0
	8/12/2020 [1]	25.0 J	2.50	2.70	0.50 U	5.70	27.0	93.0
	2/22/2021	12.0 U	2.30	2.30	0.50 U	5.50	37.0	81.0
	2/22/2021 [1]	12.0 U	2.10	2.30	0.50 U	5.80	35.0	81.0
	8/20/2021	21.0 J	1.40	2.00	0.06 J	5.80	15.0	52.0
	1/27/2022	18.0 J	1.90	2.30	0.03 J	5.70	14.0	60.0
8/11/2022	16.0 J	2.30	2.30	0.04 J	5.70	13.0	70.0	
B16	4/30/2018	58,200	426	1,870	0.50 U	6.70	7,250	13,400
	7/31/2018	53,500	385	1,850	0.50 U	6.90	8,380	13,400
	2/11/2019	56,100	307	1,850	0.50 U	7.30	6,940	13,500
	8/22/2019	40,900	199	1,380	0.50 U	7.20	5,370	10,900
	2/7/2020	41,800	206	1,450	0.50 U	7.40	6,220	11,000
	2/7/2020 [1]	42,100	218	1,380	0.50 U	7.30	5,920	11,200
	8/13/2020	43,000	270	1,900 J	0.50 U	7.00	6,900 J	11,000
	2/17/2021	39,000	250	1,300	0.57	7.00	5,600	11,000
	8/20/2021	40,000	270	1,300 J+	0.18	7.20	5,800	9,800
	1/26/2022	24,000	180	1,000	1.70 J	6.90	5,300	5,100
1/26/2022 [1]	24,000	180	1,100	1.70 J	6.90	6,100	4,900	
8/12/2022	17,000	140	1,000	2.50 U	6.70	4,000 J-	210	
B26	5/1/2018	22.3 J	4.45	10.0	0.50 U	5.20	12.1	67.5
	8/1/2018	18.6 J	4.85	9.90	0.50 U	5.20	13.4	59.0 J
	2/6/2019	12.0 U	4.62	9.40	0.50 U	5.50	13.4	69.0
	8/23/2019	31.7 J	4.97	8.80	0.50 U	5.30	12.3	55.0
	2/10/2020	12.0 U	4.77	10.4	0.50 U	5.70	13.5	71.0
	8/14/2020	19.0 J	5.40	11.0	0.50 U	5.30	13.0	75.0
	2/22/2021	12.0 U	4.40	11.0	0.50 U	5.50	12.0	60.0
	8/20/2021	50.0 U	5.40	11.0	0.09 J	5.50	13.0	66.0
	1/26/2022	39.0	4.60	9.1	0.05	5.40	9.6	30.0
8/11/2022	8.60 J	4.90	9.90	0.05	5.00	12.0	56.0	
B27	5/1/2018	665	53.9	23.4	0.50 U	7.00	74.1	419
	8/2/2018	547	41.4	13.4	0.50 U	7.10	53.7	306
	2/7/2019	261	26.8	5.80	0.50 U	6.90	44.1	197
	8/22/2019	593	98.7	35.2	0.50 U	7.00	285	824
	2/11/2020	545	55.4	17.2	0.50 U	7.00	100	430
	8/14/2020	520	53.0	14.0	0.50 U	7.40	46.0	430
	2/22/2021	420	43.0	8.90	0.50 U	7.10	38.0	330
	8/20/2021	570	50.0	17.0	0.07 J	7.20	69.0	380
	1/26/2022	560	37.0	10.0	0.10 U	7.20	40.0	260
8/11/2022	450	38.0	9.80	0.10 U	6.80	34.0	320	

TABLE 5
APPENDIX III ANALYTICAL DATA - COMPLIANCE WELLS
FEDERAL CCR RULE - 2022 ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT

Brandywine Ash Management Facility, Phase II - MD

	Analyte:	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	TDS
B37	5/1/2018	1,430	90.2	179	0.61	5.00	422	964
	8/3/2018	899	56.1	125	0.39 J	5.20	197	512
	2/8/2019	1,400	77.4	142	0.50 U	4.70	437	802
	8/22/2019	2,020	104	215	1.20	4.20	672	1,240
	2/10/2020	1,890	109	148	1.50	4.50	938	1,240
	5/11/2020	NS	NS	NS	NS	NS	684	NS
	8/14/2020	1,500	88.0	180 J	0.73	5.00	560	900
	2/23/2021	740	44.0	94.0	0.54	5.30	260	550
	8/19/2021	1,700	94.0	120.0	0.72	4.80	540	1,000
	1/27/2022	2,200	120	120	1.60	4.70	950	1,400
8/12/2022	2,000	120	120	1.20	4.20	770	1,500	
B38	5/1/2018	14,000	421	248	0.50 J	6.40	2,390	3,260
	8/3/2018	14,400	341	225	0.50 J	6.80	2,360	3,270
	2/8/2019	15,000	351	284	0.50 U	6.10	2,210	3,690
	8/22/2019	18,700	429	224	0.50 U	6.10	2,150	3,180
	2/7/2020	16,500	339	223	0.50 U	6.20	2,590	3,620
	5/11/2020	NS	NS	NS	NS	NS	2,340	NS
	8/13/2020	17,000	360	350	0.50 U	6.70	2,300	3,600
	2/23/2021	16,000	320	180	0.76	6.50	2,200	3,500
	8/19/2021	17,000	340	220	0.35	6.70	2,400	3,800
	1/27/2022	13,000	300	310	1.20	5.30	2,200	3,300
8/12/2022	12,000	300	340	1.40	4.50	2,400	930	
B39	5/1/2018	5,280	107	410	0.50 U	3.10 J	1,350	2,740
	5/1/2018 [1]	4,290	105	245	0.50 U	3.20 J	1,350	1,460
	8/3/2018	5,350	60.3	420	0.50 U	2.70 J	1,350	2,200
	2/8/2019	4,100	76.0	357	0.50 U	3.10 J	950	1,660
	8/23/2019	6,790	96.1	443	0.50 U	3.10 J	1,490	2,500
	2/11/2020	5,050	113	452	0.50 U	3.20 J	1,660	1,930
	8/17/2020	4,000	70.0	290	0.50 U	3.20 J	1,100	1,800
	2/23/2021	4,200	80.0	350	0.43 J	3.10	1,100	1,800
	8/25/2021	8,000	81.0	460	0.51	3.10	1,100	3,000
	1/28/2022	4,300	84.0	410	0.68	3.10	1,400	2,400
8/9/2022	4,400	77.0	400	0.31 J	3.10	1,600	3,200	

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.

J+ Constituent detected below reporting limit; result is an estimated value with a high bias.

U Constituent not detected above method detection limit; result shown as the reporting limit.

NS Not sampled.

[1] Duplicate sample collected.

TABLE 6
APPENDIX III INTRA-WELL STATISCAL BACKGROUND CONCENTRATIONS

FEDERAL CCR RULE - 2022 ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT
Brandywine Ash Management Facility, Phase II - MD

Analyte:	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	TDS
Well ID	µg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L
B15S	43.4	5.58	12.4	DQR [1]	3.84 - 6.71	41.7	121
B16	59,057	497	2,950	DQR [1]	5.76 - 7.48	791 [2]	16,227
B26	124	11.7	20.6	DQR [1]	4.20 - 5.90	62.9	213
B27	1,494	59.6	233	0.47	4.87 - 8.40	654	1,247
B37	4,011	213	32.9 [2]	2.21	2.90 - 5.87	779	2,559
B38	27,194	566	810	1.04	4.08 - 9.01	2,540	5,185
B39	1,346 [2]	188	59.8 [2]	2.87	2.01 - 4.20	184 [2]	364 [2]

Notes:

µg/L micrograms per Liter

mg/L milligrams per Liter

S.U. Standard Units

[1] Fluoride at wells B15S, B16, and B26 follows the Double Quantification Rule (DQR).

[2] For datasets that exhibited upward trends, the background value is the Upper Prediction Limit (UPL) for the residuals of the background dataset. To identify SSIs, the UPLs are compared to the residuals of the detection monitoring results based on the linear regression for the background dataset. In some cases, the values are negative and indicate a decrease.

