2018 ANNUAL CCR GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

COAL COMBUSTION BYPRODUCT LANDFILL

Ft. Martin Power Station
Monongalia County, West Virginia

Prepared for:

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Tetra Tech Project No. 212C-SW-00068

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1.0 INTRODUCTION

This 2018 Annual Coal Combustion Residuals (CCR) Groundwater Monitoring and Corrective Action Report was prepared by Tetra Tech, Inc. (Tetra Tech) on behalf of FirstEnergy (FE), for the Coal Combustion Byproduct Landfill (CCBL or “CCR unit”) at the Ft. Martin Power Station (hereinafter referred to as the “Station”). The Station is located in Monongalia County, West Virginia. The report was developed to comply with requirements of 40 CFR § 257.90(e).

1.1 BACKGROUND AND SITE CHARACTERISTICS

CCRs produced at the Station are placed in the facility’s captive CCBL, which is located approximately 0.75 miles northwest of the Station. The landfill is an existing CCR unit that is regulated under West Virginia Department of Environmental Protection (WVDEP) Solid Waste/National Pollutant Discharge Elimination System (NPDES) Water Pollution Control Permit No. WV0075752. A WVDEP groundwater monitoring program for the landfill has been in effect since 1993 and a separate CCR Rule groundwater monitoring program has been in effect since 2017. The permitted landfill facility consists of two separate, active disposal areas, a haul road that also doubles as the primary station access road, a gypsum stack out/loading pad, five combined leachate/sedimentation ponds, one equalization/settling pond, and a variety of stormwater management controls (channels, culverts, slope drains, etc.). The two active disposal areas are separated by the haul road and consist of the Original landfill (approximately 70 acres in size and located south of the Haul Road) and the Expansion Area landfill (approximately 77 acres in size and located north of the haul road). The Original landfill has historically been the primary disposal area, is unlined, but was built with a bottom ash drainage blanket placed on prepared original ground that serves as a leachate collection layer. The Expansion Area landfill was constructed in 2009, is underlain with a composite liner system (geomembrane and geosynthetic clay liner), and has both leachate collection and leak detection layers. The Expansion Area landfill is permitted to be developed in two construction phases, referred to as Phase 1 and Phase 2. At this time, the Phase 1 area (approximately 30 acres) has been constructed and represents the active portion of the Expansion Area landfill.

Groundwater in the CCBL area occurs primarily within fractured bedrock. The Connellsville sandstone has been identified as the uppermost aquifer for CCR Rule groundwater monitoring over most of the CCBL area, with the underlying Clarksburg units considered the uppermost aquifer in a few limited areas where monitoring is required but the Connellsville sandstone has eroded away. Due to the site’s location on a topographic high and its geologic setting, there is no shallow groundwater flow to the site from offsite areas. Historic and recent groundwater level data indicate groundwater flow at the CCBL to be primarily radial, away from the disposal areas and to the local springs/seeps in the nearby stream valleys, and that both flow systems (Connellsville and Clarksburg) exhibit very little seasonal and temporal fluctuations. A representative set of water level data from the current reporting period (2018) were used for contouring groundwater flow patterns at the site as shown on Figure 2-1. A more detailed discussion of the site's geologic and hydrogeologic characteristics is provided in Section 2.0 of this report.

1.2 REGULATORY BASIS

As required by § 257.90(e), of the CCR Rule, Owners or Operators of existing CCR landfills and surface impoundments must prepare an Annual Groundwater Monitoring and Corrective Action Report no later than January 31, 2018 and annually thereafter. According to the subject section, "For the preceding calendar year, the annual report must document the status of the groundwater monitoring and corrective action program for the CCR unit, summarize key actions completed, describe any problems encountered, discuss actions to resolve the problems, and project key activities for the upcoming year."

This report has been developed to meet the general requirements above and the specific requirements of § 257.90(e)(1) through (5), which include:

"(1) A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit (see Figure 2-1);

(2) Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken (see Section 2.1.1);

(3) In addition to all the monitoring data obtained under §§ 257.90 through 257.98, a summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs (see Sections 3.0 and 4.0 and Tables 3-2a and 3-2b);

(4) A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring in

addition to identifying the constituent(s) detected at a statistically significant increase over background levels) (see Section 2.3); and

(5) Other information required to be included in the annual report as specified in §§ 257.90 through 257.98."

In addition, the Owner and Operator must place the report in the facility's operating record as required by § 257.105(h)(1), provide notification of the report's availability to the appropriate State Director within 30 days of placement in operating record as required by § 257.106(h)(1), and place the report on the facility's publically accessible website, also within 30 days of placing the report in the operating record.

1.3 OVERVIEW OF REPORT CONTENTS

Section 1.0 of this report provided an overview of the CCR unit characteristics, regulatory basis, and a summary of the requirements for CCR Annual Groundwater Monitoring and Corrective Action Reports. Section 2.0 summarizes the status of key actions pertaining to CCR groundwater monitoring completed during 2018 for the CCBL and plans for the upcoming year. Section 3.0 presents Detection Monitoring (DM) statistical evaluations completed in 2018 from groundwater sampling events completed in 2017 and presents DM results from groundwater sampling events completed in 2018. Section 4.0 presents Assessment Monitoring (AM) results from groundwater sampling events completed in 2018.

2.0 GENERAL INFORMATION

This section provides an overview of the status of the CCR groundwater monitoring program through 2018 and key activities planned for 2019.

2.1 STATUS OF THE CCR GROUNDWATER MONITORING AND CORRECTIVE ACTION PROGRAM

During calendar year 2018, the following key actions were completed with regard to the CCR groundwater monitoring program for the CCBL.

2.1.1 Groundwater Monitoring Well System

As detailed in the facility's 2017 Annual CCR Groundwater Monitoring and Corrective Action Report ("2017 AGWMCA Report", accessible at http://ccrdocs.firstenergycorp.com/), the certified CCR monitoring well network consists of three background wells (MW-101, -127, and -128), eight downgradient wells for the Original landfill (MW-106, -107, -129, -130, -131, -132, -133, and -134), eight downgradient wells for the Expansion Area landfill (MW-121, -123, -125, -135, -136, -137, -138, and -139), and two downgradient wells positioned between the two landfills (MW-109 and -112), as summarized in attached Table 2-1 and shown on attached Figure 2-1.

It was originally intended that upgradient wells MW-101 and -127, which are both screened in the Connellsville sandstone, would be grouped for statistical evaluation purposes. However, it was subsequently determined that the two wells did not have the level of statistical similarity needed for grouping. As such, it was decided that only MW-101 would be used to establish background chemistry for the Connellsville sandstone since it exhibited lower concentrations of all the Appendix III parameters than those measured in MW-127. MW-127 was left in place (i.e., it was not abandoned) as it remains part of the WVDEP groundwater monitoring program and its water levels have continued to be used to verify groundwater flow patterns at the site. No other changes to the monitoring well network (i.e., new wells added, or existing wells abandoned) occurred during 2018.

2.1.2 Groundwater Monitoring Plan

Consistent with the work performed and summarized in the 2017 AGWMCA Report, the CCR unit's Groundwater Monitoring Plan (GWMP) was followed during all 2018 field sampling and laboratory analysis activities and for statistically evaluating groundwater monitoring data developed from the CCR sampling and analysis program. No changes to the facility's GWMP occurred during 2018.

2.1.3 Background Groundwater Sampling

As discussed in the 2017 AGWMCA Report, eight independent rounds of background groundwater samples for analyzing all Appendix III and IV parameters from each of the CCR monitoring wells were collected prior to initiating the facility's CCR Detection Monitoring program in October 2017. No modifications to this background data set occurred during 2018.

2.1.4 Statistical Methods

As presented in the 2017 AGWMCA Report, the background data set discussed in Section 2.1.3 was used to select the appropriate statistical evaluation method for each CCR groundwater monitoring parameter to identify any Statistically Significant Increases (SSIs) over background concentrations. These statistical methods are available on the facility's publicly accessible website and no changes were made to them during 2018.

2.2 PROBLEMS ENCOUNTERED/RESOLVED

There were no significant problems (e.g., insufficient groundwater yields for sampling, quality control issues, etc.) encountered during 2018 with regard to the CCR groundwater monitoring program. One minor issue that arose during the late fall was the observation that cracking of some of the concrete surface pads surrounding the monitoring well casings was occurring. It was determined that this cracking was not affecting the hydraulic integrity of the wells based on the design of their surface completion seals, and that a repair procedure would be developed and implemented when weather conditions become favorable for effectively making such repairs during the spring of 2019.

2.3 TRANSITION BETWEEN MONITORING PROGRAMS

As discussed in the 2017 AGWMCA Report, the CCR Detection Monitoring program was initiated with the collection of the first DM samples in September 2017 (referred to hereafter as sampling event DM-1). Laboratory analysis and validation of the DM-1 sample data were completed in October of 2017 and the data were included in the 2017 AGWMCA Report. Statistical evaluation of the DM-1 data was subsequently completed in January of 2018 within the 90-day period allowed by the CCR Rule, and it was determined that SSIs existed as detailed in Section 3.1 of this Report. Based on the parameters for which SSIs were identified, an Appendix III Alternative Source Demonstration (ASD) was undertaken as discussed in Section 3.2 of this Report. However, all of the Appendix III SSIs that were identified for DM-1 could not be attributed to alternative sources. As such, a transition to the applicable requirements of Assessment

Monitoring per § 257.95 of the CCR Rule occurred and are discussed in Section 4.0 of this report. Pursuant to §§ 257.94(e)(3), 257.105(h)(5), and 257.106(h)(4), a notice was prepared and posted to the facility's Operating Record and issued to the relevant State Director on August 15, 2018, to provide notification that a groundwater Assessment Monitoring program for the CCR unit had been established. Pursuant to § 257.107(h)(4) the subject notice was posted to the facility's publicly accessible website on September 7, 2018.

2.4 KEY ACTIVITIES PLANNED FOR THE UPCOMING YEAR

The following are the key CCR groundwater compliance activities planned for 2019:

- Complete the statistical evaluation of the two AM sampling events that occurred in 2018 to determine if there are any Appendix IV constituent concentrations in the downgradient wells that are at Statistically Significant Levels (SSLs) above applicable Groundwater Protection Standards (GWPS).
- If there are no SSLs, then continue with Assessment Monitoring by conducting the annual and semi-annual rounds of sampling and analysis for applicable Appendix III and Appendix IV constituents [per § 257.95(f)].
- If any SSLs are identified, provide appropriate notification [per § 257.95(g)] then potentially conduct an Appendix IV ASD [per § 257.95(g)(3)(ii)] to determine if a source other than the CCR unit may be causing the SSLs. Concurrent with undertaking an Appendix IV ASD, characterize the Nature and Extent (N&E) of the Appendix IV release and provide appropriate notification depending on the findings [per § 257.95(g)(1) and (2), respectively].
- If any SSL's are identified and an ASD is either not undertaken, indicates that an alternative source is not responsible for all the SSL's identified, or is not completed within 90 days of identifying there are SSL's, then initiate and perform an Assessment of Corrective Measures (ACM) in accordance with § 257.96.
- Develop and implement a repair plan for those monitoring wells experiencing cracking of their concrete surface pads.

3.0 DETECTION MONITORING INFORMATION

3.1 GROUNDWATER ANALYTICAL RESULTS SUMMARY

As previously noted in Section 2.3, laboratory analysis and validation of the DM-1 sample data were completed in October of 2017 and the data were included in the 2017 AGWMCA Report. A statistical evaluation of the data set was performed using the approach and methods referenced in Section 2.1.4. The evaluation for DM-1 used nine rounds of data for the Appendix III parameters in the upgradient (background) wells and the September 2017 Appendix III data for the downgradient wells. These results are summarized in Table 3-1 and indicate that the following Appendix III parameters were identified as exhibiting SSIs in the downgradient monitoring wells (labeled "MW-#") as summarized below:

	Original Landfill (Upgradient Wells MW-128 [Clarksburg] and MW-101 [Connellsville])							
Appendix III Parameters	**MW-129**	**MW-130**	**MW-106**	**MW-107**	**MW-131**	**MW-132**	**MW-133**	**MW-134**
Boron (B)	SSI			SSI		SSI	SSI	
Calcium (Ca)	SSI	SSI	SSI	SSI			SSI	
Chloride (Cl)	SSI	SSI						
Fluoride (F)			SSI	SSI	SSI	SSI		
pH	SSI					SSI		
Sulfate (SO_4)	SSI	SSI	SSI	SSI		SSI	SSI	
TDS	SSI	SSI		SSI		SSI	SSI	

Note: Shaded cells are Clarksburg Formation wells; unshaded cells are Connellsville Sandstone wells.

	Expansion Area Landfill (Upgradient Well MW-101)							
Appendix III Parameters	**MW-121**	**MW-123**	**MW-125**	**MW-135**	**MW-136**	**MW-137**	**MW-138**	**MW-139**
Boron (B)								SSI
Calcium (Ca)			SSI				SSI	SSI
Fluoride (F)			SSI	SSI	SSI		SSI	SSI
Sulfate (SO_4)	SSI		SSI				SSI	SSI
TDS	SSI		SSI				SSI	SSI

Note: All cells are Connellsville Sandstone wells.

	Both Landfills (Upgradient Well MW-101)	
Appendix III Parameters	**MW-109**	**MW-112**
Calcium (Ca)	SSI	SSI
Fluoride (F)	SSI	
pH	SSI	
Sulfate (SO_4)	SSI	
TDS	SSI	

Note: All cells are Connellsville Sandstone wells.

Based on the various parameters for which SSIs were identified, an Appendix III ASD was undertaken as discussed in Section 3.2 of this Report.

During the transition period between completing the statistical evaluation of the DM-1 data and performing the Appendix III ASD, FirstEnergy performed another round of DM sampling (event DM-2) in order to have data available should the ASD prove to be successful and the facility remained in the DM program. DM-2 sampling occurred between January 22 and January 31, 2018, with laboratory analysis and data validation completed by April 5, 2018. However, before statistical evaluation of the DM-2 data commenced, it was determined that a transition to Assessment Monitoring was required which precluded the need to statistically evaluate the DM-2 data. This data has been retained and is presented in Table 3-2a with the intent to add to the background data set, thereby increasing the statistical power of future statistical analysis.

3.2 APPENDIX III ALTERNATIVE SOURCE DEMONSTRATION

40 CFR § 257.94(e)(2) allows the owner or operator of a CCR unit 90 days from the date of determining that an SSI has occurred to demonstrate that a source other than the CCR unit caused the SSI or that the apparent SSI was from a source other than the CCR unit or resulted from errors in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Pursuant to § 257.94(e)(2), an ASD was undertaken to assess if the Appendix III SSIs determined for DM-1 were attributable to a release from the CCR unit or from a demonstrable alternative source(s). A copy of the report that documents the Appendix III ASD activities and findings is included as Attachment A of this Report.