TABLE 7
APPENDIX III STATISTICALLY SIGNIFICANT INCREASES (SSIs)
FEDERAL CCR RULE - 2022 ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT

Brandywine Ash Management Facility, Phase II - MD

Analyte:		Boron	Calcium	Chloride	Fluoride	pH	Sulfate	TDS
		µg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L
Well ID	Background UPL:	43.4	5.58	12.4	DQR [3]	3.84 - 6.71	41.7	121
B15S	5/2/2018	14.1 J	1.84	5.40	0.50 U	5.50	16.7	59.5 J
	5/2/2018 [1]	14.5 J	1.81	5.50	0.50 U	5.50	16.8	68.0
	8/1/2018	36.4 J	1.60	4.80	0.31 J	5.70	15.0	60.5
	2/6/2019	13.6 J	2.18	3.60	0.50 U	5.70	30.2	77.0
	8/23/2019	18.9	1.17	3.80	0.50 U	6.00	9.10	44.0
	2/10/2020	17.7 J	2.34	2.10	0.50 U	6.70	19.2	139 [6]
	5/11/2020	NS	NS	NS	NS	NS	NS	96.5 [7]
	8/12/2020	25.0 J	2.50	4.00	0.53	5.70	27.0 J	90.0
	8/12/2020 [1]	25.0 J	2.50	2.70	0.50 U	5.70	27.0	93.0
	2/22/2021	12.0 U	2.30	2.30	0.50 U	5.50	37.0	81.0
	2/22/2021 [1]	12.0 U	2.10	2.30	0.50 U	5.80	35.0	81.0
	8/20/2021	21.0 J	1.40	2.00	0.06 J	5.80	15.0	52.0
1/27/2022	18.0 J	1.90	2.30	0.03 J	5.70	14.0	60.0	
8/11/2022	16.0 J	2.30	2.30	0.04 J	5.70	13.0	70.0	
Background UPL:		59,057	497	2,950	DQR	5.76 - 7.48	791 [2]	16,227
B16	4/30/2018	58,200	426	1,870	0.50 U	6.70	1,032 [4]	13,400
	7/31/2018	53,500	385	1,850	0.50 U	6.90	1,997 [4]	13,400
	2/11/2019	56,100	307	1,850	0.50 U	7.30	207	13,500
	8/22/2019	40,900	199	1,380	0.50 U	7.20	-1,709	10,900
	2/7/2020	41,800	206	1,450	0.50 U	7.40	-1,161	11,000
	2/7/2020 [1]	42,100	218	1,380	0.50 U	7.30	-1,461	11,200
	8/13/2020	43,000	270	1,900 J	0.50 U	7.00	-816	11,000
	2/17/2021	39,000	250	1,300	0.57	7.00	-2,456	11,000
	8/20/2021	40,000	270	1,300 J+	0.18 [4]	7.20	-2,586	9,800
	1/26/2022	24,000	180	1,000	1.70 J	6.90	-3,371	5,100
	1/26/2022 [1]	24,000	180	1,100	1.70 J	6.90	-2,571	4,900
8/12/2022	17,000	140	1,000	2.50 U	6.70	-5,024	210 [9]	
Background UPL:		124	11.7	20.6	DQR	4.20 - 5.90 [5]	62.9	213
B26	5/1/2018	22.3 J	4.45	10.0	0.50 U	5.20	12.1	67.5
	8/1/2018	18.6 J	4.85	9.90	0.50 U	5.20	13.4	59.0 J
	2/6/2019	12.0 U	4.62	9.40	0.50 U	5.50	13.4	69.0
	8/23/2019	31.7 J	4.97	8.80	0.50 U	5.30	12.3	55.0
	2/10/2020	12.0 U	4.77	10.4	0.50 U	5.70	13.5	71.0
	8/14/2020	19.0 J	5.40	11.0	0.50 U	5.30	13.0	75.0
	2/22/2021	12.0 U	4.40	11.0	0.50 U	5.50	12.0	60.0
	8/20/2021	50.0 U	5.40	11.0	0.09 J	5.50	13.0	66.0
	1/26/2022	39.0	4.60	9.10	0.054 [8]	5.40	9.60	30.0
8/11/2022	8.60 J	4.90	9.90	0.054 [8]	5.00	12.0	56.0	

TABLE 7
APPENDIX III STATISTICALLY SIGNIFICANT INCREASES (SSIs)
FEDERAL CCR RULE - 2022 ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT

Brandywine Ash Management Facility, Phase II - MD

Analyte:		Boron	Calcium	Chloride	Fluoride	pH	Sulfate	TDS
		µg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L
Background UPL:		1,494	59.6	233	0.47	4.87 - 8.40	654	1,247
B27	5/1/2018	665	53.9	23.4	0.50 U	7.00	74.1	419
	8/2/2018	547	41.4	13.4	0.50 U	7.10	53.7	306
	2/7/2019	261	26.8	5.80	0.50 U	6.90	44.1	197
	8/22/2019	593	98.7 [4]	35.2	0.50 U	7.00	285	824
	2/11/2020	545	55.4	17.2	0.50 U	7.00	100	430
	8/14/2020	520	53.0	14.0	0.50 U	7.40	46.0	430
	2/22/2021	420	43.0	8.90	0.50 U	7.10	38.0	330
	8/20/2021	570	50.0	17.0	0.07 J	7.20	69.0	380
	1/26/2022	560	37.0	10.0	0.10 U	7.20	40.0	260
8/11/2022	450	38.0	9.80	0.10 U	6.80	34.0	320	
Background UPL:		4,011	213	32.9 [2]	2.21	2.90 - 5.87	779	2,559
B37	5/1/2018	1,430	90.2	6.50	0.61	5.00	422	964
	8/3/2018	899	56.1	-52.1	0.39 J	5.20	197	512
	2/8/2019	1,400	77.4	-44.3	0.50 U	4.70	437	802
	8/22/2019	2,020	104	19.2	1.20	4.20	672	1,240
	2/10/2020	1,890	109	-56.1	1.50	4.50	938 [6]	1,240
	5/11/2020	NS	NS	NS	NS	NS	684 [7]	NS
	8/14/2020	1,500	88.0	-33.2	0.73	5.00	560	900
	2/23/2021	740	44.0	-128.6	0.54	5.30	260	550
	8/19/2021	1,700	94.0	-111.2	0.72	4.80	540	1,000
	1/27/2022	2,200	120	120	1.60	4.70	950 [6]	1,400
5/17/2022	NS	NS	NS	NS	NS	650 [7]	NS	
8/12/2022	2,000	120	120	1.20	4.20	770	1,500	
Background UPL:		27,194	566	810	1.04	4.08 - 9.01	2,540	5,185
B38	5/1/2018	14,000	421	248	0.50 J	6.40	2,390	3,260
	8/3/2018	14,400	341	225	0.50 J	6.80	2,360	3,270
	2/8/2019	15,000	351	284	0.50 U	6.10	2,210	3,690
	8/22/2019	18,700	429	224	0.50 U	6.10	2,150	3,180
	2/7/2020	16,500	339	223	0.50 U	6.20	2,590 [6]	3,620
	5/11/2020	NS	NS	NS	NS	NS	2,340 [7]	NS
	8/13/2020	17,000	360	350	0.50 U	6.70	2,300	3,600
	2/23/2021	16,000	320	180	0.76	6.50	2,200	3,500
	8/19/2021	17,000	340	220	0.35	6.70	2,400	3,800
	1/27/2022	13,000	300	310	1.20 [4]	5.30	2,200	3,300
8/12/2022	12,000	300	340	1.40 [4]	4.50	2,400	930	

TABLE 7
APPENDIX III STATISTICALLY SIGNIFICANT INCREASES (SSIs)
FEDERAL CCR RULE - 2022 ANNUAL GROUNDWATER AND CORRECTIVE ACTION REPORT

Brandywine Ash Management Facility, Phase II - MD

Analyte:		Boron	Calcium	Chloride	Fluoride	pH	Sulfate	TDS
		µg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L
Background UPL:		1,346 [2]	188	59.8 [2]	2.87	2.01 - 4.20	184 [2]	364 [2]
B39	5/1/2018	-1,114	107	-88.4	0.50 U	3.10 J	-393	288
	5/1/2018 [1]	-1,044	105	-78.4	0.50 U	3.20 J	-393	-252
	8/3/2018	-2,497	60.3	-275	0.50 U	2.70 J	-470	-1,047
	2/8/2019	-3,477	76.0	-207	0.50 U	3.10 J	-1,024	-957
	8/23/2019	-1,606	96.1	-166	0.50 U	3.10 J	-644	-231
	2/11/2020	-4,065	113	-196	0.50 U	3.20 J	-614	-902
	8/17/2020	-5,900	70.0	-402	0.50 U	3.20 J	-1,328	-1,141
	2/23/2021	-6,494	80.0	-386	0.43 J	3.10	-1,483	-1,252
	8/25/2021	-3,459	81.0	-318	0.51	3.10	-1,632	-159
	1/28/2022	-7,811	84.0	-404	0.68	3.10	-1,460	-850
8/9/2022	-8,518	77.0	-458	0.31 J	3.10	-1,417	-163	

Notes:

Bold Concentration is a statistically significant increase (SSI) over background during the most recent sampling event.