For the Appendix III ASD a multiple Line of Evidence (LOE) approach was followed. This approach divides LOEs into five separate categories (types): Sampling causes (ASD Type I); Laboratory causes (ASD Type II); Statistical evaluation causes (ASD Type III); Natural variation not accounted for in the basic DM statistics (ASD Type IV); and Potential natural or anthropogenic sources (ASD Type V). As detailed in Attachment A, LOE Types I through IV were assessed along with the following site-specific Type V LOEs: Regional groundwater chemistry studies/reports; Potential existing and historic oil and/or gas extraction well effects; and Potential road salt effects.

Based on the information and data included in Attachment A, all of the Appendix III SSIs that were identified for DM-1 could not be attributed to sources other than the CCR unit, to errors in sampling, analysis, or statistical evaluation, or to natural variation in groundwater quality. As such, a transition to the applicable requirements of Assessment Monitoring per § 257.95 of the CCR Rule occurred and are discussed in Section 4.0 of this report.

4.0 ASSESSMENT MONITORING INFORMATION

4.1 GROUNDWATER ANALYTICAL RESULTS SUMMARY

In accordance with 40 CFR § 257.95(b) and (d)(1), the CCR groundwater sampling and analysis program implemented during 2018 consisted of two AM sampling events (AM-1 and AM-2) performed between April 17 and May 3, 2018 and between July 16 and 26, 2018, respectively. For AM-1, all Appendix IV constituents were analyzed while, for AM-2, analyses included all Appendix III parameters and only those Appendix IV constituents that were detected during AM-1. Laboratory analysis and validation of the sample data were completed on July 5, 2018 and October 11, 2018 for AM-1 and AM-2, respectively. Table 3-2b presents the validated analytical results for these events.

Statistical evaluation of the AM data in Table 3-2b remains in-progress as of the end of the 2018 reporting period since receipt of validated AM-2 data occurred in the fourth quarter of 2018 and a 90-day period is allowed by the CCR Rule for statistical evaluation, which falls in the first quarter of 2019. If any Appendix IV SSLs are identified, ASD, N&E, and/or ACM activities will be undertaken as outlined in Section 2.4 of this Report, and the associated recordkeeping, notification, and reporting will be performed in accordance with the applicable requirements of 40 CFR §§ 257.95, 96, 105, 106, and 10.

4.2 GROUNDWATER PROTECTION STANDARDS

In accordance with 40 CFR § 257.95(h), as amended by the United States Environmental Protection Agency (USEPA) in July of 2018, GWPS for Appendix IV constituents at the site were established based on either the prescribed limits in the CCR Rule or on the Upper Prediction Limits (UPLs) determined for the two upgradient (background) monitoring wells at the site (MW-101 and MW-128) during the eight background sampling rounds conducted between September 2016 and August 2017. In accordance with the CCR Rule requirements, GWPSs are set at the higher of the federal Maximum Contaminant Level (MCL) or UPL. For those constituents that don't have MCLs, the GWPSs are set at the higher of the EPA Risk Screening Level (RSL) or the UPL. The site-specific Appendix IV GWPSs are as follows:

			Connellsville Sandstone (MW-101)		Clarksburg Formation (MW-128)	
Appendix IV Constituents	**Units**	**CCR Rule Limit**	**UPL**	**GWPS**	**UPL**	**GWPS**
Antimony	mg/L	0.006	0.00146	0.006	0.000576	0.006
Arsenic	mg/L	0.01	0.0015	0.01	0.001357	0.01
Barium	mg/L	2	0.092642	2	0.509786	2
Beryllium	mg/L	0.004	NA	0.004	NA	0.004
Cadmium	mg/L	0.005	NA	0.005	NA	0.005
T. Chromium	mg/L	0.1	NA	0.1	0.00114	0.1
Cobalt	mg/L	0.006	NA	0.006	NA	0.006
Fluoride	mg/L	4	0.103	4	2.133	4
Lead	mg/L	0.015	NA	0.015	NA	0.015
Lithium	mg/L	0.04	0.009909	0.04	0.013878	0.04
Mercury	mg/L	0.002	0.00029	0.002	0.00099	0.002
Molybdenum	mg/L	0.1	0.00765	0.1	0.009648	0.1
Selenium	mg/L	0.5	NA	0.5	NA	0.5
Thallium	mg/L	0.002	NA	0.002	NA	0.002
Ra226+Ra228	pCi/L	5	0.54	5	1.127	5

Note: "NA" indicates not applicable because constituent was not detected during the eight rounds of background sampling and analysis.

The GWPS listed above will be used to evaluate potential Appendix IV SSLs for the AM-1 and AM-2 data sets as noted in Section 4.1 of this Report.

4.3 APPENDIX IV ALTERNATIVE SOURCE DEMONSTRATION

FirstEnergy will determine whether it may be appropriate to perform an ASD for any Appendix IV constituents that may be identified as being at SSLs above applicable GWPS. As per the CCR Rule timeframe allowance (90-days), this determination will be made during the first quarter of 2019. Whatever determination is made, the associated recordkeeping, notification, and reporting will be performed in accordance with the applicable requirements of 40 CFR §§ 257.95, 96, 105, 106, and 107.

TABLES

TABLE 2-1
CCR RULE GROUNDWATER MONITORING SYSTEM WELL SUMMARY
FT. MARTIN CCB LANDFILL – 2018 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

Well	Year Installed	Formation Monitored	Ground Surface Elevation (ft MSL)	Total Well Depth (ft bgs)	Monitored Interval (ft bgs)	Monitored Interval (ft MSL)	Casing ID and Material
Background							
MW-101	1993	Connellsville SS	1113.05	34.0	24.0 – 34.0	1079.05 - 1089.05	2" - Sch. 40 PVC
MW-127*	2008	Connellsville SS	1112.00	37.0	27.0 – 37.0	1075.00 – 1085.00	2" - Sch. 40 PVC
MW-128	2008	Clarksburg	1114.00	97.5	77.5 – 97.5	1016.50 – 1036.50	2" - Sch. 40 PVC
Original Landfill - Downgradient							
MW-106	1993	Connellsville SS	1111.51	44.0	24.0 – 44.0	1067.51 – 1087.51	2" - Sch. 40 PVC
MW-107	1993	Connellsville SS	1107.28	55.5	45.5 – 55.5	1051.78 – 1061.78	2" - Sch. 40 PVC
MW-129	2016	Clarksburg	1057.84	29.4	19.4 – 29.4	1028.40 – 1038.40	2" - Sch. 40 PVC
MW-130	2016	Clarksburg	1034.29	33.3	23.3 – 33.3	1001.03 – 1011.03	2" - Sch. 40 PVC
MW-131	2016	Connellsville SS	1133.45	25.5	15.5 – 25.5	1107.95 – 1117.95	2" - Sch. 40 PVC
MW-132	2016	Connellsville SS	1155.72	77.5	67.5 – 77.5	1078.27 – 1088.27	2" - Sch. 40 PVC
MW-133	2016	Connellsville SS	1130.70	45.3	35.3 – 45.3	1085.45 – 1095.45	2" - Sch. 40 PVC
MW-134	2016	Connellsville SS	1088.67	23.8	13.8 – 23.8	1064.91 – 1074.91	2" - Sch. 40 PVC
Expansion Area Landfill - Downgradient							
MW-121	2008	Connellsville SS	1098.00	39.0	29.0 – 39.0	1059.00 – 1069.00	2" - Sch. 40 PVC
MW-123	2008	Connellsville SS	1084.00	35.5	25.5 – 35.5	1048.50 – 1058.50	2" - Sch. 40 PVC
MW-125	2008	Connellsville SS	1140.41	75.0	55.0 – 75.0	1065.41 – 1085.41	2" - Sch. 40 PVC
MW-135	2016	Connellsville SS	1081.36	37.5	27.5 – 37.5	1043.82 – 1053.82	2" - Sch. 40 PVC
MW-136	2016	Connellsville SS	1075.59	22.5	12.5 – 22.5	1053.12 – 1063.12	2" - Sch. 40 PVC
MW-137	2016	Connellsville SS	1094.53	37.9	27.9 – 37.9	1056.64 – 1066.64	2" - Sch. 40 PVC
MW-138	2016	Connellsville SS	1150.12	49.9	39.9 – 49.9	1100.25 – 1110.25	2" - Sch. 40 PVC
MW-139	2016	Connellsville SS	1127.26	42.8	32.8 – 42.8	1084.48 – 1094.48	2" - Sch. 40 PVC
Both Landfills - Downgradient							
MW-109	1993	Connellsville SS	1122.79	54.5	34.5 – 54.5	1068.29 – 1088.29	2" - Sch. 40 PVC
MW-112	2002	Connellsville SS	1124.11	50.0	40.0 – 50.0	1074.11 – 1084.11	2" - Sch. 40 PVC

Notes: SS = sandstone MSL = mean sea level bgs = below ground surface ID = inside diameter PVC = polyvinyl chloride
* = used only for water level measurements

TABLE 3-1
CCR RULE GROUNDWATER DETECTION MONITORING STATISTICAL EVALUATION SUMMARY
FT. MARTIN CCB LANDFILL - CCR SAMPLING EVENT DM-1

Original Landfill -Clarksburg Formation				Downgradient Wells	
Parameter	Units	Data Distribution for Upgradient Well MW-128	UPL[a]	MW-129	MW-130
Boron	mg/L	Normal	0.236	3.07	0.0685
Calcium	mg/L	Normal	11.325	386	56.1
Chloride	mg/L	Log-Normal	1.067	17.5	7.14
Fluoride	mg/L	Normal	2.133	0.04	0.122
pH	S.U.	Normal	8.181 (6.86)[b]	6.78 (< LPL)	7.03
Sulfate	mg/L	Log-Normal	2.47	1030	88.9
TDS	mg/L	Normal	321.42	1987	348

Original Landfill - Connellsville Sandstone				Downgradient Wells					
Parameter	Units	Data Distribution for Upgradient Well MW-101	UPL[a]	MW-106	MW-107	MW-131	MW-132	MW-133	MW-134
Boron	mg/L	Log-Normal	0.111	0.0161	0.815	0.0228	0.232	1.16	0.0293
Calcium	mg/L	Normal	79.282	85.1	80.9	63.6	9.1	215	56.6
Chloride	mg/L	Normal	54.542	1.49	3.78	1.06	11.4	5.38	1.26
Fluoride	mg/L	Normal	0.094	0.113	0.16	0.151	1.73	0.089	0.028
pH	S.U.	Non-parametric	8.11 (6.78)[b]	7.01	7.03	7.29	8.3 (> UPL)	6.93	7.09
Sulfate	mg/L	Normal	72.667	74.4	157	39.8	192	430	5.24
TDS	mg/L	Normal	449.118	328	560	328	736	1040	252

Expansion Area Landfill - Connellsville Sandstone				Downgradient Wells							
Parameter	Units	Data Distribution for Upgradient Well MW-101	UPL[a]	MW-121	MW-123	MW-125	MW-135	MW-136	MW-137	MW-138	MW-139
Boron	mg/L	Log-Normal	0.111	0.0225	0.0055	0.0894	0.0563	0.0315	0.0212	0.105	0.168
Calcium	mg/L	Normal	79.282	59.6	68.4	122	66.9	60.5	55.8	267	114
Chloride	mg/L	Normal	54.542	15.9	5.1	1.18	2.8	3.66	1.32	1.64	2.34
Fluoride	mg/L	Normal	0.094	0.081	0.07	0.129	0.111	0.269	0.068	0.227	0.31
pH	S.U.	Non-parametric	8.11 (6.78)[b]	7.12	7.08	7.01	7.11	6.93	7.01	6.96	6.87
Sulfate	mg/L	Normal	72.667	82.1	23.1	178	24.3	39.1	15	523	87.8
TDS	mg/L	Normal	449.118	456	340	724	324	308	248	1215	468

Both Landfills - Connellsville Sandstone				Downgradient Wells	
Parameter	Units	Data Distribution for Upgradient Well MW-101	UPL[a]	MW-109	MW-112
Boron	mg/L	Log-Normal	0.111	0.111	0.0217
Calcium	mg/L	Normal	79.282	233	80.3
Chloride	mg/L	Normal	54.542	13.8	38.2
Fluoride	mg/L	Normal	0.094	0.174	0.051
pH	S.U.	Non-parametric	8.11 (6.78)[b]	6.77 (< LPL)	7.2
Sulfate	mg/L	Normal	72.667	435	30.4
TDS	mg/L	Normal	449.118	1064	356

[a] Prediction Limits calculated using 5% alpha; Upper Prediction Limit used for all parameters, except pH where both upper and lower prediction limits were calculated.

[b] For pH, lower prediction limit shown in parantheses, both used for comparison.

(green shading) = Appendix III Parameter SSI

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TABLE 3-2a

CCR RULE GROUNDWATER DETECTION MONITORING ANALYTICAL RESULTS SUMMARY

FT. MARTIN CCB LANDFILL - 2018 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

			APPENDIX III (all Chemical Constituents reported as TOTAL RECOVERABLE)[1]						
SAMPLING EVENT NO.[2]	WELL ID[3]	SAMPLE DATE	BORON METALS MG/L	CALCIUM METALS MG/L	CHLORIDE MISC MG/L	FLUORIDE MISC MG/L	PH MISC S.U.	SULFATE MISC MG/L	TDS MISC MG/L
10 (DM-2)	MW-101	1/25/2018	0.0234 J	62	47.3	0.061 J	7.03	59.5	380
10 (DM-2)	MW-106	1/23/2018	0.0178 J	81.7	1.71	0.062 J	7.09	73.7	324
10 (DM-2)	MW-107	1/23/2018	0.844	79.4	3.99	0.128	7.31	157	552
10 (DM-2)	MW-109	1/22/2018	0.116 J	204	13 J-	0.103	7.12	395	928
10 (DM-2)	MW-112	1/25/2018	0.0212 J	76.7	40.4	0.05 J	7.3	29.7	336
10 (DM-2)	MW-121	1/25/2018	0.0189 J	74.6	12.7	0.091 J	7.2	89.2	460
10 (DM-2)	MW-123	1/22/2018	0.0164 J	73.5	5.51 J-	0.025 U	7.39	24.4	344
10 (DM-2)	MW-125	1/24/2018	0.109 J	119	1.13	0.172	7.22	184	656
10 (DM-2)	MW-127	1/31/2018	0.0549 J	157	127	0.064 J	7.12	115	756
10 (DM-2)	MW-128	1/25/2018	0.166 J	10.5	0.618	2.04	7.77	0.444	300
10 (DM-2)	MW-128 (D)	1/25/2018	0.165 J	10.1	0.625	2.04	7.77	0.448	296
10 (DM-2)	MW-129	1/31/2018	3.41	353	21.8	0.036 J	6.66	988	1853.333
10 (DM-2)	MW-130	1/29/2018	0.0352 J	55.1	8.89	0.095 J	7.18	101	312
10 (DM-2)	MW-131	1/23/2018	0.0256 J	59.3	1.45	0.107	7.31	38.4	272
10 (DM-2)	MW-132	1/23/2018	0.22	7.26	10.7	2.22	8.34	183	692
10 (DM-2)	MW-133	1/31/2018	0.915	185	5.34	0.074 J	7.25	373	880
10 (DM-2)	MW-134	1/29/2018	0.0295 J	53.9	1.41	0.025 U	7.23	5.49	232
10 (DM-2)	MW-135	1/22/2018	0.0577 J	67.8	3.92 J-	0.025 U	7.34	27.1	324
10 (DM-2)	MW-136	1/24/2018	0.0279 J	49.1	3.15	0.211	7.09	36.9	276
10 (DM-2)	MW-137	1/22/2018	0.0211 J	51.5	1.53	0.025 U	7.14	14.1	232
10 (DM-2)	MW-138	1/24/2018	0.0999 J	248	1.57	0.258	6.96	496	1085
10 (DM-2)	MW-139	1/24/2018	0.167 J	107	2.08	0.293	7.36	79.6	440