Bold Concentration is a statistically significant increase (SSI) over background.

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.

J+ Constituent detected below reporting limit; result is an estimated value with a high bias.

U Constituent not detected above method detection limit; result shown as the reporting limit.

NS Not sampled.

[1] Duplicate sample collected.

[2] For datasets that exhibited upward trends, the background value is the Upper Prediction Limit (UPL) for the residuals of the background dataset. To identify SSIs, the UPLs are compared to the residuals of the detection monitoring results based on the linear regression for the background dataset. In some cases, the values are negative and indicate a decrease.

[3] Fluoride at wells B15S, B16, and B26 follows the Double Quantification Rule (DQR).

[4] Alternate Source Demonstration successful.

[5] For nonparametric pH distributions, the nonparametric prediction limits are the minimum and maximum background concentration (Unified Guidance, 2009, p. 18.16).

[6] SSI detected, however verification resample disconfirms the result.

[7] Well-constituent pair was resampled and SSI was not verified.

[8] The Double Quantification Rule (DQR) is used for background data sets with no detections. In Fall 2021, a new analytical laboratory was contracted for these analyses. The new laboratory's equipment uses a lower detection limit than the previous analytical laboratory. A new background concentration will be established once a sufficient data set is analyzed under the lower detection limits. Until that time, any detection below the existing DQR Reporting Limit, established at 0.5 mg/L for fluoride, should not be considered an SSI.

[9] The value is suspected to be erroneous because it is inconsistent with historical values

APPENDIX A
Groundwater Flow Velocity Calculation

Appendix A

Groundwater Velocity Calculation

Brandywine Ash Management Facility Phase II

Brandywine, Maryland

1. Governing Equation

Groundwater flow velocity at the Site was calculated between several monitoring wells around Phase II. 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 slug tests (cm per second)

η = Effective porosity % (unitless)

Δh = Change in groundwater elevation between two points (ft)

Δl = Distance between two points (ft)

This equation is for Darcy flow through porous media.

2. Hydraulic Conductivity Estimated

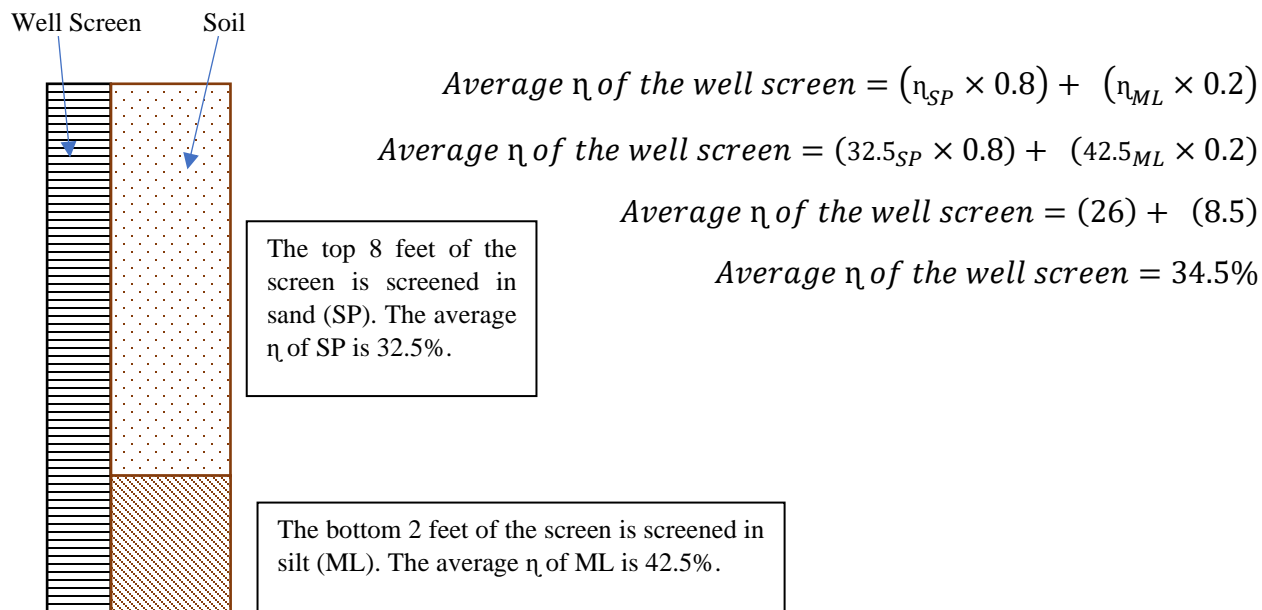
Hydraulic conductivity (K) was calculated at select monitoring wells around Phase II. Monitoring wells B15S, B16, B26, B27, and B28 were slug tested at least two times (rising and falling head tests). The location of the slug tested wells are shown on **Figure 3**. The K value for each slug test at a given well was averaged, which generated an average K for each monitoring well. 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 in **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 monitoring well screen.

EXAMPLE POROSITY ESTIMATION FOR WELL SCREEN



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 then 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 Phase II were selected. Ideally, monitoring wells should be along a groundwater flow path. Based on that requirement, the groundwater velocity was calculated between B16 to B27, B16 to B28, B26 to B27, and B26 to B28. See **Figure 3** through **Figure 5** for the selected well locations relative to groundwater flow.

5. Groundwater Velocity

Groundwater velocity around Phase II ranged from 1.41×10^{-4} centimeters per second (cm/sec) (146 feet/year) between monitoring wells B16 and B28 to 4.46×10^{-6} cm/sec (4.62 feet/year) between monitoring wells B26 and B27. The average groundwater velocity around Phase II was calculated at 2.65×10^{-5} cm/sec (28.33 feet/year). **Table A-2** of **Appendix A** presents the calculated groundwater velocities. Therefore, to be considered independent samples, groundwater monitoring events should be at least two (2) weeks apart for groundwater to completely travel through the 8-inch diameter borehole.

APPENDIX A
TABLE A-1
Groundwater Flow Velocity Variables

Brandywine CCR Management Facility Phase II
Brandywine, 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)

Upgradient Well	Downgradient Well	Δl (ft)	Δh (ft)
B16	B27	1,315	10.04
B16	B28	1,270	32.55
B26	B27	1,172.5	10.97
B26	B28	1,612.5	33.5

Well ID:	Average Hydraulic Conductivity (K) (cm/sec) [1]
B16	2.81E-03
B26	5.50E-06
B27	3.85E-04
B28	8.17E-04

Well Location	Soil Observed in the Screen	Average η of Screen
B16	(SP/GP) (75%),(SP/ML) (25%)	24.5
B26	ML 100%	42.5
B27	ML/SP 50% and CL/SP 50%	39.4
B28	SP/CL 100%	41.3

Sediment Size	Effective Porosity % (η)	Average η [2]
Clay (CL)	45-55	50
Silt (ML)	35-50	42.5
Sand (SP)	25-40	32.5
Gravel (GP)	25-40	32.5
Sand and Gravel (SP/GP)	10-35	22.5

Notes:

ft - feet

cm/sec - centimeters per second

[1] Average hydraulic conductivity is an average result of the falling and rising head slug tests.

[2] Average effective porosity is an average of the published effective porosities for each soil type.

[3] Δh values were calculated from groundwater elevation measurements collected on 20 August 2019.

APPENDIX A
TABLE A-2
Groundwater Flow Velocity Calculation

Brandywine CCR Management Facility Phase II
Brandywine, Maryland

Upgradient Well	Downgradient Well	Hydraulic Conductivity (K) (cm/sec)	Average Porosity of Screen Interval (%)	DTW (ft btoic) [1]	TOC Elevation	Groundwater Elevation (ft-msl)	Average K (cm/sec) [2]	Average η	Δh (ft)	Δl (ft)	$\Delta h/\Delta l$	Linear Velocity (cm/sec)	Linear Velocity (feet/year)
B16	NA	2.81E-03	24.5	32.10	236.11	204.01	NA	NA	NA	NA	NA	NA	NA
B16	B27	3.85E-04	39.4	20.80	214.77	193.97	1.60E-03	0.3195	10.04	1,315	0.0076	3.82E-05	39.50
B16	B28	8.17E-04	41.3	8.32	179.78	171.46	1.81E-03	0.329	32.55	1,270	0.0256	1.41E-04	146.17

Upgradient Well	Downgradient Well	Hydraulic Conductivity (K) (cm/sec)	Average Porosity of Screen Interval (%)	DTW (ft btoic)	TOC Elevation	Groundwater Elevation (ft-msl)	Average K (cm/sec) [1]	Average η	Δh (ft)	Δl (ft)	$\Delta h/\Delta l$	Linear Velocity (cm/sec)	Linear Velocity (feet/year)
B26	NA	5.50E-06	42.5	13.47	218.41	204.94	NA	NA	NA	NA	NA	NA	NA
B26	B27	3.85E-04	39.4	20.80	214.77	193.97	1.95E-04	0.4095	10.97	1,173	0.0094	4.46E-06	4.62
B26	B28	8.17E-04	41.3	8.32	179.78	171.46	4.11E-04	0.419	33.5	1,613	0.0208	2.04E-05	21.08

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] Groundwater flow velocities were calculated from groundwater elevation measurements collected on 11 August 2020.