	APPENDIX IV (all Chemical Constituents reported as TOTAL RECOVERABLE)[1]															
WELL ID[3]	ANTIMONY METALS MG/L		ARSENIC METALS MG/L	BARIUM METALS MG/L	BERYLLIUM METALS MG/L	CADMIUM METALS MG/L	CHROMIUM METALS MG/L	COBALT METALS MG/L	LEAD METALS MG/L	LITHIUM METALS MG/L	MERCURY METALS MG/L	MOLYBDENUM METALS MG/L	SELENIUM METALS MG/L	THALLIUM METALS MG/L	RADIUM-226 RADIOCHEM PCI/L	RADIUM-228 RADIOCHEM PCI/L
MW-101	0.00017 U		0.00015 U	0.06462	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.00823 J	0.00004 U	0.00028 U	0.0011 U	0.00017 U	0.112	0.521
MW-106	0.00017 U		0.00025 J	0.0653	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.00659 J	0.00005 J	0.00195 J	0.0011 U	0.00017 U	1 U	1 U
MW-107	0.00017 U		0.00016 J	0.03351	0.00022 U	0.00017 U	0.00053 J	0.00047 U	0.00052 U	0.01394 J	0.00004 J	0.00066 J	0.0011 U	0.00017 U	0.0581 U	1 U
MW-109	0.00017 U		0.00016 J	0.03239	0.00022 U	0.00017 U	0.00045 U	0.00062 J	0.00052 U	0.01407 J	0.00004 J	0.00076 J	0.0011 U	0.00017 U	1 U	1.36 J
MW-112	0.00017 U		0.00015 U	0.15005	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.00737 J	0.00004 U	0.00028 U	0.0011 U	0.00017 U	0.0999 U	0.262 U
MW-121	0.00017 U		0.00015 U	0.03965	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.00784 J	0.00004 U	0.00178 J	0.0011 U	0.00017 U	0.223	0.424
MW-123	0.00022 J		0.0002 J	0.12081	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.005 U	0.00004 U	0.00227 J	0.0011 U	0.00017 U	1 U	1 U
MW-125	0.00017 U		0.00016 J	0.01818	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.01345 J	0.00004 J	0.00128 J	0.0011 U	0.00017 U	0.232	0.376 U
MW-127	0.00017 U		0.00015 U	0.04832	0.00022 U	0.00017 U	0.00628	0.00059 J	0.00052 U	0.03827 J-	0.00004 U	0.00131 J	0.00135 J	0.00017 U	0.463	2.63
MW-128	0.00017 U		0.001 U	0.39358	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.0093 J	0.00004 U	0.00135 J	0.0011 U	0.00017 U	0.133	0.412 U
MW-128 (D)	0.00017 U		0.001 U	0.40862	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.00974 J	0.00004 U	0.00133 J	0.0011 U	0.00017 U	0.218	0.547 U
MW-129	0.00017 U		0.00031 J	0.02066	0.00022 U	0.00017 U	0.00045 U	0.00067 J	0.00052 U	0.01668 J	0.00004 U	0.00028 U	0.00122 J	0.00017 U	0.11	2.18
MW-130	0.00017 U		0.001 U	0.07083	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.005 U	0.00004 U	0.00028 U	0.0011 U	0.00017 U	0.00445 U	0.337 U
MW-131	0.00017 U		0.00018 J	0.11799	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.00765 J	0.00004 J	0.00028 U	0.00116 J	0.00017 U	1 U	0.251 U
MW-132	0.00469		0.00682	0.05932	0.00022 U	0.00017 U	0.00112 J	0.00047 U	0.00052 U	0.04446	0.00005 J	0.03154	0.00315 J	0.00017 U	0.0641 U	1 U
MW-133	0.00017 U		0.00022 J	0.02309	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.02043 J	0.00004 U	0.00253 J	0.0011 U	0.00017 U	0.0643 U	0.907
MW-134	0.00017 U		0.001 U	0.28143	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00074 J	0.00644 J	0.00004 U	0.00493 J	0.0011 U	0.00017 U	0.406	1 U
MW-135	0.00017 U		0.0008 J	0.1669	0.00022 U	0.00017 U	0.00045 U	0.00091 J	0.00052 U	0.00734 J	0.00004 U	0.00153 J	0.0011 U	0.00017 U	1 U	1 U
MW-136	0.00017 U		0.001 U	0.07813	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.005 U	0.00004 U	0.00092 J	0.0011 U	0.00017 U	0.147	0.531
MW-137	0.00017 U		0.00063 J	0.13994	0.00022 U	0.00017 U	0.00045 U	0.00055 J	0.00052 U	0.005 U	0.00004 J	0.00059 J	0.0011 U	0.00017 U	1 U	1 U
MW-138	0.00017 U		0.00015 U	0.00999	0.00022 U	0.00017 U	0.00045 U	0.00079 J	0.00052 U	0.01342 J	0.00004 U	0.00028 U	0.0011 U	0.00017 U	0.758	1.19
MW-139	0.00017 U		0.00041 J	0.04318	0.00022 U	0.00017 U	0.00045 U	0.00049 J	0.00052 U	0.01177 J	0.00004 J	0.00068 J	0.0011 U	0.00017 U	0.223	0.903

NOTES:

[1] Lab analyses were completed by Beta Lab and TestAmerica Laboratories, Inc., both of which are accredited/certified laboratories: Beta Lab ISO/IEC 17025 Cert No. 2489.01 (Exp. 11-30-20) and ISO/IEC 9001 Cert. No. 83761-IS7 (Exp. 01-16-21) and TestAmerica NELAP Identification Number: 02-00416, EPA Region: 3, Expiration Date: 04-30-19.

[2] Event No. 10 corresponds to Detection Monitoring (DM) sampling event DM-2.

[3] Field duplicate samples that were taken for Quality Control purposes are noted with a (D).

DATA QUALIFER DEFINITIONS:

The following definitions provide brief explanations of the validation qualifiers assigned to results in the data review process.

U	The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted method detection limit for sample and method.
J	The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the reporting limit).
J+	The result is an estimated quantity, but the result may be biased high.
J-	The result is an estimated quantity, but the result may be biased low.
UJ	The analyte was analyzed for, but was not detected. The reported detection limit is approximate and may be inaccurate or imprecise.
R	The sample result (detected) is unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in sample
UR	The sample result (nondetected) is unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in sample.

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TABLE 3-2b

CCR RULE GROUNDWATER ASSESSMENT MONITORING ANALYTICAL RESULTS SUMMARY

FT. MARTIN CCB LANDFILL - 2018 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

			APPENDIX III (all Chemical Constituents reported as TOTAL RECOVERABLE)[1]							APPENDIX IV (all Chemical Constituents reported as TOTAL RECOVERABLE)[1]														
SAMPLING EVENT NO.[2]	WELL ID[3]	SAMPLE DATE	BORON METALS MG/L	CALCIUM METALS MG/L	CHLORIDE MISC MG/L	FLUORIDE MISC MG/L	PH MISC S.U.	SULFATE MISC MG/L	TDS MISC MG/L	ANTIMONY METALS MG/L	ARSENIC METALS MG/L	BARIUM METALS MG/L	BERYLLIUM METALS MG/L	CADMIUM METALS MG/L	CHROMIUM METALS MG/L	COBALT METALS MG/L	LEAD METALS MG/L	LITHIUM METALS MG/L	MERCURY METALS MG/L	MOLYBDENUM METALS MG/L	SELENIUM METALS MG/L	THALLIUM METALS MG/L	RADIUM-226 RADIOCHEM PCI/L	RADIUM-228 RADIOCHEM PCI/L
11 (AM-1)	MW-101	4/17/2018	0.0312 J	62.5	28.2	0.062 J	6.89	55	372	0.00017 U	0.00015 U	0.06207	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.00915 J	0.00004 U	0.00028 U	0.0011 U	0.00017 U	0.0323 U	-0.0088 U
12 (AM-2)	MW-101	7/26/2018				0.069 J				0.00017 U	0.00015 U	0.07174			0.00045 U	0.00047 U		0.00796 J		0.00028 U	0.0011 U		1 U	0.19 U
11 (AM-1)	MW-106	4/25/2018	0.0201 J	85.6	1.59	0.128	7.12	74.3	340	0.00017 U	0.00015 U	0.06233	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.00648 J	0.00004 U	0.00513	0.0011 U	0.00017 U	0.305	0.181 U
12 (AM-2)	MW-106	7/17/2018				0.142				0.00017 U	0.00015 U	0.06001 J+			0.00045 U	0.00047 U		0.00657 J		0.00438 J	0.0011 U		1 U	0.625 U
11 (AM-1)	MW-107	4/25/2018	0.874	82.1	3.74	0.182	7.28	158	548	0.00017 U	0.00015 U	0.03345	0.00022 U	0.00017 U	0.00189 J	0.00047 U	0.00052 U	0.01427 J	0.00004 U	0.00066 J	0.0011 U	0.00017 U	0.0898 U	-0.0637 U
12 (AM-2)	MW-107	7/17/2018				0.189				0.00023 J	0.00025 J	0.04726 J+			0.00546	0.00047 U		0.01955 J		0.00185 J	0.0011 U		1 U	0.145 U
11 (AM-1)	MW-109	4/18/2018	0.108 J	220	13.4	0.239	7.07	402	992	0.00017 U	0.00015 U	0.03148	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.01689 J	0.00004 U	0.00077 J	0.0011 U	0.00017 U	0.26	0.308 U
12 (AM-2)	MW-109	7/19/2018				0.239				0.00017 U	0.00018 J	0.03025 J+			0.00045 U	0.00047 U		0.01534 J		0.00078 J	0.0011 U		1 U	0.23 U
11 (AM-1)	MW-112	5/1/2018	0.0168 J	80.9	37	0.047 J	7.2	29.8 J-	332	0.00017 U	0.00017 J	0.15157	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.00734 J	0.00004 U	0.00028 U	0.0011 U	0.00017 U	0.188	-0.16 U
12 (AM-2)	MW-112	7/25/2018				0.067 J				0.00017 U	0.00024 J	0.1646			0.00045 U	0.00047 U		0.00732 J		0.00028 U	0.0011 U		1 U	0.219 U
11 (AM-1)	MW-121	4/18/2018	0.0185 J	70.8	14.1	0.09 J	7.37	83.3	440	0.00017 U	0.00016 J	0.04019	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.00944 J	0.00004 U	0.00167 J	0.0011 U	0.00017 U	0.117	0.29 U
12 (AM-2)	MW-121	7/23/2018				0.103				0.00017 U	0.00015 J	0.03933			0.00045 U	0.00047 U		0.00752 J		0.0008 J	0.0011 U		1 U	0.336 U
11 (AM-1)	MW-123	4/30/2018	0.015 U	76.7	5.36	0.061 J	7.4	24.9 J-	376	0.00017 U	0.00015 J	0.10988	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.005 U	0.00004 U	0.00249 J	0.0011 U	0.00017 U	0.435	0.116 U
12 (AM-2)	MW-123	7/24/2018				0.084 J				0.00017 U	0.00021 J	0.11072			0.00045 U	0.00047 U		0.005 U		0.00206 J	0.0011 U		1 U	0.502
11 (AM-1)	MW-125	4/19/2018	0.0916 J	124	1.23	0.185	7.07	194	688	0.00017 U	0.00015 U	0.01621	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.01477 J	0.00004 U	0.00094 J	0.0011 U	0.00017 U	0.238	0.0562 U
12 (AM-2)	MW-125	7/25/2018				0.205				0.00017 U	0.00015 U	0.01853			0.00045 U	0.00047 U		0.01258 J		0.001 J	0.0011 U		1 U	0.411 U
11 (AM-1)	MW-127	5/1/2018	0.0173 J	153	130	0.083 J	7.21	119 J-	796	0.00017 U	0.00015 U	0.04967	0.00022 U	0.00017 U	0.01157	0.00071 J	0.00052 U	0.03944	0.00004 U	0.00154 J	0.0011 U	0.00017 U	0.324	0.788
12 (AM-2)	MW-127	7/26/2018				0.109				0.00017 U	0.00015 U	0.05261			0.00258 J	0.00047 U		0.03483		0.00115 J	0.0011 U		1 U	0.943
11 (AM-1)	MW-128	4/17/2018	0.18 J	10.5	0.645	2.05	7.9	0.42	304	0.00017 U	0.00073 J	0.40822	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.01172 J	0.00004 U	0.00096 J	0.0011 U	0.00017 U	0.0961 U	0.0207 U
12 (AM-2)	MW-128	7/25/2018				2.05				0.00017 U	0.00068 J	0.41717			0.00045 U	0.00047 U		0.00973 J		0.00089 J	0.0011 U		1 U	0.53
11 (AM-1)	MW-129	5/2/2018	3.4	335	18.8	0.056 J	6.54	1010 J-	1713.333	0.00017 U	0.00033 J	0.01783	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.01361 J	0.00004 U	0.00028 U	0.0011 U	0.00017 U	0.0838 U	1 U
12 (AM-2)	MW-129	7/26/2018				0.073 J				0.00017 U	0.00024 J	0.02006			0.00045 U	0.00047 U		0.01359 J		0.00028 U	0.0011 U		1 U	0.438 U
11 (AM-1)	MW-130	5/2/2018	0.046 J	55.9	7.75	0.126	6.99	95.6 J-	324	0.00017 U	0.00017 J	0.06703	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.005 U	0.00004 U	0.00028 U	0.0011 U	0.00017 U	0.0337 U	0.376 U
11 (AM-1)	MW-130 (D)	5/2/2018	0.0421 J	56.8	7.68	0.128	7.01	94.9 J-	312	0.00017 U	0.00034 J	0.06855	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.005 U	0.00004 U	0.00028 U	0.0011 U	0.00017 U	0.0188 U	0.0859 U
12 (AM-2)	MW-130	7/26/2018				0.185				0.00017 U	0.00035 J	0.0698			0.00045 U	0.00048 J		0.005 U		0.00028 U	0.0011 U		1 U	0.493
11 (AM-1)	MW-131	4/26/2018	0.0203 J	67.7	0.714	0.159	7.3	40.4	300	0.00017 U	0.00015 U	0.12558	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.00991 J	0.00004 U	0.00028 U	0.0011 U	0.00017 U	0.143	0.645
12 (AM-2)	MW-131	7/19/2018				0.193				0.00017 U	0.00015 U	0.1274 J+			0.00045 U	0.00047 U		0.01158 J		0.00028 U	0.0011 U		1 U	0.109 U
11 (AM-1)	MW-132	4/26/2018	0.231	6.58	8.11	2.28	8.47	204	680	0.00484	0.00785	0.04799	0.00022 U	0.00017 U	0.00086 J	0.00047 U	0.00052 U	0.03419	0.00004 U	0.03236	0.00115 J	0.00017 U	0.164	-0.118 U
12 (AM-2)	MW-132	7/18/2018				2.54				0.00446	0.0071	0.04611 J+			0.00089 J	0.00047 U		0.031		0.02123	0.0011 U		1 U	0.289 U
11 (AM-1)	MW-133	5/3/2018	0.79	164	5.62	0.069 J	7.2 J	354	872	0.00017 U	0.00041 J	0.02043	0.00004 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.022 J	0.00004 U	0.00277 J	0.0011 U	0.00017 U	0.149	0.0394 U
12 (AM-2)	MW-133	7/18/2018				0.119				0.00017 U	0.0003 J	0.01988 J+			0.00045 U	0.00047 U		0.01952 J		0.00202 J	0.0011 U		1 U	0.0789 U
12 (AM-2)	MW-133 (D)	7/18/2018				0.117				0.00017 U	0.00032 J	0.02005 J+			0.00045 U	0.00047 U		0.02024 J		0.00207 J	0.0011 U		1 U	0.259 U
11 (AM-1)	MW-134	4/23/2018	0.0276 J	58	1	0.032 J	7.13	5.96	252	0.00017 U	0.00048 J	0.28388	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.0065 J	0.00004 U	0.00028 J	0.0011 U	0.00017 U	0.27	0.214 U
12 (AM-2)	MW-134	7/16/2018				0.039 J				0.00019 J	0.00083 J	0.27394 J+			0.00045 U	0.00047 U		0.00674 J		0.00081 J	0.0011 U		1 U	1 U
11 (AM-1)	MW-135	4/18/2018	0.0505 J	69.6	3.12	0.116	7.3	23.3	332	0.00017 U	0.00066 J	0.16488	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.00781 J	0.00004 U	0.00119 J	0.0011 U	0.00017 U	0.352	0.0905 U
12 (AM-2)	MW-135	7/23/2018				0.132				0.00017 U	0.00114	0.17694			0.00045 U	0.00054 J		0.00624 J		0.00107 J	0.0011 U		1 U	0.025 U
11 (AM-1)	MW-136	4/30/2018	0.0233 J	52.7	2.64	0.157	6.89	38.2 J-	280	0.00017 U	0.00027 J	0.07547	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.005 U	0.00004 U	0.00059 J	0.0011 U	0.00017 U	0.135	0.518 U
12 (AM-2)	MW-136	7/23/2018				0.174				0.00017 U	0.00035 J	0.08234			0.00045 U	0.00047 U		0.005 U		0.00043 J	0.0011 U		1 U	-0.0938 U
11 (AM-1)	MW-137	4/19/2018	0.0166 J	55.4	1.68	0.082 J	6.92	21	252	0.00018 J	0.0006 J	0.13408	0.00022 U	0.00017 U	0.00045 U	0.00058 J	0.00052 U	0.005 J	0.00004 U	0.00058 J	0.0011 U	0.00017 U	0.239	0.837
12 (AM-2)	MW-137	7/24/2018				0.082 J				0.00017 U	0.00036 J	0.13097			0.00045 U	0.00047 U		0.005 U		0.00028 U	0.0011 U		1 U	-0.00874 U
11 (AM-1)	MW-138	4/24/2018	0.101 J	239	1.61	0.267	6.9	486	1045	0.00017 U	0.00025 J	0.01102	0.00022 U	0.00017 U	0.00045 U	0.0008 J	0.00052 U	0.01504 J	0.00004 U	0.00028 U	0.0011 U	0.00017 U	0.679	0.939
12 (AM-2)	MW-138	7/24/2018				0.31				0.00017 U	0.00015 U	0.0107			0.00045 U	0.0009 J		0.01363 J		0.00028 U	0.0011 U		1 U	0.316 U
11 (AM-1)	MW-139	4/24/2018	0.186 J	112	2.33	0.311	7.21	84.4	448	0.00017 U	0.00023 J	0.04192	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.0128 J	0.00004 U	0.00061 J	0.0011 U	0.00017 U	0.246	0.216 U
12 (AM-2)	MW-139	7/24/2018				0.397				0.00017 U	0.0002 J	0.0434			0.00045 U	0.00047 U		0.00963 J		0.00079 J	0.0011 U		1 U	0.701

NOTES:

[1] Lab analyses were completed by Beta Lab and TestAmerica Laboratories, Inc., both of which are accredited/certified laboratories: Beta Lab ISO/IEC 17025 Cert No. 2489.01 (Exp. 11-30-20) and ISO/IEC 9001 Cert. No. 83761-IS7 (Exp. 01-16-21) and TestAmerica NELAP Identification Number: 02-00416, EPA Region: 3, Expiration Date: 04-30-19.

[2] Event Nos. 11 and 12 correspond to Assessment Monitoring (AM) sampling events AM-1 and AM-2, respectively.

[3] Field duplicate samples that were taken for Quality Control purposes are noted with a (D).

DATA QUALIFER DEFINITIONS:

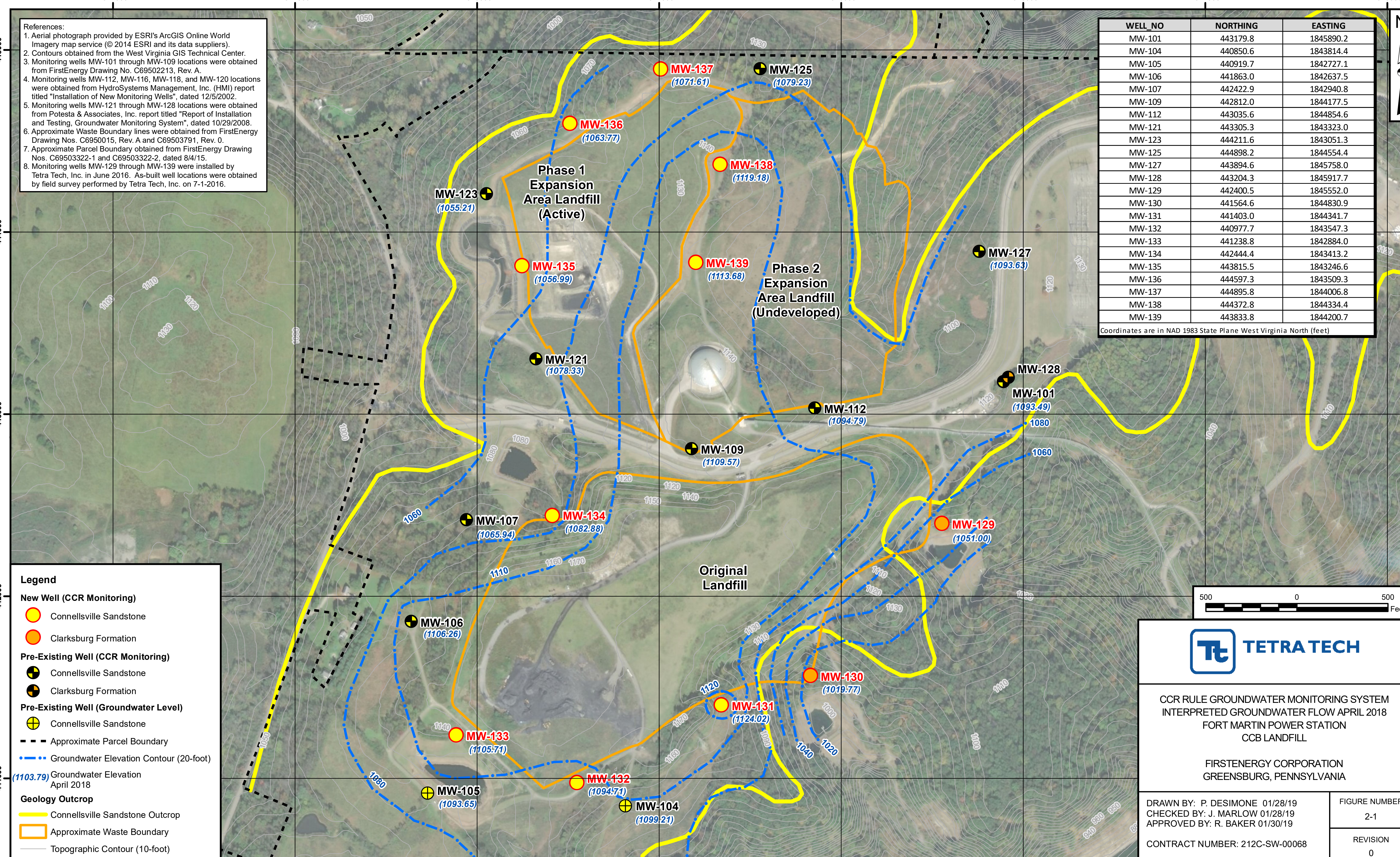
The following definitions provide brief explanations of the validation qualifiers assigned to results in the data review process.

U	The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted method detection limit for sample and method.
J	The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the reporting limit).
J+	The result is an estimated quantity, but the result may be biased high.
J-	The result is an estimated quantity, but the result may be biased low.
UJ	The analyte was analyzed for, but was not detected. The reported detection limit is approximate and may be inaccurate or imprecise.
R	The sample result (detected) is unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in sample
UR	The sample result (nondetected) is unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in sample.

TETRA TECH

FIGURES

PGH P:\GIS\FIRST_ENERGY\MAPDOCS\FORTMARTIN_PROPOSED_MW_APRIL2018_CCR.MXD 01/30/19 PD



References:

1. Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2014 ESRI and its data suppliers).
2. Contours obtained from the West Virginia GIS Technical Center.
3. Monitoring wells MW-101 through MW-109 locations were obtained from FirstEnergy Drawing No. C69502213, Rev. A.
4. Monitoring wells MW-112, MW-116, MW-118, and MW-120 locations were obtained from HydroSystems Management, Inc. (HMI) report titled "Installation of New Monitoring Wells", dated 12/5/2002.
5. Monitoring wells MW-121 through MW-128 locations were obtained from Potesta & Associates, Inc. report titled "Report of Installation and Testing, Groundwater Monitoring System", dated 10/29/2008.
6. Approximate Waste Boundary lines were obtained from FirstEnergy Drawing Nos. C6950015, Rev. A and C69503791, Rev. 0.
7. Approximate Parcel Boundary obtained from FirstEnergy Drawing Nos. C69503322-1 and C69503322-2, dated 8/4/15.
8. Monitoring wells MW-129 through MW-139 were installed by Tetra Tech, Inc. in June 2016. As-built well locations were obtained by field survey performed by Tetra Tech, Inc. on 7-1-2016.

WELL_NO	NORTHING	EASTING
MW-101	443179.8	1845890.2
MW-104	440850.6	1843814.4
MW-105	440919.7	1842727.1
MW-106	441863.0	1842637.5
MW-107	442422.9	1842940.8
MW-109	442812.0	1844177.5
MW-112	443035.6	1844854.6
MW-121	443305.3	1843323.0
MW-123	444211.6	1843051.3
MW-125	444898.2	1844554.4
MW-127	443894.6	1845758.0
MW-128	443204.3	1845917.7
MW-129	442400.5	1845552.0
MW-130	441564.6	1844830.9
MW-131	441403.0	1844341.7
MW-132	440977.7	1843547.3
MW-133	441238.8	1842884.0
MW-134	442444.4	1843413.2
MW-135	443815.5	1843246.6
MW-136	444597.3	1843509.3
MW-137	444895.8	1844006.8
MW-138	444372.8	1844334.4
MW-139	443833.8	1844200.7

Coordinates are in NAD 1983 State Plane West Virginia North (feet)

Legend

New Well (CCR Monitoring)
- Connellsville Sandstone
- Clarksburg Formation

Pre-Existing Well (CCR Monitoring)
- Connellsville Sandstone
- Clarksburg Formation

Pre-Existing Well (Groundwater Level)
- Connellsville Sandstone
- Approximate Parcel Boundary
- Groundwater Elevation Contour (20-foot)
- (1103.79) Groundwater Elevation April 2018

Geology Outcrop
- Connellsville Sandstone Outcrop
- Approximate Waste Boundary
- Topographic Contour (10-foot)

TETRA TECH

CCR RULE GROUNDWATER MONITORING SYSTEM
INTERPRETED GROUNDWATER FLOW APRIL 2018
FORT MARTIN POWER STATION
CCB LANDFILL

FIRSTENERGY CORPORATION
GREENSBURG, PENNSYLVANIA

DRAWN BY: P. DESIMONE 01/28/19
CHECKED BY: J. MARLOW 01/28/19
APPROVED BY: R. BAKER 01/30/19

CONTRACT NUMBER: 212C-SW-00068

FIGURE NUMBER 2-1

REVISION 0

ATTACHMENT A

CCR Appendix III Alternative Source Demonstration Report – 2017 Detection Monitoring

Coal Combustion Byproduct Landfill

Ft. Martin Power Station
Monongalia County, West Virginia

Prepared for:

FirstEnergy

800 Cabin Hill Drive
Greensburg, PA 15601

Prepared by:

Tetra Tech, Inc.

400 Penn Center Boulevard, Suite 200
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Phone: (412) 829-3600
Fax: (412) 829-3260

Tetra Tech Project No. 212C-SW-00068

April 16, 2018

CCR APPENDIX III ALTERNATIVE SOURCE DEMONSTRATION REPORT
2017 DETECTION MONITORING

COAL COMBUSTION BYPRODUCT LANDFILL

FT. MARTIN POWER STATION
MONONGALIA COUNTY, WEST VIRGINIA

Prepared for:

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Tetra Tech Project No. 212C-SW-00068

April 16, 2018

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1.0 INTRODUCTION/BACKGROUND

FirstEnergy (FE) owns and operates the coal-fired Ft. Martin Power Station (hereinafter referred to as the “Station”) located in Monongalia County, West Virginia. Coal Combustion Residuals (CCRs) produced at the Station are placed in the facility’s captive dry disposal landfill, which is located approximately 0.75 miles northwest of the Station. The landfill is regulated under both West Virginia Department of Environmental Protection (WVDEP) Solid Waste/National Pollutant Discharge Elimination System (NPDES) Water Pollution Control Permit No. WV0075752, and the United States Environmental Protection Agency (USEPA) Disposal of Coal Combustion Residuals from Electric Utilities rule (40 CFR Part 257, hereinafter referred to as the “CCR Rule” or “Rule”). Under the Rule the landfill is categorized as an active CCR unit and is subject to the groundwater monitoring requirements of 40 CFR §§ 257.90 through 257.98. The permitted landfill facility consists of two separate, active disposal areas separated by a set of parallel roads (a gravel-surfaced haul road and a paved access road): the Original Landfill (approximately 70 acres in size and located south of the roads) and the Expansion Area Landfill (approximately 77 acres in size and located north of the roads). For the purpose of CCR Rule groundwater compliance, the two disposal areas are monitored as separate units.