[2] Average hydraulic conductivity is the average hydraulic conductivities between B16 or B26 and identified well.

Groundwater Velocity Mean	2.65E-05 cm/sec	27.38 feet/year
Groundwater Velocity Median	2.93E-05 cm/sec	30.29 feet/year

APPENDIX B
Alternate Source Demonstration – June 2022

17 June 2022

Mr. James Spence
GenOn MD Ash Management LLC
c/o Chalk Point Generating Station
25100 Chalk Point Road
Aquasco, Maryland 20608

**Subject: Alternative Source Demonstration
Groundwater Detection Monitoring Program, Federal CCR Rule
Brandywine Ash Management Facility – Phase II, Brandywine, Maryland**

Dear Mr. Spence:

Geosyntec Consultants, Inc. (Geosyntec) has completed statistical testing for potential statistically significant increases (SSIs) over background concentrations in downgradient compliance monitoring wells at the Brandywine Ash Management Facility Phase II (the Site) located in Brandywine, Maryland pursuant to the Federal Coal Combustion Residuals (CCR) Rule. **Table 1** (attached) shows one potential SSI detected for fluoride during the tenth Detection Monitoring Program event (January 2022) at compliance monitoring well B38. The location of the compliance and background monitoring wells at the Site are shown in **Figure 1**. This Alternative Source Demonstration (ASD) has been prepared in accordance with 40 CFR 257.94(e)(2) and demonstrates that the detected fluoride SSI at compliance well B38 is not indicative of a leachate release from the Phase II CCR unit and that the unit can remain in the Detection Monitoring Program.

As shown in **Table 1**, background concentrations of 2.21 mg/L and 1.04 mg/L have been established for fluoride at monitoring wells B37 and B38, respectively. B37 and B38 are adjacent wells located in the site access road between the Phase I and Phase II areas of the site. A previous ASD (Geosyntec, 2018) showed that boron, calcium, chloride, pH, sulfate, and TDS detected in these two wells are not attributed to a release from the regulated Phase II unit. Monitoring well B37, located adjacent to B38 has a fluoride background concentration of 2.21 mg/L, which is more than double the concentration detected at B38 during the January 2022 monitoring event. Therefore, the fluoride concentration of 1.20 mg/L detected in the January 2022 sample from B38 is likely derived from Phase I leachate. No additional SSIs were detected for other Appendix III indicator constituents during these two monitoring events at any of the compliance wells.

It should be noted that, prior to commencing the ninth monitoring event, the analytical laboratory was changed, and the new analytical laboratory used a lower method detection limit (MDL) and reporting limit (RL) for fluoride analysis. Subsequent fluoride detections at concentrations below

the former laboratory's RL should not be considered to be SSIs under the Double Quantification Rule.

In summary, this ASD shows that the SSI detected for fluoride in groundwater samples collected during the January 2022 Detection Monitoring Program event at monitoring well B38 is not due to a release of CCR leachate from the Phase II CCR unit and is due to natural variations in groundwater quality and influence from the Phase I area. Therefore, the site should remain in the Detection Monitoring Program.

If you have any questions regarding this letter or the approach it describes, please do not hesitate to contact the undersigned at 410.381.4333.

Very truly yours,



Mark Bauer
Senior Geologist



Robert M. Glazier
Senior Principal

Attachments:

Certification
Table 1 – Appendix III Statistically Significant Increases (SSIs)
Figure 1 – Groundwater Monitoring Well Network

cc: Steve Frank, GenOn
Michelle Desperes, GenOn

Certification

I, **Stephanie J. Cushing**, a qualified professional engineer registered in the state of **Maryland**, verify the accuracy of the information in the *Alternate Source Demonstration Report for the Brandywine Ash Management Facility Phase II Unit* based on my review and understanding of the requirements of 40 CFR 257.94(e)(2).

Printed Name: Stephanie J. Cushing

PE License Number: 53570 State: Maryland

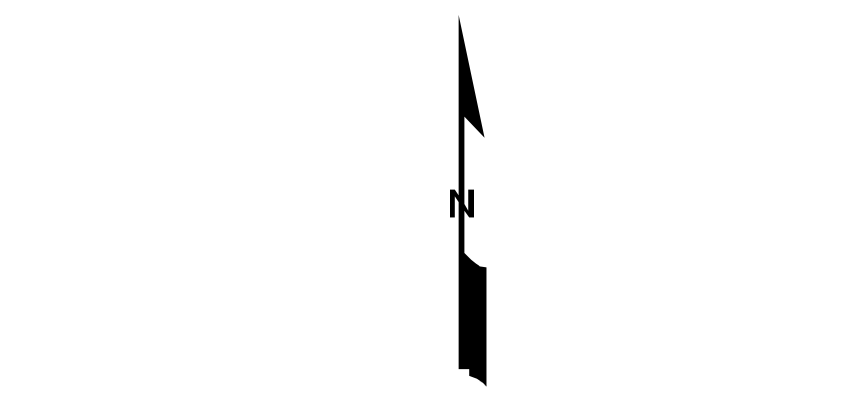
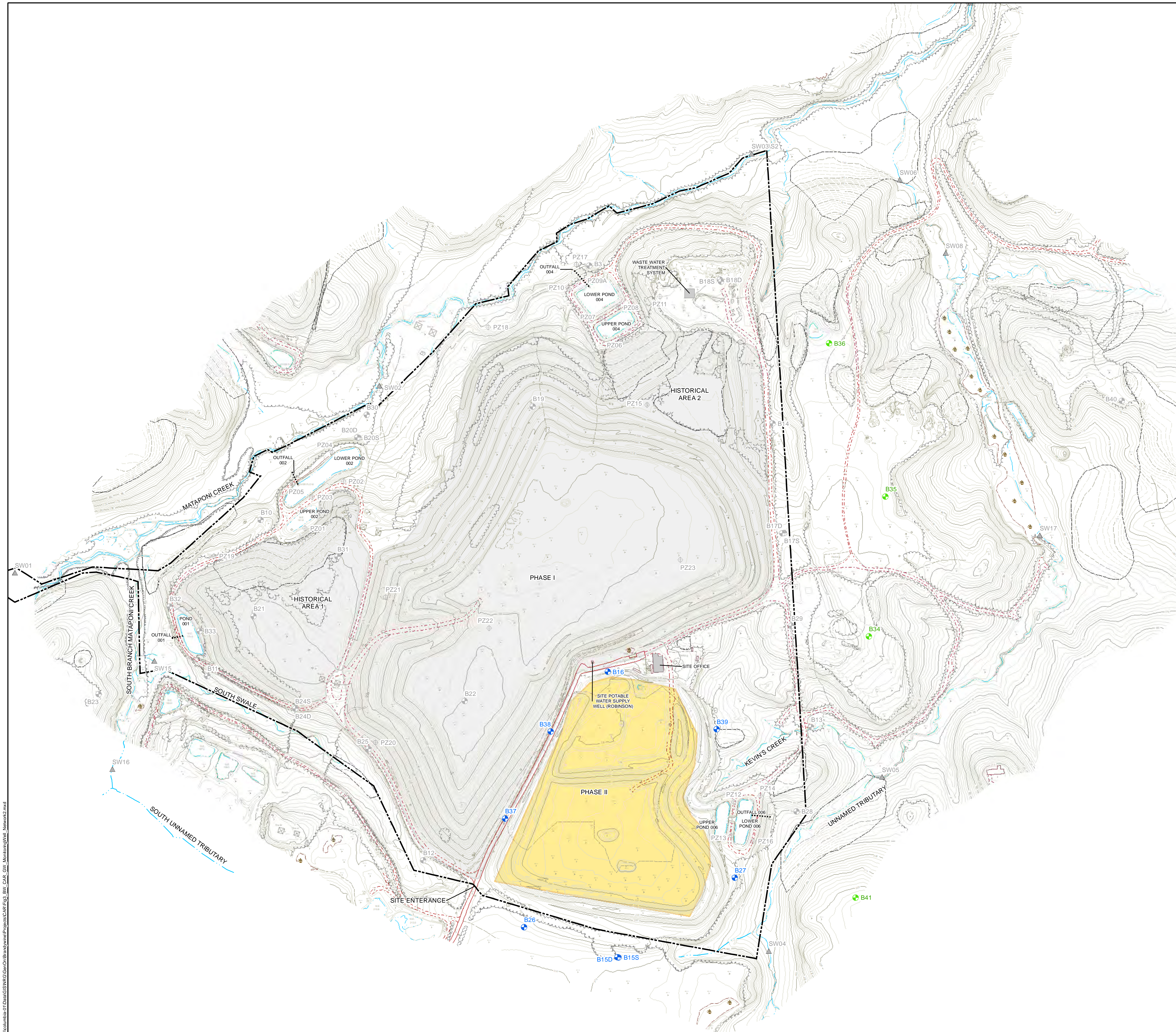
Signature: 

Date: 06/17/2022

Seal:

Stamp:







- Legend**
- PROPERTY BOUNDARY
 - WET
 - GRADE CONTOUR (FEET, MSL)
 - TREE LINE
 - WATER / CHANNEL LINE
 - PAVED / UNPAVED ROAD
 - UNPAVED ROAD
 - NPDES OUTFALL
 - EXISTING PIEZOMETER
 - MONITORING WELL USED FOR WATER LEVELS ONLY
 - BACKGROUND MONITORING WELL
 - COMPLIANCE MONITORING WELL
 - SURFACE WATER STATION
 - CCB MANAGEMENT UNITS NOT REGULATED UNDER THE CCR RULE (APPROXIMATE LIMITS)
 - CCB MANAGEMENT UNITS REGULATED UNDER THE CCR RULE (APPROXIMATE LIMITS)

- NOTES:**
- EXISTING CONDITIONS FROM GROUND CONTROL SURVEY DATED 28 DECEMBER 2013 BY L. ROBERT KIMBALL INC. AND FROM AERIAL PHOTOGRAPHY DATED 13 DECEMBER 2012 BY AIR PHOTOGRAPHICS INC.
 - HORIZONTAL CONTROL IS BASED ON NAD83 MARYLAND STATE PLANE DATUM; VERTICAL CONTROL IS BASED ON NAVD88 DATUM.
 - PROPERTY BOUNDARIES ACCESSED VIA TOWSON UNIVERSITY'S ARCGIS SERVER AT [HTTP://MDIMAP.TOWSON.EDU/ARCGIS/SERVICES](http://mdimap.towson.edu/arcgis/services) ON 26 AUGUST 2014.
 - GROUND SURFACE SURVEY PERFORMED BY BEN DYER AND ASSOCIATES, INC. WEEK OF 19 OCTOBER 2015.



REV	DATE	DESCRIPTION	DRN	APP
 				
TITLE: GROUNDWATER MONITORING WELL NETWORK				
PROJECT: 2022 ALTERNATIVE SOURCE DEMONSTRATION FEDERAL CCR RULE				
SITE: BRANDYWINE ASH MANAGEMENT FACILITY BRANDYWINE, MARYLAND				
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.		DESIGN BY: BNM		DATE: JUNE 2022
NOT FOR CONSTRUCTION		DRAWN BY: BNM		PROJECT NO.: MEM0822K
SIGNATURE _____		CHECKED BY: KWH		FILE: Fig. BW_CAR_GW_MonitoringWell_Network2
DATE _____		REVIEWED BY: MB		FIGURE NO.: 1
		APPROVED BY: RMG		

I:\columbia-01\Drawings\NRG\GenOn\Brandywine\Project\CAR\Fig3_BW_CAR_GW_MonitoringWell_Network2.mxd

**TABLE 1
APPENDIX III STATISTICALLY SIGNIFICANT INCREASES (SSIs)
FEDERAL CCR RULE**

Brandywine Ash Management Facility, Phase II - MD

Analyte:		Boron	Calcium	Chloride	Fluoride	pH	Sulfate	TDS
		µg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L
Well ID	Background UPL:	43.4	5.58	12.4	DQR [3]	3.84 - 6.71	41.7	121
B15S	5/2/2018	14.1 J	1.84	5.4	0.50 U	5.50	16.7	59.5 J
	5/2/2018 [1]	14.5 J	1.81	5.5	0.50 U	5.50	16.8	68.0
	8/1/2018	36.4 J	1.60	4.8	0.31 J	5.70	15.0	60.5
	2/6/2019	13.6 J	2.18	3.6	0.50 U	5.70	30.2	77.0
	8/23/2019	18.9	1.17	3.8	0.50 U	6.00	9.1	44.0
	2/10/2020	17.7 J	2.34	2.1	0.50 U	6.70	19.2	139.0 [6]
	5/11/2020	NS	NS	NS	NS	NS	NS	96.5 [7]
	8/12/2020	25.0 J	2.50	4.0	0.53	5.70	27.0 J	90.0
	8/12/20 [1]	25.0 J	2.50	2.7	0.50 U	5.70	27.0	93.0
	2/22/2021	12.0 U	2.30	2.3	0.50 U	5.50	37.0	81.0
	2/22/2021 [1]	12.0 U	2.10	2.3	0.50 U	5.80	35.0	81.0
8/20/2021	21.0 J	1.40	2.0	0.055 J	5.80	15.0	52.0	
1/27/2022	18.0 J	1.90	2.3	0.034 J	5.70	14.0	60.0	
Background UPL:		59,057	497	2,950	DQR [3]	5.76 - 7.48	791 [2]	16,227
B16	4/30/2018	58,200	426	1,870	0.50 U	6.70	1,032 [4]	13,400
	7/31/2018	53,500	385	1,850	0.50 U	6.90	1,997 [4]	13,400
	2/11/2019	56,100	307	1,850	0.50 U	7.30	207	13,500
	8/22/2019	40,900	199	1,380	0.50 U	7.20	-1,709	10,900
	2/7/2020	41,800	206	1,450	0.50 U	7.40	-1,161	11,000
	2/7/2020 [1]	42,100	218	1,380	0.50 U	7.30	-1,461	11,200
	8/13/2020	43,000	270	1,900 J	0.50 U	7.00	-816	11,000
	2/17/2021	39,000	250	1,300	0.57	7.00	-2,456	11,000
	8/20/2021	40,000	270	1,300 J+	0.18 J+	7.20	-2,586	9,800
	1/26/2022	24,000	180	1,000	1.70 J	6.90	-3,371	5,100
1/26/2022 [1]	24,000	180	1,100	1.70 J	6.90	-2,571	4,900	
Background UPL:		124	11.7	20.6	DQR [3]	4.20 - 5.90 [5]	62.9	213
B26	5/1/2018	22.3 J	4.45	10.0	0.50 U	5.20	12.1	67.5
	8/1/2018	18.6 J	4.85	9.9	0.50 U	5.20	13.4	59.0 J
	2/6/2019	12.0 U	4.62	9.4	0.50 U	5.50	13.4	69.0
	8/23/2019	31.7 J	4.97	8.8	0.50 U	5.30	12.3	55.0
	2/10/2020	12.0 U	4.77	10.4	0.50 U	5.70	13.5	71.0
	8/14/2020	19.0 J	5.40	11.0	0.50 U	5.30	13.0	75.0
	2/22/2021	12.0 U	4.40	11.0	0.50 U	5.50	12.0	60.0
	8/20/2021	50.0 U	5.40	11.0	0.09 J	5.50	13.0	66.0
	1/26/2022	39.0	4.60	9.1	0.054	5.40	9.6	30.0
Background UPL:		1,494	59.6	233	0.47	4.87 - 8.40	654	1,247
B27	5/1/2018	665	53.9	23.4	0.50 U	7.00	74.1	419
	8/2/2018	547	41.4	13.4	0.50 U	7.10	53.7	306
	2/7/2019	261	26.8	5.8	0.50 U	6.90	44.1	197
	8/22/2019	593	98.7 [4]	35.2	0.50 U	7.00	285	824
	2/11/2020	545	55.4	17.2	0.50 U	7.00	100	430
	8/14/2020	520	53.0	14.0	0.50 U	7.40	46.0	430
	2/22/2021	420	43.0	8.9	0.50 U	7.10	38.0	330
	8/20/2021	570	50.0	17.0	0.072 J	7.20	69.0	380
1/26/2022	560	37.0	10.0	0.10 U	7.20	40.0	260	