In accordance with § 257.94 of the Rule, the initial Detection Monitoring (DM) sampling and analysis event for the CCR unit was completed in October 2017, and the statistical evaluation of the resulting data was completed in January 2018. As required by § 257.90(e), results and findings from the 2017 groundwater monitoring program were documented in an Annual Groundwater Monitoring and Corrective Action Report that was posted in both the CCR unit’s operating record and on its publicly accessible website in January 2018 (Tetra Tech, 2018). Subsequent to the monitoring period documented in that report, Statistically Significant Increases (SSIs) for the following CCR Rule Appendix III parameters were determined in the downgradient monitoring wells (labeled “MW-#”) as summarized below:

	Original Landfill							
Appendix III Parameters	**MW-129**	**MW-130**	**MW-106**	**MW-107**	**MW-131**	**MW-132**	**MW-133**	**MW-134**
Boron (B)	SSI			SSI		SSI	SSI	
Calcium (Ca)	SSI	SSI	SSI	SSI			SSI	
Chloride (Cl)	SSI	SSI						
Fluoride (F)			SSI	SSI	SSI	SSI		
pH	SSI					SSI		
Sulfate (SO_4)	SSI	SSI	SSI	SSI		SSI	SSI	
TDS	SSI	SSI		SSI		SSI	SSI	

Note: Shaded cells are Clarksburg Formation wells; unshaded cells are Connellsville Sandstone wells.

	Expansion Area Landfill							
Appendix III Parameters	**MW-121**	**MW-123**	**MW-125**	**MW-135**	**MW-136**	**MW-137**	**MW-138**	**MW-139**
Boron (B)								SSI
Calcium (Ca)			SSI				SSI	SSI
Fluoride (F)			SSI	SSI	SSI		SSI	SSI
Sulfate (SO_4)	SSI		SSI				SSI	SSI
TDS	SSI		SSI				SSI	SSI

Note: All cells are Connellsville Sandstone wells.

	Both Landfills	
Appendix III Parameters	**MW-109**	**MW-112**
Calcium (Ca)	SSI	SSI
Fluoride (F)	SSI	
pH	SSI	
Sulfate (SO_4)	SSI	
TDS	SSI	

Note: All cells are Connellsville Sandstone wells.

40 CFR § 257.94(e)(2) allows the owner or operator of a CCR unit 90 days from the date of determining that an SSI has occurred to demonstrate that a source other than the CCR unit caused the SSI or that the apparent SSI was from a source other than the CCR unit or resulted

from errors in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Pursuant to § 257.94(e)(2), this Alternative Source Demonstration (ASD) report has been prepared to assess if the Appendix III SSIs determined for the October 2017 DM event are attributable to a release from the CCR unit or from a demonstrable alternative source(s).

2.0 APPROACH

For this ASD, a multiple Line of Evidence (LOE) approach as presented in *Guidance for Development of Alternative Source Demonstrations at Coal Combustion Residual Sites* (EPRI, 2017) was followed. This approach divides LOEs into five separate ASD categories (types):

- Sampling causes (ASD Type I);
- Laboratory causes (ASD Type II);
- Statistical evaluation causes (ASD Type III);
- Natural variation not accounted for in the basic DM statistics (ASD Type IV); and
- Potential natural or anthropogenic sources (ASD Type V).

EPRI (2017) includes detailed checklists that provide a standardized, incremental approach that is followed to determine whether additional LOE evaluations are warranted or not. These checklists include:

- Checklist 1: Sampling, Laboratory, or Statistical Causes (ASD Types I, II, and III);
- Checklist 2: LOEs Associated with the CCR Unit (ASD Type IV); and
- Checklist 3: LOEs Associated with Alternative Natural or Anthropogenic Sources (ASD Type V).

For this ASD only Checklists 1 and 2 were completed. Based on indications from these checklists as well as the CCR unit's topographic and geologic setting, development and operational history, and currently available information and data, it was determined that most of the LOEs in Checklist 3 were either not applicable, indeterminate, or that defensible demonstrations could not be made. As such, additional evaluations of the following site-specific LOEs were performed:

- Regional groundwater chemistry studies/reports;
- Potential existing and historic oil and/or gas extraction well effects; and
- Potential road salt effects.

The findings from the checklist completion activities and site-specific LOE evaluations are summarized in Section 3.0.

3.0 SUMMARY OF FINDINGS

3.1 ASD CHECKLIST 1

ASD Checklist 1 is attached as Table 1 of this report. The checklist evaluations were performed by re-reviewing the CCR groundwater monitoring program's field sampling notes and chain-of-custody forms, laboratory data validation (Level 2) reports, statistical evaluation spreadsheets, and results from field-filtered duplicate samples that were obtained during events where turbid unfiltered samples had been obtained. Referring to Table 1 it's seen that for many potential sampling, laboratory, or statistical evaluation causes, no instances/issues/indications were identified. Turbidity may be a contributing factor in wells MW-129 and -132, since the turbidity was elevated (>10 NTU) in Event 9. There was a significant difference in total Calcium compared to the dissolved concentration in Event 9 for MW-129, but not for MW-132. However, Calcium in MW-129 had high historical variability, and was not correlated with turbidity in this well. For other potential causes where some issues were identified, it was determined that they most likely did not contribute to the Appendix III SSIs. Based on these LOE findings, sampling, laboratory analysis, and statistical evaluations are not demonstrable alternative sources of all the Appendix III SSIs determined for the October 2017 DM event.

3.2 ASD CHECKLIST 2

ASD Checklist 2 is attached as Table 2 of this report. The checklist evaluations were performed by re-reviewing the groundwater analytical results (background and DM) for both Appendix III and IV parameters provided in Tetra Tech (2018), leachate data for the CCR unit provided by FE (summarized in attached Table 3), and hydrogeologic and design information and data included in *CCR Rule Groundwater Monitoring System Evaluation Report for The Ft. Martin Power Station* (Tetra Tech, 2017). For the LOEs in Checklist 2, the following evaluation criteria were used:

- Primary Indicators – As per Table A-1 in EPRI (2017), primary indicator constituents for CCRs include the CCR Rule parameters Boron (Appendix III), Calcium (Appendix III), Chloride (Appendix III), Fluoride (Appendix III and IV), Lithium (Appendix IV), Molybdenum (Appendix IV), and Sulfate (Appendix III), as well as Bromide, Potassium, and Sodium, which are parameters that are not listed in the CCR Rule.
- Secondary Indicators – For this ASD, secondary indicator constituents for CCRs include those Appendix III and IV constituents that are not considered primary indicators.

- Leachate Data – Analytical results from the February 2018 sampling event at the CCR unit (six locations – LM1, LM2, and LM3 for the Original landfill and LM4, LM5 and LM6 for the Expansion Area landfill) were used for comparison to the October 2017 DM results. These results and associated comparisons are attached as Table 3 of this report.
- Site Hydrogeology - As discussed in in the *CCR Rule Groundwater Monitoring System Evaluation Report* (Tetra Tech, 2017), the Connellsville sandstone of the Pennsylvanian Age Conemaugh Group was determined to be the uppermost aquifer at the site for both disposal areas. The Connellsville sandstone is eroded away within two small areas along the southeastern edge of the Original landfill area and along the eastern edge of the Expansion Area landfill; in these areas the underlying Clarksburg formation comprises the uppermost water-bearing unit and is also monitored. Based on the site setting (situated along a broad, relatively flat hilltop) and groundwater water level measurements in the site wells, overall groundwater flow is primarily radial, away from the disposal areas and to the local springs/seeps in the nearby stream valleys. The CCR groundwater monitoring well network at the site is shown on Figure 1 and consists of two background wells (MW-101 for the Connellsville sandstone and MW-128 for the Clarksburg formation), eight downgradient wells (MW-106, -107, and -129 through -134) for the Original Landfill, eight downgradient wells (MW-121, -123, -125, and -135 through -139) for the Expansion Area landfill, and two downgradient wells (MW-109 and -112) positioned along an apparent groundwater divide between the two disposal areas. Geologic and hydrogeologic characteristics of the site and the monitoring well network are discussed in greater detail in the above-referenced report.
- CCR Unit Design - As shown on Figure 1, the CCR unit consists of two adjacent disposal areas, the Original Landfill and the Expansion Area Landfill. Historically, the Original Landfill has been the primary disposal area (pre-2009), and is unlined but was built with a bottom ash drainage blanket placed on the original ground surface that serves as a leachate collection layer. The Expansion Area Landfill was constructed in 2009, is underlain with a composite liner system (geomembrane and geosynthetic clay liner), and has both leachate collection and leak detection layers. The Expansion Area Landfill is permitted to be developed in two construction phases, referred to as Phase 1 and Phase 2. At this time the Phase 1 area (approximately 30 acres) has been constructed and represents the active portion of the Expansion Area Landfill. Stormwater runoff and leachate from the Original Landfill flow to four clay-lined sedimentation ponds (Pond Nos. 3, 4, 5, and 6) while flows from the Expansion Area Landfill discharge to a composite-lined

sedimentation pond (Pond No. 2). Discharges from all the sedimentation ponds are either pumped or flow by gravity to the Station and are routed through the Station's wastewater treatment system.

Based on the LOE findings presented in Table 2, at least one or more of the Appendix III SSIs determined for the October 2017 DM event can most likely be attributed to a release from the CCR unit.

3.3 REGIONAL GROUNDWATER STUDY

In an effort to evaluate the potential for natural variation in groundwater quality in the Connellsville sandstone or Clarksburg formation to impact site groundwater quality regarding the SSI constituents, the *Basic Data Report - Records of Wells, Springs, and Test Borings, Chemical Analyses of Ground Water, and Selected Drillers' Logs from The Monongahela River Basin in West Virginia* (USGS, 1968) was reviewed. As previously noted, the Connellsville sandstone and Clarksburg formation are members of the Conemaugh Group. Table 2 of the subject report included constituent concentration data for a well in the site vicinity producing water from the Conemaugh Group. It is noted that the results were reported as dissolved concentrations while the CCR analytical results are in total (unfiltered) concentrations. In general, total (unfiltered) concentrations for the same sample would be expected to be higher than dissolved concentrations. The following summarizes results reported for this well for constituents at the site which have an SSI: Calcium – 39 mg/L, Chloride – 10 mg/L and Sulfate – 114 mg/L. Data for this well (referred to in this section as "subject well") is also referenced in *Groundwater Hydrology of Monongahela River Basin* (USGS, 1984).

- Clarksburg Wells, Original Landfill - The reported calcium concentration of 39 mg/L in the subject well is higher than the UPL of 11.325 mg/L determined for the background well (MW-128); however, comparing the calcium concentration in the subject well to the downgradient well concentrations would not eliminate the SSIs at any of the wells. The reported chloride concentration of 10 mg/L for the subject well is higher than the background well UPL of 1.067 mg/L. Comparing downgradient concentrations to the chloride concentration in the subject well could potentially eliminate the SSI for MW-130, although the SSI for MW-129 would remain. The reported sulfate concentration of 114 mg/l is also higher than the background well UPL of 2.47 mg/L. Comparing downgradient concentrations to the sulfate concentration in the subject well could potentially eliminate the SSI for MW-130, although the SSI for MW-129 would remain.

- Connellsville Wells, Original Landfill – The reported calcium concentration of 39 mg/L in the subject well is less than the UPL of 79.282 determined for the background well (MW-101). The reported chloride concentration of 10 mg/L for the subject well is also lower than the background well UPL of 54.542 mg/L, however, the reported sulfate concentration of 114 mg/L is higher than the background well UPL of 72.667 mg/L. Comparing downgradient concentrations to the sulfate concentration in the subject well could potentially eliminate the SSI for MW-106, although the SSIs for MW-107, -132, and -133 would remain.

- Connellsville Wells, Expansion Landfill - The reported calcium concentration of 39 mg/L in the subject well is less than the UPL of 79.282 determined for the background well (MW-101), and the reported chloride concentration of 10 mg/L for the subject well is also lower than the background well UPL of 54.542 mg/L. The reported sulfate concentration of 114 mg/l in the subject well is higher than the background well UPL of 72.667 mg/L. Comparing downgradient concentrations to the sulfate concentration in the subject well could potentially eliminate the SSIs for MW-121 and -139, although the SSIs for MW-125 and -138 would remain.

- Connellsville Wells, Both Landfills - The reported calcium concentration of 39 mg/L in the subject well is less than the UPL of 79.282 mg/L determined for the background well (MW-101), and the reported chloride concentration of 10 mg/L for the subject well is also lower than the background well UPL of 54.542 mg/L. The reported sulfate concentration of 114 mg/l is higher than the background well UPL of 72.667 mg/L. Comparing downgradient concentrations to the sulfate concentration in the subject well would not eliminate the SSI for the one downgradient well exhibiting an SSI (MW-109).

In summary, very limited information on the natural variation of SSI constituents was identified under the scope of this ASD. The data for the one nearby well referenced in the public records suggest that natural levels for chloride and sulfate in the site area may be higher than the chloride and sulfate concentrations which resulted in some, but not all, of the SSIs identified for chloride and sulfate.

3.4 POTENTIAL FOR OIL AND GAS WELL IMPACTS

In an effort to evaluate the potential for oil and gas well development on and near the site to impact groundwater quality for the SSI constituents, particularly chloride and TDS, the locations of oil and gas wells and basic information on the wells (e.g., total depth, date drilled, status, etc.)

were obtained from the West Virginia Geologic and Economic Survey (WVGES) online oil and gas well database (http://ims.wvgs.wvnet.edu/WVOG/viewer.htm). Figure 2 presents the locations of these wells relative to the CCR monitoring well network. A total of 14 existing or plugged/abandoned oil and gas wells were identified as shown on Figure 2. The table below summarizes key information for these wells obtained from the database records.

API #	Completion Year	Well Type	Operator	Total Depth (ft)	Deepest Formation
4706100330	1972	Dry	Keystone Gas Co. (Crescent Hills Co)	3058	Speechley
4706101138		Gas	Noumenon Corp, a WV Corp	1429	
4706130016		Gas	Monongahela West Penn Public Service Co.		
4706130058	1933	Gas	House, L. J., Convex Glass Company	3215	Greenland Gap Fm
4706130058		Gas	Federal Gas	1440	Big Injun (Price & equivs)
4706130133		Gas	House, L. J., Convex Glass Company	1310	Big Injun (Price & equivs)
4706130141		Gas	House, L. J., Convex Glass Company	1408	Big Injun (Price & equivs)
4706130154		Gas	House, L. J., Convex Glass Company	1416	Big Injun (Price & equivs)
4706130191	1917	Gas	Manufacturers Light & Heat Co.	1402	Undiff Price below Big Injun
4706130335		Gas	House, L. J., Convex Glass Company	1482	
4706130483	1931	Gas	House, L. J., Convex Glass Company	3010	Greenland Gap Fm
4706130483		Oil	House, L. J., Convex Glass Company	1423	Big Injun (Price & equivs)
4706170375		NA	Carnegie Natural Gas Co.	NA	NA
4706170502		NA	---------- Unknown ----------	NA	NA

The completion dates for most of the wells are unknown, implying they were drilled as part of historic oil and gas well exploration in the area and potentially could have been drilled in the early 1900s or possibly in the late 1800s. A review of data for the other wells indicates they were drilled between 1917 and 1972. The total depths of the wells range from 1310 ft to 3215 ft and they produced from formations including the Big Injun and Speechley. There is also the potential for unidentified poorly plugged oil and gas wells to exist in the area. As indicated on Figure 2, the wells are distributed throughout much of the site. Considering the age of the wells there would seem to be potential for groundwater impacts from corroded/damaged well casing, degrading seals, etc. which could result in out-of-interval migration of oil and gas and formation brine. Potential constituents known to be associated with oil and gas wells include barium, chloride, sodium and elevated TDS levels. At this point in time, insufficient information is available to specifically link impacts to individual CCR wells. It is noteworthy that certain oil and gas wells, including API #'s 4706170502, 4706130483, 4706100330, and 4706130141 are located in upgradient areas of the site.

3.5 POTENTIAL FOR IMPACT FROM ROAD SALTING

To evaluate the potential for road salt to result in elevated chloride levels in groundwater and contribute to SSIs, the concentrations of chloride for the first Detection Monitoring event were plotted (Figure 3). It is noteworthy that the highest concentrations of chloride for the subject event (38.2 mg/L for MW-112 and 37.6 mg/L for MW-101) are for wells located along the Station haul and access roads which bisect the site in an east west direction and to which road salt is applied in the winter months. MW-129, which has an SSI for chloride, is located approximately 700 ft to the south of MW-112 and -101 and in a general downgradient location from the roads. However, insufficient information is currently available to specifically link impacts of road salting to the MW-129 chloride SSI. As discussed in the previous section, the potential also exists for elevated chloride levels in groundwater to result from impacts from the oil and gas wells located on the site.

4.0 CERTIFICATION STATEMENT

In accordance with § 257.94(e)(2) of the CCR Rule, an ASD for Appendix IIII constituents was undertaken for the CCR unit identified herein. Based on the information and data that were available for review, all of the Appendix III SSIs that were identified for the October 2017 Detection Monitoring event could not be attributed to sources other than the CCR unit, errors in sampling, analysis, or statistical evaluation, or from natural variation in groundwater quality. As such, a transition to the applicable requirements of Assessment Monitoring per § 257.95 of the CCR Rule appears to be warranted.

5.0 REFERENCES

USGS, 1968. *Ward, P.E., and Wilmoth, B.M., Records of Wells, Springs, and Test Borings, Chemical Analyses of Ground Water, and Selected Drillers' Logs from the Monongahela River Basin in West Virginia. West Virginia Geological and Economic Survey Basic Data Report 1.*

EPRI, 2017. *Guidelines for Development of Alternative Source Demonstrations at Coal Combustion Residual Sites*. EPRI, Palo Alto, CA: 2017. 3002010920.

Tetra Tech, 2017. *Groundwater Monitoring System Evaluation Report for the Ft. Martin Power Station, Coal Combustion Byproduct Landfill*. Tetra Tech, Inc., Pittsburgh, PA, October 2017.

Tetra Tech, 2018. *2017 Annual CCR Groundwater Monitoring and Corrective Action Report, Coal Combustion Byproduct Landfill, Ft. Martin Power Station*. Tetra Tech, Inc., Pittsburgh, PA, January 2018. http://ccrdocs.firstenergycorp.com/

TABLES

Table 1 - ASD Checklist 1: Sampling, Laboratory, or Statistical Causes

ASD Type	Potential Cause	Evaluation Summary
Sampling Causes (ASD Type I)	Sample mislabeling	No mislabeling found by comparing COCs and lab data identifiers, but one lab ID missing for MW-137 in Event 3 on COC but had been corrected in lab report and database.
	Contamination	No concerns mentioned in field notes or Data Validation Reports.
	Sampling technique	Bladder pumps used on all dates for all wells.
	Turbidity	High turbidity (> 10 NTU) in MW-129, -130 and -132 in Events 3 through 9. Turbidity may be contributing factor in SSI for Ca in MW-129 since total Ca greater than dissolved Ca in Event 9 (Detection Monitoring 1) but sample had high variability and turbidity not as high as in other samples from that well. Differences for Ca in MW-130 and -132 were small, although total was higher than dissolved in Event 9 samples.
	Sampling anomalies	No issues described in field notes.
Laboratory Causes (ASD Type II)	Calibration	Lab calibration issue for Ca in Event 1, so results qualified as "J" for MW-121, -123, -125, -135, -136, -137, -138 and duplicate. SSIs for Ca were in other wells using Event 9 data, so not reason for SSI. No comments on lab calibration in later Data Validation Reports for Appendix III parameters.
	Contamination	No lab contamination noted in lab reports or Data Validation Reports.
	Digestion methods	No differences for Appendix III parameters.
	Dilution corrections	Dilution factors in some events different for Cl and SO4 between wells in same event and between events in same well for some cases. Dilution factors for Ca usually 1, except was 5 in Event 9 for MW-129 and -132 and in Event 4 for MW-107 and -134. All values for Ca, Cl, SO4 detected, so no errors in detection limit calculations.
	Interference	No concerns mentioned in Data Validation Reports, unlikely for Appendix III parameters.
	Analytical methods	Methods same as in CCR GW Monitoring Plan.
	Laboratory technique / qualifier flags	Had low recovery for MS/MSD for Cl in Event 1 (MW-107, -112, -121, -133, and -134) and in Event 9 (MW-109, -121, and -135). Had low recovery for MS/MSD for SO4 in Event 1 (MW-131 and -132), in Event 4 (MW-129, -133, and -134), in Event 5 (MW-106, -121, -133, -136, -138, and -139), and in Event 8 (MW-112, -123, -131, -132, duplicate, -133, and -137). Had low recovery for MS/MSD for F in Event 5 (MW-109, -127, -128 and -130), in Event 6 (MW-106, -128, and -130) and in Event 9 (MW-130). Qualifier flags added appropriately. Not reason for SSI for Cl using background well MW-128 since no bias and none in downgradient wells MW-129 and -130 in Event 9. Not reason for SSI for SO4 since no bias in background wells (MW-128 and -101) or in downgradient wells in Event 9. Background well MW-101 had no bias for F. SSIs for F in associated downgradient wells were MW-107, -109, -125, -132, -135, -136, -138, and -139; these wells had no low bias in Event 9 so not reason for SSI.
	Transcription error(s)	None identified.
Statistical Evaluation Causes (ASD Type III)	Lack of statistical independence	Sampling interval was monthly or longer in background wells MW-101 and -128, which are 2-inch diameter wells in fractured bedrock, so not likely to be a concern.
	Outliers	Apparent outliers in MW-125 and -137 for Event 2. Also, downward trend was observed in MW-132 for Cl, F, SO4 and TDS.
	False positives	One error in SSI classification was found for MW-106 for Cl, which had a lower concentration in Event 9 than the UPL for the associated background well, MW-101. In general, for the case of small sample sizes (e.g., n < 10-20), there is no mathematical algorithm to statistically prove a false positive result without resampling.
	Non-detect processing	Appendix III parameters had all detected values in background well MW-128, in background well MW-101 (except for F in Event 7) and in all 18 downgradient wells for Event 9 used for Detection Monitoring 1.
	Background data / change in normality	No new background data used for Detection Monitoring 1.

Table 2 - ASD Checklist 2: Lines of Evidence Associated with the CCR Unit

	Line of Evidence (LOE)	Determination[1] (Yes, No, ND, N/A)	Indication	LOE Type[2]	Applies to[3]	Weight of Evidence Determination / Basis
Primary CCR Indicators						
1a	If the CCR unit contains fly ash, is there an SSI/SSL for boron and sulfate?	Yes	CCR Release	Key	Monitoring Point	Original Landfill: Yes (this disposal area contains fly ash present on unlined original ground surface).
1b	If the CCR unit contains FGD gypsum (only) is there an SSI/SSL for sulfate?	Yes	CCR Release	Key	Monitoring Point	Expansion Area Landfill: Yes (this disposal area contains primarily FGD gypsum and has a composite liner system).
1c	Are there other constituents in the groundwater that represent primary indicators? List the applicable constituents.	Yes	CCR Release	Supporting	Monitoring Point	Original Landfill: Calcium, Chloride, Fluoride, Lithium, and Molybdenum are all found at detectible levels in multiple downgradient monitoring wells. Expansion Area Landfill: Calcium, Fluoride, and Lithium are all found at detectible levels in multiple downgradient monitoring wells.
1d	Is there an SSI/SSL for any of the other primary indicators?	Yes	CCR Release	Key if No	Monitoring Point	Original Landfill: Calcium (MW-106, -107, -129, -130, and -133), Chloride (MW-129 and -130), and Fluoride (MW-106, -107, -131, and -132) have exhibited SSIs. Lithium (MW-107, -129, -131, -132, and -133) has exhibited elevated downgradient concentrations as compared to background concentrations. No statistical evaluations of Lithium data have been performed as no assessment monitoring sampling has been required to date. Expansion Area Landfill: Calcium (MW-125, -138, and -139) and Fluoride (MW-125, -135, -136, -138, and -139) have exhibited SSIs. Lithium (MW-125 and -138) has exhibited elevated downgradient concentrations as compared to background concentrations. No statistical evaluations of Lithium data have been performed as no assessment monitoring sampling has been required to date.
1e	Is the leachate concentration for any of the primary indicators (including boron and sulfate) with an SSI/SSL statistically higher than background? List the applicable constituents.	Yes	CCR Release	Key if No	Constituent	Original Landfill: Boron, Calcium, Chloride, Molybdenum, and Sulfate – Yes; Fluoride and Lithium not analyzed in leachate sampling program. It is noted that statistical analysis has not been performed on leachate results; evaluation based on the February 2018 leachate sampling event. Expansion Area Landfill: Boron, Calcium, Sulfate – Yes; Fluoride and Lithium not analyzed in leachate sampling program. It is noted that statistical analysis has not been performed on leachate results; evaluation based on the February 2018 leachate sampling event.
1f	Are concentrations for the primary indicators increasing?	No	Uncertain	Supporting	Monitoring Point	Original Landfill: No. It should be noted that the CCR dataset covers a very limited time range (~1 year) for trend analysis. Expansion Area Landfill: No. It should be noted that the CCR dataset covers a very limited time range (~1 year) for trend analysis.
Secondary Indicators						
2a	Are there other SSI(s) or SSL(s) of Appendix III or IV parameters?	Yes	CCR Release	Supporting	Monitoring Point	Original Landfill: Antimony (MW-130 and -132), Arsenic (MW-132), Barium (MW-131 and -134), Molybdenum (MW-132), and Radium 226+228 (MW-106, -133, and -134) have exhibited elevated downgradient concentrations as compared to background concentrations. No statistical evaluations of these Appendix IV constituents have been performed as no assessment monitoring sampling has been required to date.

	Line of Evidence (LOE)	Determination[1] (Yes, No, ND, N/A)	Indication	LOE Type[2]	Applies to[3]	Weight of Evidence Determination / Basis
Secondary Indicators (Continued)						
2a (con't)	(These are potential secondary indicators. List the applicable constituents.)					Expansion Area Landfill: Barium (MW-123, -135, and -137) and Radium 226+228 (MW-123, -125, and -135 through -139) have exhibited elevated downgradient concentrations as compared to background concentrations. No statistical evaluations of these Appendix IV constituents have been performed as no assessment monitoring sampling has been required to date.
2b	Are the constituents identified in 2a present in leachate in concentrations statistically higher than background?	Yes / No	CCR Release	Key if No	Constituent	Original Landfill: Antimony, Arsenic, Molybdenum – Yes; Barium – No; Radium 226+228 not analyzed in leachate sampling program. It is noted that statistical analysis has not been performed on leachate results; evaluation based on the February 2018 leachate sampling event. Expansion Area Landfill: Barium – No; Radium 226+228 not analyzed in leachate sampling program. It is noted that statistical analysis has not been performed on leachate results; evaluation based on the February 2018 leachate sampling event.
2c	Are concentrations for any of the secondary indicators increasing? List the applicable constituents.	No	Uncertain	Supporting	Monitoring Point	Original Landfill: Antimony, Arsenic, Barium, and Molybdenum,– No; Radium 226+228 – Too Variable for Determination. It should be noted that the CCR dataset covers a very limited time range (~1 year) for trend analysis. Expansion Area Landfill: Barium– No; Radium 226+228 – Too Variable for Determination. It should be noted that the CCR dataset covers a very limited time range (~1 year) for trend analysis.
Other Chemistry						
3a	Are organic constituents present in concentrations statistically higher than background?	N/A	-----	Supporting	Monitoring Point	Organics not analyzed as part of groundwater testing program at site.
3b	Is major ion chemistry similar to leachate?	ND	-----	Key	Monitoring Point	Based on primary and secondary indicator LOE's listed above, major chemistry analysis was not performed as part of Appendix III ASD.
3c	Does major ion chemistry suggest a mixture of leachate and background groundwater?	ND	-----			Based on primary and secondary indicator LOE's listed above, major chemistry analysis was not performed as part of Appendix III ASD.
3d	Does tritium age dating indicate that the groundwater was recharged after the facility was first used?	N/A	-----	Key if No	Monitoring Point	Disposal site development initiated in the early 1980's.
3e	Does isotopic analysis show evidence of mixing with CCR leachate?	ND	-----	Key	Monitoring Point	Based on primary and secondary indicator LOE's listed above, isotopic analysis was not performed as part of Appendix III ASD.
Hydrogeology						
4a	Is the monitoring well with an SSI/SSL downgradient from CCR unit at any point during year?	Yes	CCR Release	Key if No	Monitoring Point	Multiple SSIs were identified in the downgradient wells, all of which are positioned downgradient of the disposal site during all times of the year.