TABLE 1
APPENDIX III STATISTICALLY SIGNIFICANT INCREASES (SSIs)
FEDERAL CCR RULE

Brandywine Ash Management Facility, Phase II - MD

Analyte:		Boron	Calcium	Chloride	Fluoride	pH	Sulfate	TDS
		µg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L
Background UPL:		4,011	213	32.9 [2]	2.21	2.90 - 5.87	779	2,559
B37	5/1/2018	1,430	90.2	6.5	0.61	5.00	422	964
	8/3/2018	899	56.1	-52.1	0.39 J	5.20	197	512
	2/8/2019	1,400	77.4	-44.3	0.50 U	4.70	437	802
	8/22/2019	2,020	104	19.2	1.20	4.20	672	1,240
	2/10/2020	1,890	109	-56.1	1.50	4.50	938 [6]	1,240
	5/11/2020	NS	NS	NS	NS	NS	684 [7]	NS
	8/14/2020	1,500	88.0	-33.2	0.73	5.00	560	900
	2/23/2021	740	44.0	-129	0.54	5.30	260	550
	8/19/2021	1,700	94.0	-111	0.72	4.80	540	1,000
	1/27/2022	2,200	120	-119	1.60	4.70	950 [6]	1,400
5/9/2022	NS	NS	NS	NS	NS	650 [7]	NS	
Background UPL:		27,194	566	810	1.04	4.08 - 9.01	2,540	5,185
B38	5/1/2018	14,000	421	248	0.50 J	6.40	2,390	3,260
	8/3/2018	14,400	341	225	0.50 J	6.80	2,360	3,270
	2/8/2019	15,000	351	284	0.50 U	6.10	2,210	3,690
	8/22/2019	18,700	429	224	0.50 U	6.10	2,150	3,180
	2/7/2020	16,500	339	223	0.50 U	6.20	2,590 [6]	3,620
	5/11/2020	NS	NS	NS	NS	NS	2,340 [7]	NS
	8/13/2020	17,000	360	350	0.50 U	6.70	2,300	3,600
	2/23/2021	16,000	320	180	0.76	6.50	2,200	3,500
	8/19/2021	17,000	340	220	0.35	6.70	2,400	3,800
	1/27/2022	13,000	300	310	1.20 [4]	5.30	2,200	3,300
Background UPL:		1,346 [2]	188	59.8 [2]	2.87	2.01 - 4.20	184 [2]	364 [2]
B39	5/1/2018	-1,114	107	-88.4	0.50 U	3.10 J	-393	288
	5/1/2018 [1]	-1,044	105	-78.4	0.50 U	3.20 J	-393	-252
	8/3/2018	-2,497	60.3	-275	0.50 U	2.70 J	-470	-1,047
	2/8/2019	-3,477	76.0	-207	0.50 U	3.10 J	-1,024	-957
	8/23/2019	-1,606	96.1	-166	0.50 U	3.10 J	-644	-231
	2/11/2020	-4,065	113	-196	0.50 U	3.20 J	-614	-902
	8/17/2020	-5,900	70.0	-402	0.50 U	3.20 J	-1,328	-1,141
	2/23/2021	-6,494	80.0	-386	0.43 J	3.10	-1,483	-1,252
	8/25/2021	-3,459	81.0	-318	0.51	3.10	-1,632	-159
	1/28/2022	-7,811	84.0	-404	0.68	3.10	-1,460	-850

Notes:

- Bold** Concentration is a statistically significant increase (SSI) over background during the most recent sampling event.
- Bold** Concentration is a statistically significant increase (SSI) over background.
- 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.
- J+ Constituent detected below reporting limit; result is an estimated value with a high bias.
- U Constituent not detected above method detection limit; result shown as the reporting limit.
- NS Not sampled.
- [1] Duplicate sample collected.
- [2] For datasets that exhibited upward trends, the background value is the Upper Prediction Limit (UPL) for the residuals of the background dataset collected from August 2015 to October 2017. To identify SSIs, the UPLs are compared to the residuals of the detection monitoring results based on the linear regression for the background dataset. In some cases, the values are negative and indicate a decrease.
- [3] Fluoride at wells B15S, B16, and B26 follows the Double Quantification Rule (DQR). A confirmed exceedance is registered if any well-constituent pair in the '100% non-detect' group exhibits quantified measurements (i.e., at or above the reporting limit [RL]) in two consecutive sample and resample events. (Unified Guidance, 2009 p.6.11)
- [4] Alternate Source Demonstration successful.
- [5] For nonparametric pH distributions, the nonparametric prediction limits are the minimum and maximum background concentration (Unified Guidance, 2009, p. 18.16).
- [6] SSI detected, however verification resample disconfirms the result.
- [7] Well-constituent pair was resampled and SSI was not verified.

APPENDIX C
Alternate Source Demonstration
– December 2022

16 January 2023

Mr. James Spence
GenOn MD Ash Management LLC
c/o Chalk Point Generating Station
25100 Chalk Point Road
Aquasco, Maryland 20608

**Subject: Alternative Source Demonstration
Groundwater Detection Monitoring Program, Federal CCR Rule
Brandywine Ash Management Facility – Phase II, Brandywine, Maryland**

Dear Mr. Spence:

Geosyntec Consultants, Inc. (Geosyntec) has completed statistical testing for potential statistically significant increases (SSIs) over background concentrations in downgradient compliance monitoring wells at the Brandywine Ash Management Facility Phase II (the Site) located in Brandywine, Maryland pursuant to the Federal Coal Combustion Residuals (CCR) Rule. **Table 1** (attached) shows one potential SSI detected for fluoride during the tenth Detection Monitoring Program event (August 2022) at compliance monitoring well B38. The location of the compliance and background monitoring wells at the Site are shown in **Figure 1**. This Alternative Source Demonstration (ASD) has been prepared in accordance with 40 CFR 257.94(e)(2) and demonstrates that the detected fluoride SSI at compliance well B38 is not indicative of a leachate release from the Phase II CCR unit and that the unit can remain in the Detection Monitoring Program.

As shown in **Table 1**, background concentrations of 2.21 mg/L and 1.04 mg/L have been established for fluoride at monitoring wells B37 and B38, respectively. B37 and B38 are adjacent wells located in the site access road between the Phase I and Phase II areas of the Site. A 2018 ASD¹ showed that boron, calcium, chloride, pH, sulfate, and TDS detected in these two wells are not attributed to a release from the regulated Phase II unit. Additionally, a 2022 ASD² showed that fluoride detected in B38 in January 2022 is not attributed to a release from the regulated Phase II unit. Monitoring well B37, located adjacent to B38 has a fluoride background concentration of 2.21 mg/L, which is nearly double the concentration detected at B38 during the August 2022 monitoring event. Therefore, the fluoride concentration of 1.40 mg/L detected in the August 2022

¹ Geosyntec Consultants, Inc., 2018. Alternate Source Demonstration Report – Federal CCR Rule, Brandywine Ash Management Facility, Phase II, Brandywine, MD

² Geosyntec Consultants, Inc., 2022. Alternate Source Demonstration Report – Federal CCR Rule, Brandywine Ash Management Facility, Phase II, Brandywine, MD

sample from B38 is likely derived from Phase I leachate. Phase I was covered with a geosynthetic cap system. Construction of the geosynthetic cap was completed in April 2018. The geosynthetic cap consists of (from bottom to top): (i) a 40-mil high-density polyethylene (HDPE) geomembrane; (ii) a 200-mil geocomposite drainage layer; and (iii) a two-foot-thick vegetated earthen cover, as specified in Maryland Department of the Environment, Code of Maryland Regulations 26.04.07.21.H. No additional SSIs were detected for other Appendix III indicator constituents during these two monitoring events at any of the compliance wells.

It should be noted that, prior to commencing the ninth Detection Monitoring Program event in August 2021, the analytical laboratory was changed, and the new analytical laboratory used a lower method detection limit (MDL) and reporting limit (RL) for fluoride analysis. Subsequent fluoride detections at concentrations below the former laboratory's RL should not be considered to be SSIs under the Double Quantification Rule.

In summary, this ASD shows that the SSI detected for fluoride in groundwater samples collected during the August 2022 Detection Monitoring Program event at monitoring well B38 in is not due to a release of CCR leachate from the Phase II CCR unit and is due to natural variations in groundwater quality and influence from the Phase I area. Therefore, the Site should remain in the Detection Monitoring Program.

If you have any questions regarding this letter or the approach it describes, please do not hesitate to contact the undersigned at 410.381.4333.

Very truly yours,



Ted Wilson
Professional Scientist



Robert M. Glazier
Senior Principal

Attachments:

Certification
Table 1 – Appendix III Statistically Significant Increases (SSIs)
Figure 1 – Groundwater Monitoring Well Network

cc: Steve Frank, GenOn
Michelle Desperes, GenOn

Certification

I, **Stephanie J. Cushing**, a qualified professional engineer registered in the state of **Maryland**, verify the accuracy of the information in the *Alternate Source Demonstration Report for the Brandywine Ash Management Facility Phase II Unit* based on my review and understanding of the requirements of 40 CFR 257.94(e)(2).