	Line of Evidence (LOE)	Determination[1] (Yes, No, ND, N/A)	Indication	LOE Type[2]	Applies to[3]	Weight of Evidence Determination / Basis
Hydrogeology (Continued)						
4b	Review the Hydrogeological vs Leachate Scenario Table (EPRI, Table A-2) and identify the most representative scenario for each SSI or SSL case. List cases and scenario numbers.	-----	-----	Key	Monitoring Point	**Original Landfill** Boron - CCR Leachate Release (Row a) Calcium - CCR Leachate Release (Row a) Chloride - CCR Leachate Release + Possible Alternative Source (Row b) Fluoride - CCR Leachate Release (Row a) pH – CCR Leachate Release (Row a) Sulfate - CCR Leachate Release (Row a) TDS - CCR Leachate Release (Row a) **Expansion Area Landfill** Boron - CCR Leachate Release (Row a) Calcium - CCR Leachate Release (Row a) Chloride - CCR Leachate Release + Possible Alternative Source (Row b) Fluoride - CCR Leachate Release (Row a) pH – CCR Leachate Release (Row a) Sulfate - CCR Leachate Release (Row a) TDS - CCR Leachate Release (Row a)
4c	Is the CCR unit immediately underlain by clay, shale, or other geologic media with low hydraulic conductivity?	Varies	Uncertain	Supporting	Unit	Some areas of site are underlain by clayey colluvial soils, mostly along what were the lower portions of tributary valleys.
4d	Is the monitoring point distant from the facility AND does the constituent with an SSI/SSL have low mobility in groundwater given the hydrogeologic environment at the monitoring location (EPRI, Table A-3)?	No	CCR Release	Supporting	Case	All downgradient monitoring wells are located at the waste boundary.
4e	Are the background monitoring wells screened in the same hydrostratigraphic unit, and along the same groundwater flow path, as the monitoring location with the SSI?	Yes	CCR Release	Supporting	Monitoring Point	The background monitoring wells for the Connellsville sandstone (MW-101) and the Clarksburg formation (MW-128) are screened in same hydrostratigraphic units as their corresponding downgradient wells for both the Original and Expansion Area Landfills.

	Line of Evidence (LOE)	Determination[1] (Yes, No, ND, N/A)	Indication	LOE Type[2]	Applies to[3]	Weight of Evidence Determination / Basis
CCR Unit Design						
5a	Does the entire footprint of the monitored CCR unit have a liner?	Yes / No	CCR Release / Potential Alternate Source	Supporting	Unit	Original Landfill: Entire footprint does not have a liner system. Expansion Area Landfill: Entire footprint has a liner system.
5b	If the facility is lined, is it a composite liner?	Yes	Potential Alternate Source	Supporting	Unit	The Expansion Area Landfill liner system is a composite system comprised of a geosynthetic clay liner (GCL) overlain by a high density polyethylene (HDPE) geomembrane.
5c	Does the entire footprint of the CCR unit have a leachate collection system?	Yes / No	CCR Release / Potential Alternate Source	Supporting	Unit	The entire footprint of the Original Landfill has a bottom ash blanket drain placed on the original ground surface that serves as a leachate collection layer, while the entire footprint of the Expansion Area Landfill includes both a leachate collection system and a leak detection layer.
5d	If the CCR unit is unlined, is it known to have or is it likely to have groundwater intersecting the CCR?	Yes	CCR Release	Supporting	Unit	Given the existence of a number of springs in an undeveloped ravine in the Phase 2 Expansion Area Landfill, it's very likely that similar springs were present in the ravines that were filled during development of the Original Landfill; as such, groundwater likely intersects CCRs in that area.

Table Notes:

1. ND (not determined) indicates that this line of evidence was not tested or there are insufficient data to make a determination; N/A means lines of evidence not applicable to the CCR unit.
2. Line of Evidence (LOE) Types:
   Key lines of evidence are based on relationships that must be observed in order for an SSI/SSL to be due to a release from a CCR unit. If these relationships are not observed, then they are critical to establishing an ASD. It is difficult to build a strong ASD without any key lines of evidence. It may be possible to build an ASD with a single key line of evidence, but the ASD will be stronger with additional key or supporting lines of evidence.
   Supporting lines of evidence provide additional information that supports the ASD. Supporting lines of evidence are generally not sufficient to build an ASD unless there is at least one key line of evidence, although it may be possible if there are many supporting lines of evidence.
3. This LOE applies to:
   Constituent: An SSI/SSL for that constituent at any monitoring point
   Monitoring Point: All SSIs/SSLs at a specific monitoring point
   Case: An SSI/SSL for a specific constituent at a specific monitoring point
   Unit: All SSIs/SSLs at the monitored unit

Table 3.a - Leachate Data Summary (Original Landfill)

	Leachate Concentrations (mg/L)				GW Concentrations (mg/L) Clarksburg Formation							
Parameters	LM1	LM2	LM3	Leachate Avg.	BK UPL (MW-128)	MW-129	MW-130	DG Avg.	Leachate Avg. > BK UPL?	DG Avg. > BK UPL?	MW-129 < Leachate Avg.?	MW-130 < Leachate Avg.?
Boron	17.0	18.1	9.49	14.9	0.236	3.07	0.0685	1.5693	Yes	Yes	Yes	Yes
Calcium	571	565	340	492	11.325	386	56.1	221.1	Yes	Yes	Yes	Yes
Chloride	15.5	18.9	6.93	13.78	1.067	17.5	7.14	12.32	Yes	Yes	No	Yes
pH	8.44	8.62	7.36	8.14	8.181 (6.86)	6.78	7.03	6.91	In Range	In Range	Yes	Yes
Sulfate	1480	1390	767	1212	2.47	1030	88.9	559.5	Yes	Yes	Yes	Yes
TDS	2600	2550	1460	2203	321.42	1987	348	1168	Yes	Yes	Yes	Yes
Antimony	0.001497	0.001502	0.001729	0.001576	0.000576	0.00017	0.0009	0.00054	Yes	No	Yes	Yes
Lithium	----	----	----	----	0.013878	0.01402	0.005	0.0095	----	----	----	----

	Leachate Concentrations (mg/L)				GW Concentrations (mg/L) Connellsville Sandstone																
Parameters	LM1	LM2	LM3	Leachate Avg.	BK UPL (MW-101)	MW-131	MW-132	MW-133	MW-134	MW-106	MW-107	DG Avg.	Leachate Avg. > BK UPL?	DG Avg. > BK UPL?	MW-131 < Leachate Avg.?	MW-132 < Leachate Avg.?	MW-133 < Leachate Avg.?	MW-134 < Leachate Avg.?	MW-106 < Leachate Avg.?	MW-107 < Leachate Avg.?
Boron	17.0	18.1	9.5	14.9	0.111	0.0228	0.232	1.16	0.0293	0.0161	0.815	0.379	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Calcium	571.0	565.0	340.0	492.0	79.282	63.6	9.1	215	56.6	85.1	80.9	85.05	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fluoride	----	----	----	----	0.094	0.151	1.73	0.089	0.028	0.113	0.16	0.379	----	----	----	----	----	----	----	----
pH	8.44	8.62	7.36	8.14	8.11 (6.78)	7.29	8.3	6.93	7.09	7.01	7.03	7.28	> UPL	In Range	Yes	No	Yes	Yes	Yes	Yes
Sulfate	1480	1390	767	1212	72.667	39.8	192	430	5.24	74.4	157	149.74	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TDS	2600	2550	1460	2203	449.118	328	736	1040	252	328	560	541	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Antimony	0.001497	0.001502	0.001729	0.001576	0.00146	0.00017	0.00507	0.00017	0.00017	0.0009	0.00017	0.00111	Yes	No	Yes	No	Yes	Yes	Yes	Yes
Arsenic	0.007207	0.005201	0.001810	0.004739	0.0015	0.00015	0.01251	0.00023	0.00056	0.00018	0.00015	0.00230	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Barium	0.025060	0.021694	0.028593	0.025116	0.092642	0.11174	0.03899	0.01811	0.25906	0.0529	0.02821	0.08484	No	No	No	No	Yes	No	No	No
Lithium	----	----	----	----	0.009909	0.01011	0.03157	0.0214	0.00713	0.00602	0.01511	0.01522	----	----	----	----	----	----	----	----
Molybdenum	1.35697	1.25696	0.701888	1.10527	0.00765	0.00028	0.02836	0.00182	0.00028	0.00208	0.00029	0.00552	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Radium (226+228)	----	----	----	----	0.54	0.3965	0.128	0.7445	1.379	1.622	0.1999	0.7450	----	----	----	----	----	----	----	----

Notes: BK - Background; DG -Downgradient; GW - Groundwater; UPL - Upper Prediction Limit
Leachate Concentrations from sampling performed in February 2018.
GW Concentrations of App. III parameters from sampling and analysis completed in October 2017.
GW Concentrations of App. IV parameters from sampling and analysis completed in August 2017.
BK UPL's based on 8 baseline sampling events.
Two-sided comparison (upper and lower) performed for pH. Comparisons to the BK UPL must fall within the PL range to be considered "No".
LM1 = BA Underdrain flow to Pond No. 3; LM2 = BA Underdrain flow to Pond No. 4; LM3 = BA Underdrain flow to Pond No. 5.

Table 3.b - Leachate Data Summary (Expansion Area Landfill)

	Leachate Concentrations (mg/L)				GW Concentrations (mg/L) Connellsville Sandstone																			
Parameters	**LM4**	**LM5**	**LM6**	**Leachate Avg.**	**BK UPL (MW-101)**	**MW-121**	**MW-123**	**MW-125**	**MW-135**	**MW-136**	**MW-137**	**MW-138**	**MW-139**	**DG Avg.**	**Leachate Avg. > BK UPL?**	**DG Avg. > BK UPL?**	**MW-121 < Leachate Avg.?**	**MW-123 < Leachate Avg.?**	**MW-125 < Leachate Avg.?**	**MW-135 < Leachate Avg.?**	**MW-136 < Leachate Avg.?**	**MW-137 < Leachate Avg.?**	**MW-138 < Leachate Avg.?**	**MW-139 < Leachate Avg.?**
Boron	17.2	0.179	1.34	6.24	0.111	0.0225	0.0055	0.0894	0.0563	0.0315	0.0212	0.105	0.168	0.0624	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Calcium	584	146	114	281	79.282	59.6	68.4	122	66.9	60.5	55.8	267	114	101.8	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fluoride	----	----	----	----	0.094	0.081	0.07	0.129	0.111	0.269	0.068	0.227	0.31	0.158	----	Yes	----	----	----	----	----	----	----	----
Sulfate	1790	90.1	193	691	72.667	82.1	23.1	178	24.3	39.1	15	523	87.8	121.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TDS	6100	452	540	2364	449.118	456	340	724	324	308	248	1215	468	510	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Barium	0.020778	0.119515	0.035171	0.058488	0.092642	0.03485	0.12073	0.0152	0.16274	0.08764	0.13672	0.009725	0.03678	0.07555	No	No	Yes	No	Yes	No	No	No	Yes	Yes
Lithium	----	----	----	----	0.009909	0.00793	0.005	0.01214	0.00809	0.005	0.005	0.014955	0.00972	0.00848	----	No	----	----	----	----	----	----	----	----
Radium (226+228)	----	----	----	----	0.54	0.388	1.184	1	0.971	1.229	1.0695	1.307	1.307	1.057	----	Yes	----	----	----	----	----	----	----	----

Notes: BK - Background; DG -Downgradient; GW - Groundwater; UPL - Upper Prediction Limit
Leachate Concentrations from sampling performed in February 2018.
GW Concentrations of App. III parameters from sampling and analysis completed in October 2017.
GW Concentrations of App. IV parameters from sampling and analysis completed in August 2017.
BK UPL's based on 8 baseline sampling events.
LM4 = Phase 1 LCS; LM5 = Phase 1 UDCS; LM6 = Pond No. 2 LDS

FIGURES

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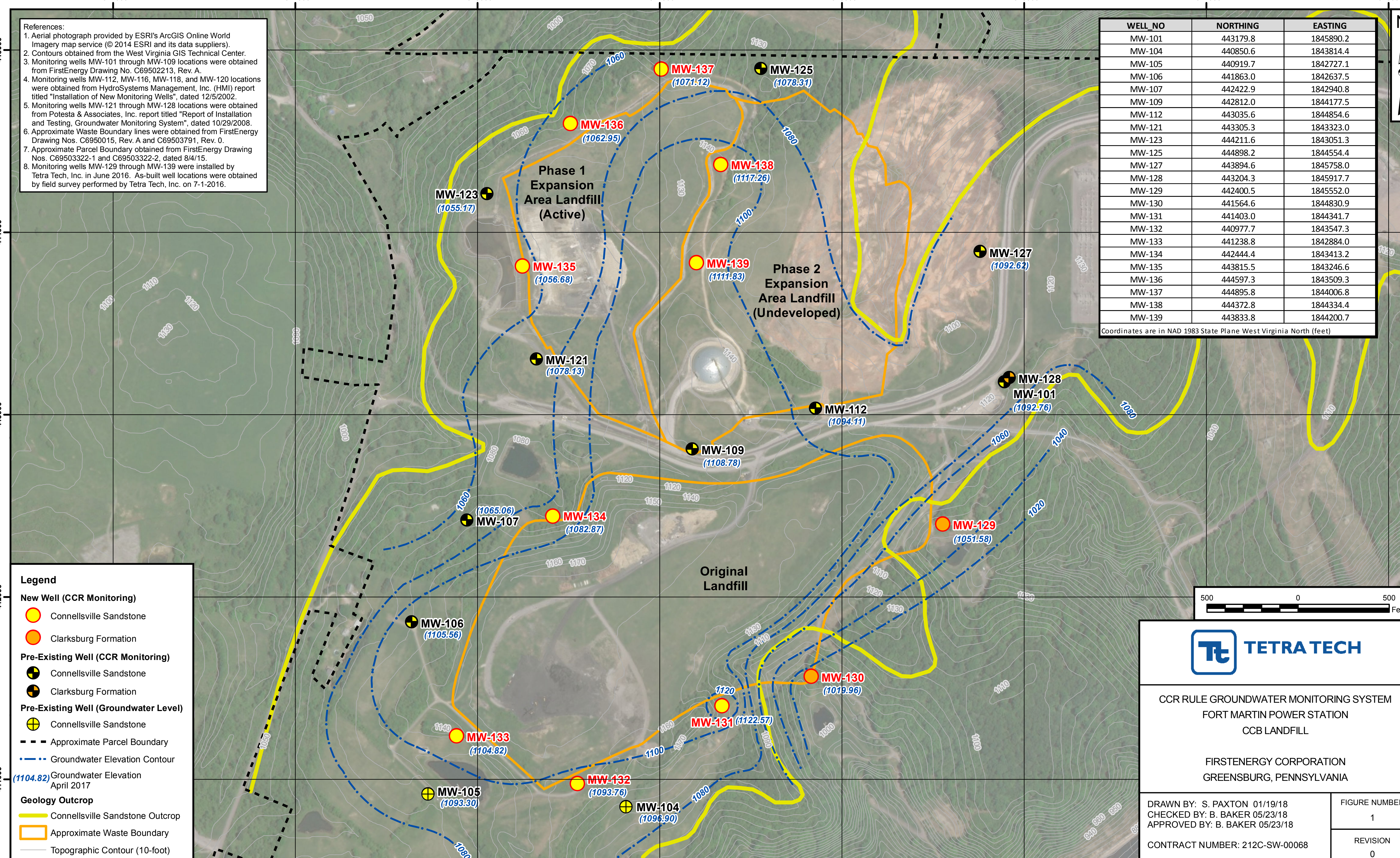

References:
1. Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2014 ESRI and its data suppliers).
2. Contours obtained from the West Virginia GIS Technical Center.
3. Monitoring wells MW-101 through MW-109 locations were obtained from FirstEnergy Drawing No. C69502213, Rev. A.
4. Monitoring wells MW-112, MW-116, MW-118, and MW-120 locations were obtained from HydroSystems Management, Inc. (HMI) report titled "Installation of New Monitoring Wells", dated 12/5/2002.
5. Monitoring wells MW-121 through MW-128 locations were obtained from Potesta & Associates, Inc. report titled "Report of Installation and Testing, Groundwater Monitoring System", dated 10/29/2008.
6. Approximate Waste Boundary lines were obtained from FirstEnergy Drawing Nos. C6950015, Rev. A and C69503791, Rev. 0.
7. Approximate Parcel Boundary obtained from FirstEnergy Drawing Nos. C69503322-1 and C69503322-2, dated 8/4/15.
8. Monitoring wells MW-129 through MW-139 were installed by Tetra Tech, Inc. in June 2016. As-built well locations were obtained by field survey performed by Tetra Tech, Inc. on 7-1-2016.

WELL_NO	NORTHING	EASTING
MW-101	443179.8	1845890.2
MW-104	440850.6	1843814.4
MW-105	440919.7	1842727.1
MW-106	441863.0	1842637.5
MW-107	442422.9	1842940.8
MW-109	442812.0	1844177.5
MW-112	443035.6	1844854.6
MW-121	443305.3	1843323.0
MW-123	444211.6	1843051.3
MW-125	444898.2	1844554.4
MW-127	443894.6	1845758.0
MW-128	443204.3	1845917.7
MW-129	442400.5	1845552.0
MW-130	441564.6	1844830.9
MW-131	441403.0	1844341.7
MW-132	440977.7	1843547.3
MW-133	441238.8	1842884.0
MW-134	442444.4	1843413.2
MW-135	443815.5	1843246.6
MW-136	444597.3	1843509.3
MW-137	444895.8	1844006.8
MW-138	444372.8	1844334.4
MW-139	443833.8	1844200.7

Coordinates are in NAD 1983 State Plane West Virginia North (feet)

Legend

New Well (CCR Monitoring)
- Connellsville Sandstone
- Clarksburg Formation

Pre-Existing Well (CCR Monitoring)
- Connellsville Sandstone
- Clarksburg Formation

Pre-Existing Well (Groundwater Level)
- Connellsville Sandstone
- Approximate Parcel Boundary
- Groundwater Elevation Contour
- (1104.82) Groundwater Elevation April 2017

Geology Outcrop
- Connellsville Sandstone Outcrop
- Approximate Waste Boundary
- Topographic Contour (10-foot)

TETRA TECH

CCR RULE GROUNDWATER MONITORING SYSTEM
FORT MARTIN POWER STATION
CCB LANDFILL

FIRSTENERGY CORPORATION
GREENSBURG, PENNSYLVANIA

DRAWN BY: S. PAXTON 01/19/18
CHECKED BY: B. BAKER 05/23/18
APPROVED BY: B. BAKER 05/23/18

CONTRACT NUMBER: 212C-SW-00068

FIGURE NUMBER 1

REVISION 0

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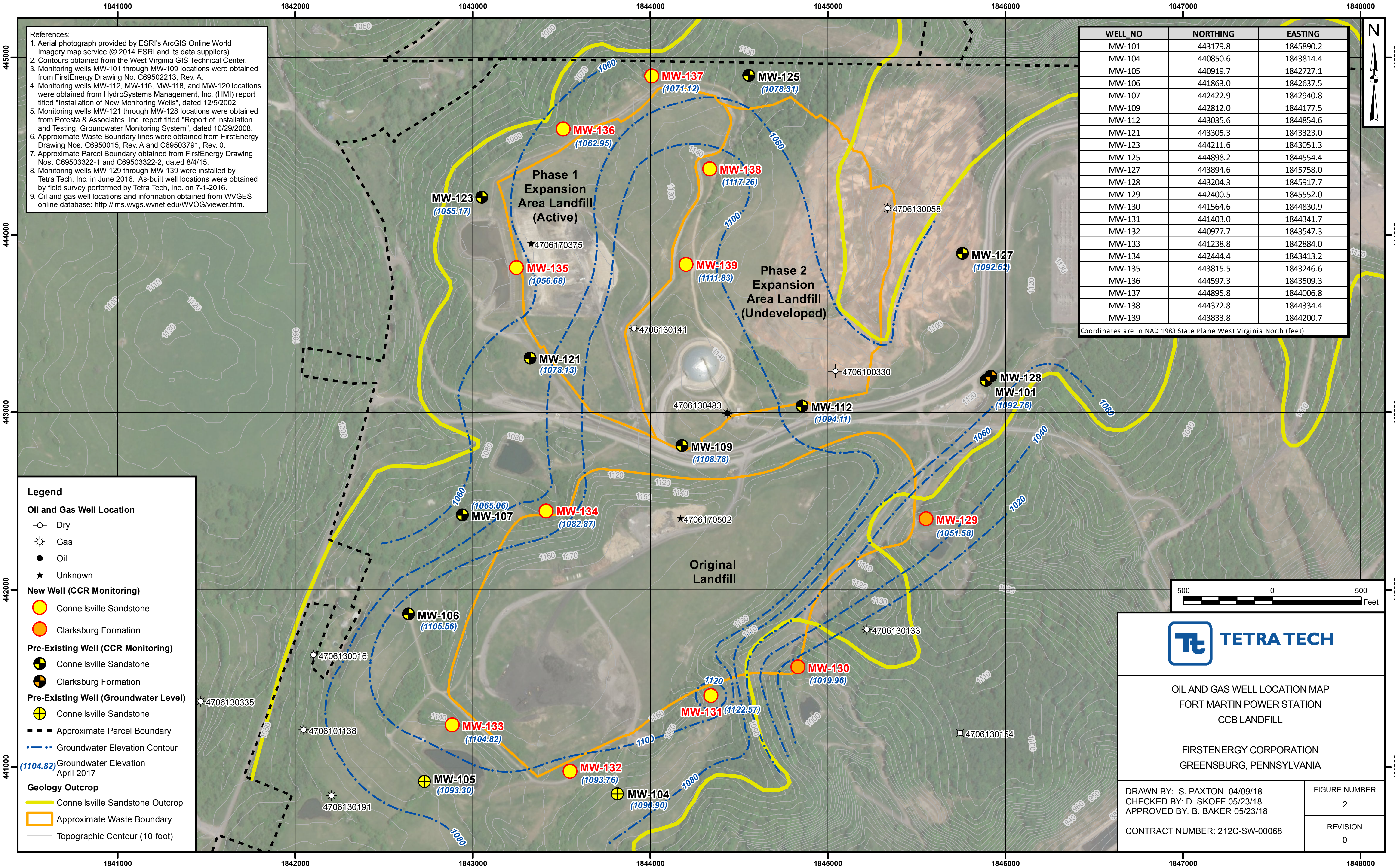

WELL_NO	NORTHING	EASTING
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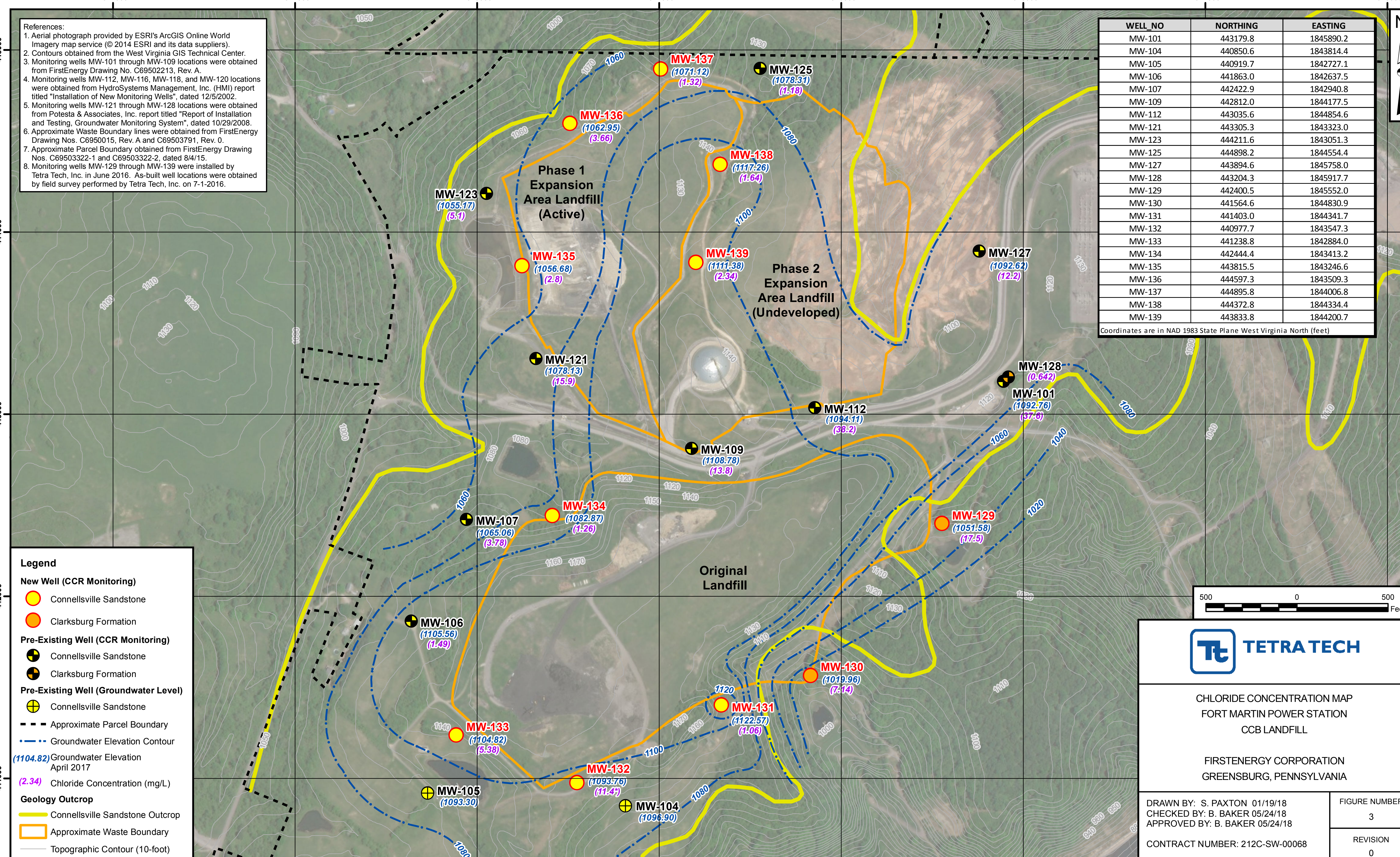
MW-104	440850.6	1843814.4
MW-105	440919.7	1842727.1
MW-106	441863.0	1842637.5
MW-107	442422.9	1842940.8
MW-109	442812.0	1844177.5
MW-112	443035.6	1844854.6
MW-121	443305.3	1843323.0
MW-123	444211.6	1843051.3
MW-125	444898.2	1844554.4
MW-127	443894.6	1845758.0
MW-128	443204.3	1845917.7
MW-129	442400.5	1845552.0
MW-130	441564.6	1844830.9
MW-131	441403.0	1844341.7
MW-132	440977.7	1843547.3
MW-133	441238.8	1842884.0
MW-134	442444.4	1843413.2
MW-135	443815.5	1843246.6
MW-136	444597.3	1843509.3
MW-137	444895.8	1844006.8
MW-138	444372.8	1844334.4
MW-139	443833.8	1844200.7

Coordinates are in NAD 1983 State Plane West Virginia North (feet)



References:
1. Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2014 ESRI and its data suppliers).
2. Contours obtained from the West Virginia GIS Technical Center.
3. Monitoring wells MW-101 through MW-109 locations were obtained from FirstEnergy Drawing No. C69502213, Rev. A.
4. Monitoring wells MW-112, MW-116, MW-118, and MW-120 locations were obtained from HydroSystems Management, Inc. (HMI) report titled "Installation of New Monitoring Wells", dated 12/5/2002.
5. Monitoring wells MW-121 through MW-128 locations were obtained from Potesta & Associates, Inc. report titled "Report of Installation and Testing, Groundwater Monitoring System", dated 10/29/2008.
6. Approximate Waste Boundary lines were obtained from FirstEnergy Drawing Nos. C6950015, Rev. A and C69503791, Rev. 0.
7. Approximate Parcel Boundary obtained from FirstEnergy Drawing Nos. C69503322-1 and C69503322-2, dated 8/4/15.
8. Monitoring wells MW-129 through MW-139 were installed by Tetra Tech, Inc. in June 2016. As-built well locations were obtained by field survey performed by Tetra Tech, Inc. on 7-1-2016.

WELL_NO	NORTHING	EASTING
MW-101	443179.8	1845890.2
MW-104	440850.6	1843814.4
MW-105	440919.7	1842727.1
MW-106	441863.0	1842637.5
MW-107	442422.9	1842940.8
MW-109	442812.0	1844177.5
MW-112	443035.6	1844854.6
MW-121	443305.3	1843323.0
MW-123	444211.6	1843051.3
MW-125	444898.2	1844554.4
MW-127	443894.6	1845758.0
MW-128	443204.3	1845917.7
MW-129	442400.5	1845552.0
MW-130	441564.6	1844830.9
MW-131	441403.0	1844341.7
MW-132	440977.7	1843547.3
MW-133	441238.8	1842884.0
MW-134	442444.4	1843413.2
MW-135	443815.5	1843246.6
MW-136	444597.3	1843509.3
MW-137	444895.8	1844006.8
MW-138	444372.8	1844334.4
MW-139	443833.8	1844200.7

Coordinates are in NAD 1983 State Plane West Virginia North (feet)

Legend

New Well (CCR Monitoring)
- Connellsville Sandstone
- Clarksburg Formation

Pre-Existing Well (CCR Monitoring)
- Connellsville Sandstone
- Clarksburg Formation

Pre-Existing Well (Groundwater Level)
- Connellsville Sandstone
- Approximate Parcel Boundary
- Groundwater Elevation Contour
- (1104.82) Groundwater Elevation April 2017
- (2.34) Chloride Concentration (mg/L)

Geology Outcrop
- Connellsville Sandstone Outcrop
- Approximate Waste Boundary
- Topographic Contour (10-foot)

TETRA TECH

CHLORIDE CONCENTRATION MAP
FORT MARTIN POWER STATION
CCB LANDFILL

FIRSTENERGY CORPORATION
GREENSBURG, PENNSYLVANIA

DRAWN BY: S. PAXTON 01/19/18
CHECKED BY: B. BAKER 05/24/18
APPROVED BY: B. BAKER 05/24/18

CONTRACT NUMBER: 212C-SW-00068

FIGURE NUMBER 3

REVISION 0