Printed Name: Stephanie J. Cushing

PE License Number: 53570 State: Maryland

Signature: 

Date: 1/16/2023

Seal:

Stamp:



**TABLE 1
APPENDIX III STATISTICALLY SIGNIFICANT INCREASES (SSIs)
FEDERAL CCR RULE**

Brandywine Ash Management Facility, Phase II - MD

Analyte:		Boron	Calcium	Chloride	Fluoride	pH	Sulfate	TDS
		µg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L
Well ID	Background UPL:	43.4	5.58	12.4	DQR [3]	3.84 - 6.71	41.7	121
B15S	5/2/2018	14.1 J	1.84	5.40	0.50 U	5.50	16.7	59.5 J
	5/2/2018 [1]	14.5 J	1.81	5.50	0.50 U	5.50	16.8	68.0
	8/1/2018	36.4 J	1.60	4.80	0.31 J	5.70	15.0	60.5
	2/6/2019	13.6 J	2.18	3.60	0.50 U	5.70	30.2	77.0
	8/23/2019	18.9	1.17	3.80	0.50 U	6.00	9.10	44.0
	2/10/2020	17.7 J	2.34	2.10	0.50 U	6.70	19.2	139 [6]
	5/11/2020	NS	NS	NS	NS	NS	NS	96.5 [7]
	8/12/2020	25.0 J	2.50	4.00	0.53	5.70	27.0 J	90.0
	8/12/20 [1]	25.0 J	2.50	2.70	0.50 U	5.70	27.0	93.0
	2/22/2021	12.0 U	2.30	2.30	0.50 U	5.50	37.0	81.0
	2/22/2021 [1]	12.0 U	2.10	2.30	0.50 U	5.80	35.0	81.0
	8/20/2021	21.0 J	1.40	2.00	0.06 J	5.80	15.0	52.0
1/27/2022	18.0 J	1.90	2.30	0.03 J	5.70	14.0	60.0	
8/11/2022	16.0 J	2.30	2.30	0.04 J	5.70	13.0	70.0	
Background UPL:		59,057	497	2,950	DQR	5.76 - 7.48	791 [2]	16,227
B16	4/30/2018	58,200	426	1,870	0.50 U	6.70	1,032 [4]	13,400
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	8/20/2021	40,000	270	1,300 J+	0.18 [4]	7.20	-2,586	9,800
	1/26/2022	24,000	180	1,000	1.70 J	6.90	-3,371	5,100
	1/26/2022 [1]	24,000	180	1,100	1.70 J	6.90	-2,571	4,900
	8/12/2022	17,000	140	1,000	2.50 U	6.70	-5,024	210 [9]
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	2/6/2019	12.0 U	4.62	9.40	0.50 U	5.50	13.4	69.0
	8/23/2019	31.7 J	4.97	8.80	0.50 U	5.30	12.3	55.0
	2/10/2020	12.0 U	4.77	10.4	0.50 U	5.70	13.5	71.0
	8/14/2020	19.0 J	5.40	11.0	0.50 U	5.30	13.0	75.0
	2/22/2021	12.0 U	4.40	11.0	0.50 U	5.50	12.0	60.0
	8/20/2021	50.0 U	5.40	11.0	0.09 J	5.50	13.0	66.0
	1/26/2022	39.0	4.60	9.10	0.054 [8]	5.40	9.60	30.0
	8/11/2022	8.60 J	4.90	9.90	0.054 [8]	5.00	12.0	56.0

**TABLE 1
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FEDERAL CCR RULE**

Brandywine Ash Management Facility, Phase II - MD

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B27	5/1/2018	665	53.9	23.4	0.50 U	7.00	74.1	419
	8/2/2018	547	41.4	13.4	0.50 U	7.10	53.7	306
	2/7/2019	261	26.8	5.80	0.50 U	6.90	44.1	197
	8/22/2019	593	98.7 [4]	35.2	0.50 U	7.00	285	824
	2/11/2020	545	55.4	17.2	0.50 U	7.00	100	430
	8/14/2020	520	53.0	14.0	0.50 U	7.40	46.0	430
	2/22/2021	420	43.0	8.90	0.50 U	7.10	38.0	330
	8/20/2021	570	50.0	17.0	0.07 J	7.20	69.0	380
	1/26/2022	560	37.0	10.0	0.10 U	7.20	40.0	260
8/11/2022	450	38.0	9.80	0.10 U	6.80	34.0	320	
Background UPL:		4,011	213	32.9 [2]	2.21	2.90 - 5.87	779	2,559
B37	5/1/2018	1,430	90.2	6.50	0.61	5.00	422	964
	8/3/2018	899	56.1	-52.1	0.39 J	5.20	197	512
	2/8/2019	1,400	77.4	-44.3	0.50 U	4.70	437	802
	8/22/2019	2,020	104	19.2	1.20	4.20	672	1,240
	2/10/2020	1,890	109	-56.1	1.50	4.50	938 [6]	1,240
	5/11/2020	NS	NS	NS	NS	NS	684 [7]	NS
	8/14/2020	1,500	88.0	-33.2	0.73	5.00	560	900
	2/23/2021	740	44.0	-128.6	0.54	5.30	260	550
	8/19/2021	1,700	94.0	-111.2	0.72	4.80	540	1,000
	1/27/2022	2,200	120	120	1.60	4.70	950 [6]	1,400
5/17/2022	NS	NS	NS	NS	NS	650 [7]	NS	
8/12/2022	2,000	120	120	1.20	4.20	770	1,500	
Background UPL:		27,194	566	810	1.04	4.08 - 9.01	2,540	5,185
B38	5/1/2018	14,000	421	248	0.50 J	6.40	2,390	3,260
	8/3/2018	14,400	341	225	0.50 J	6.80	2,360	3,270
	2/8/2019	15,000	351	284	0.50 U	6.10	2,210	3,690
	8/22/2019	18,700	429	224	0.50 U	6.10	2,150	3,180
	2/7/2020	16,500	339	223	0.50 U	6.20	2,590 [6]	3,620
	5/11/2020	NS	NS	NS	NS	NS	2,340 [7]	NS
	8/13/2020	17,000	360	350	0.50 U	6.70	2,300	3,600
	2/23/2021	16,000	320	180	0.76	6.50	2,200	3,500
	8/19/2021	17,000	340	220	0.35	6.70	2,400	3,800
	1/27/2022	13,000	300	310	1.20 [4]	5.30	2,200	3,300
8/12/2022	12,000	300	340	1.40 [4]	4.50	2,400	930	

TABLE 1
APPENDIX III STATISTICALLY SIGNIFICANT INCREASES (SSIs)
FEDERAL CCR RULE

Brandywine Ash Management Facility, Phase II - MD

Analyte:		Boron	Calcium	Chloride	Fluoride	pH	Sulfate	TDS
		µg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L
Background UPL:		1,346 [2]	188	59.8 [2]	2.87	2.01 - 4.20	184 [2]	364 [2]
B39	5/1/2018	-1,114	107	-88.4	0.50 U	3.10 J	-393	288
	5/1/2018 [1]	-1,044	105	-78.4	0.50 U	3.20 J	-393	-252
	8/3/2018	-2,497	60.3	-275	0.50 U	2.70 J	-470	-1,047
	2/8/2019	-3,477	76.0	-207	0.50 U	3.10 J	-1,024	-957
	8/23/2019	-1,606	96.1	-166	0.50 U	3.10 J	-644	-231
	2/11/2020	-4,065	113	-196	0.50 U	3.20 J	-614	-902
	8/17/2020	-5,900	70.0	-402	0.50 U	3.20 J	-1,328	-1,141
	2/23/2021	-6,494	80.0	-386	0.43 J	3.10	-1,483	-1,252
	8/25/2021	-3,459	81.0	-318	0.51	3.10	-1,632	-159
	1/28/2022	-7,811	84.0	-404	0.68	3.10	-1,460	-850
8/9/2022	-8,518	77.0	-458	0.31 J	3.10	-1,417	-163	

Notes:

Bold Concentration is a statistically significant increase (SSI) over background during the most recent sampling event.

Bold Concentration is a statistically significant increase (SSI) over background.

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.

J+ Constituent detected below reporting limit; result is an estimated value with a high bias.

U Constituent not detected above method detection limit; result shown as the reporting limit.

NS Not sampled.

[1] Duplicate sample collected.

[2] For datasets that exhibited upward trends, the background value is the Upper Prediction Limit (UPL) for the residuals of the background dataset. To identify SSIs, the UPLs are compared to the residuals of the detection monitoring results based on the linear regression for the background dataset. In some cases, the values are negative and indicate a decrease.

[3] Fluoride at wells B15S, B16, and B26 follows the Double Quantification Rule (DQR).

[4] Alternate Source Demonstration successful.

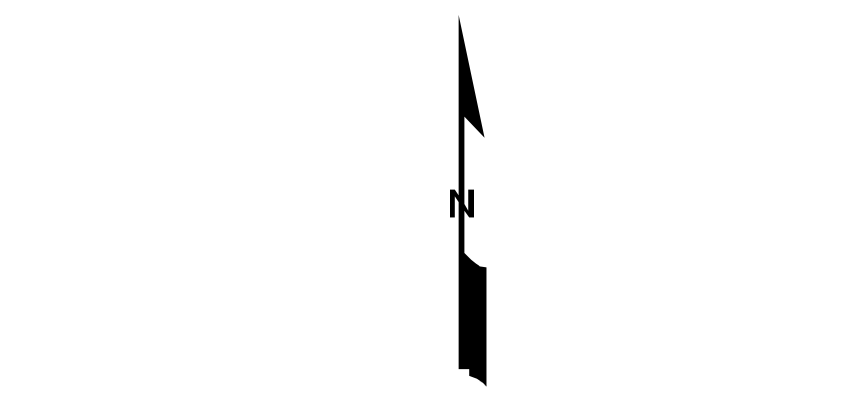
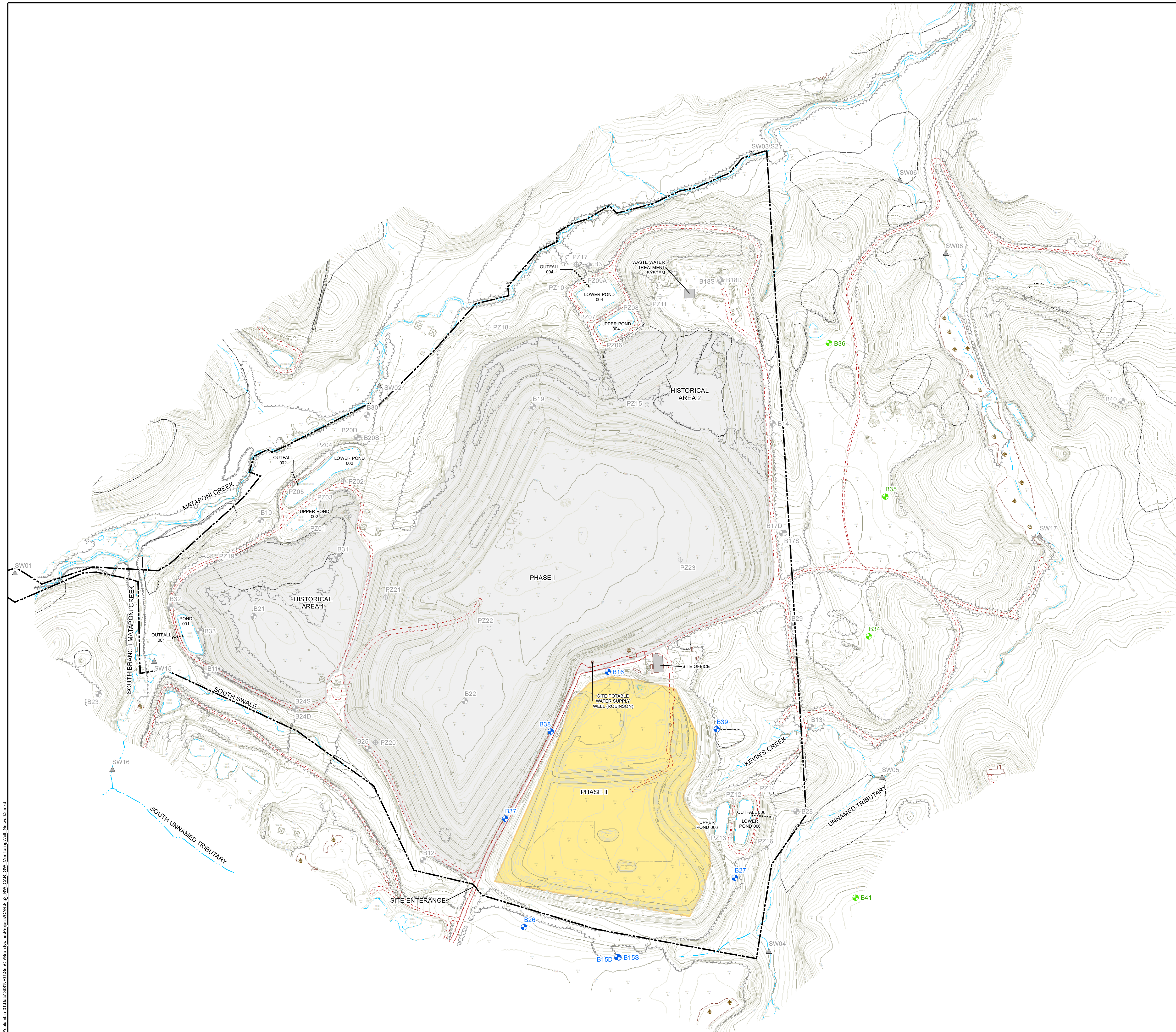
[5] For nonparametric pH distributions, the nonparametric prediction limits are the minimum and maximum background concentration (Unified Guidance, 2009, p. 18.16).

[6] SSI detected, however verification resample disconfirms the result.

[7] Well-constituent pair was resampled and SSI was not verified.

[8] The Double Quantification Rule (DQR) is used for background data sets with no detections. In Fall 2021, a new analytical laboratory was contracted for these analyses. The new laboratory's equipment uses a lower detection limit than the previous analytical laboratory. A new background concentration will be established once a sufficient data set is analyzed under the lower detection limits. Until that time, any detection below the existing DQR Reporting Limit, established at 0.5 mg/L for fluoride, should not be considered an SSI.



[9] The value is suspected to be erroneous because it is inconsistent with historical values



- Legend**
- PROPERTY BOUNDARY
 - WET
 - GRADE CONTOUR (FEET, MSL)
 - TREE LINE
 - WATER / CHANNEL LINE
 - PAVED / UNPAVED ROAD
 - UNPAVED ROAD
 - NPDES OUTFALL
 - EXISTING PIEZOMETER
 - MONITORING WELL USED FOR WATER LEVELS ONLY
 - BACKGROUND MONITORING WELL
 - COMPLIANCE MONITORING WELL
 - SURFACE WATER STATION
 - CCB MANAGEMENT UNITS NOT REGULATED UNDER THE CCR RULE (APPROXIMATE LIMITS)
 - CCB MANAGEMENT UNITS REGULATED UNDER THE CCR RULE (APPROXIMATE LIMITS)

- NOTES:**
- EXISTING CONDITIONS FROM GROUND CONTROL SURVEY DATED 28 DECEMBER 2013 BY L. ROBERT KIMBALL INC. AND FROM AERIAL PHOTOGRAPHY DATED 13 DECEMBER 2012 BY AIR PHOTOGRAPHICS INC.
 - HORIZONTAL CONTROL IS BASED ON NAD83 MARYLAND STATE PLANE DATUM; VERTICAL CONTROL IS BASED ON NAVD88 DATUM.
 - PROPERTY BOUNDARIES ACCESSED VIA TOWSON UNIVERSITY'S ARCGIS SERVER AT [HTTP://MDIMAP.TOWSON.EDU/ARCGIS/SERVICES](http://mdimap.towson.edu/arcgis/services) ON 26 AUGUST 2014.
 - GROUND SURFACE SURVEY PERFORMED BY BEN DYER AND ASSOCIATES, INC. WEEK OF 19 OCTOBER 2015.



REV	DATE	DESCRIPTION	DRN	APP
 				
TITLE: GROUNDWATER MONITORING WELL NETWORK				
PROJECT: 2022 ALTERNATIVE SOURCE DEMONSTRATION FEDERAL CCR RULE				
SITE: BRANDYWINE ASH MANAGEMENT FACILITY BRANDYWINE, MARYLAND				
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.		DESIGN BY: BNM		DATE: JANUARY 2023
NOT FOR CONSTRUCTION		DRAWN BY: BNM		PROJECT NO.: MEM0822K
SIGNATURE _____		CHECKED BY: KWH		FILE: Fig_BW_CAR_GW_MonitoringWell_Network2
DATE _____		REVIEWED BY: MB		FIGURE NO.: 1
		APPROVED BY: RMG		

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