2019 ANNUAL CCR RULE GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

COAL COMBUSTION BYPRODUCT LANDFILL

Hatfield's Ferry Power Station
Greene County, Pennsylvania

Prepared for:

FirstEnergy

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Tetra Tech Project No. 212C-SW-00071

January 2020

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1.0 INTRODUCTION

This 2019 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 Hatfield's Ferry Power Station (hereinafter referred to as the "Station"). The Station is located in Greene County, Pennsylvania. This report was developed to comply with the requirements of § 257.90(e) of the federal CCR Rule (40 CFR, Part 257, Subpart D).

1.1 BACKGROUND AND SITE CHARACTERISTICS

CCRs produced at the Station were placed in the facility's captive CCBL, which is located approximately one mile west-southwest of the Station. The landfill is an existing CCR unit that is regulated under Pennsylvania Department of Environmental Protection (PADEP) Solid Waste Permit No. 300370 and the CCR Rule. A PADEP 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. Although CCR generation ceased when the Station closed in 2013, a September 2015 modification to the state permit also allowed CCRs generated at other FirstEnergy facilities to be disposed at the Hatfield CCBL. However, no disposal from any other facilities has occurred to date.

The original topography of the CCBL area has been altered by surface mining of coal (primarily Waynesburg seam) that was performed during the 1970s and 1980s throughout much of the central portion of the site. Mine spoil, in some cases mixed with fly ash, was used as backfill for mined areas. The CCBL consists of three permitted disposal areas: Phase I (approximately 11 acres), Phase II (approximately 20 acres), and Phase III (approximately 107 acres at full build-out). The Phase I and II areas are unlined but do include an underdrain blanket system and are largely overlain by the Phase III area, which has a Pennsylvania Class I Residual Solid Waste liner system that includes two geomembranes, a geosynthetic clay liner (GCL), a leachate collection system, and a leak detection zone. Disposal operations were performed in the Phase I and II areas until 2010, at which time all operations were transitioned to the Phase III area. Between 2009 and 2013, the Phase III area was constructed in stages (referred to as "Steps"): Steps 1, 2, and 3-1, which have a combined lined area of approximately 58 acres. Underdrain flows collected from the Phase I and II areas are routed to two concrete sumps where they are then pumped to a passive wetland treatment system located northeast of the Phase II disposal area. Surface water runoff and leachate collected from the Phase III area are routed to the landfill's Leachate Storage Impoundment (LSI), which is located east of the Phase II and Phase III disposal areas. Like the Phase III area, the LSI has a Class I liner system.

Groundwater in the CCBL area occurs primarily within the unconsolidated mine spoil and underlying upper few feet of highly fractured, weathered shale bedrock, and flow is primarily controlled by topography and by the bedrock structure (i.e., dip). The uppermost aquifer in the CCBL area is the Mine spoil/weathered bedrock aquifer (shallow aquifer) but some of the shallow groundwater also migrates to the underlying Uniontown Sandstone aquifer. Within the footprint of the CCBL the Mine spoil/weathered bedrock and Uniontown Sandstone form a single interconnected flow unit, as the shallow Mine spoil/weathered bedrock groundwater discharges/infiltrates directly into the Uniontown Sandstone north of the former outcrop of the Waynesburg coal. The Uniontown Sandstone is directly underlain by a shale layer that serves as an aquiclude to further vertical groundwater flow downward into other aquifers at the site. The Mine spoil/weathered bedrock unit has been identified as the uppermost aquifer for CCR Rule groundwater monitoring under most of the CCBL area, with the underlying Uniontown Sandstone considered the uppermost aquifer in those CCBL areas located north of the former outcrop of the Waynesburg coal.

Historic and recent groundwater level data indicate groundwater flow within the mine spoil/weathered bedrock aquifer is primarily to the north along the slope of the top of bedrock. A portion of the shallow groundwater in the eastern section of the CCBL (northeast of the waste boundary) also flows eastward. Groundwater in the Uniontown Sandstone aquifer migrates primarily to the northeast and east towards outcrop areas along major drainage features in the area. The historic and recent groundwater data also indicates that the groundwater flow patterns at the site exhibit very little seasonal and temporal fluctuations. A representative set of water level data from the current reporting period (2019) were used for contouring groundwater flow patterns at the site in the interconnected Mine spoil/weathered bedrock and Uniontown Sandstone aquifers. 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 ("AGWMCA 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 Table 3-1);

(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 (see Sections 4.2, 4.3, and 5.0)."

In addition, the Owner or 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 the operating record as required by § 257.106(h)(1), and place the report on the facility's publicly 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 2019 for the CCBL and plans for the upcoming year. Section 3.0 presents Detection Monitoring (DM) results from groundwater sampling events completed in 2019. Section 4.0 presents Assessment Monitoring (AM) results from groundwater sampling events completed in 2019 and discusses both Appendix IV Alternative Source Demonstration (ASD) activities and Nature and Extent of Release Characterization ("N&E Characterization") results from groundwater sampling events completed in 2019. Finally, Section 5.0 presents a summary of the Assessment of Corrective Measures (ACM) activities that were performed for the CCR unit during 2019.

2.0 GENERAL INFORMATION

This section provides an overview of the status of the CCR groundwater monitoring program through 2019 and key activities planned for 2020.

2.1 STATUS OF THE CCR GROUNDWATER MONITORING AND CORRECTIVE ACTION PROGRAM

During calendar year 2019 (January 1st through December 31st), 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 documented in the facility's 2017 and 2018 AGWMCA Reports (accessible at http://ccrdocs.firstenergycorp.com/), the certified CCR monitoring well network consists of three upgradient (background) wells in the Mine spoil/bedrock aquifer (MW-212A, -213A, and -215A), three upgradient (background) wells in the Uniontown Sandstone aquifer (MW-212B, -213B, and -215B), five downgradient wells to monitor the combined aquifer (MW-216A, -220A, -202B, -203B, and -204B), and one piezometer in the Mine spoil/bedrock aquifer (PZ-221A), as summarized in attached Table 2-1 and shown on attached Figure 2-1. The piezometer is being used to evaluate groundwater flow patterns near the northwestern edge of the CCR unit, with provision to convert it to a CCR monitoring well if water level data indicates a flow component in the CCR uppermost aquifer from the CCR unit towards the northwest.

It was originally intended that upgradient wells MW-212A, -213A, and -215A, which are all screened in the mine spoil/weathered bedrock aquifer, would be grouped for statistical evaluation purposes. However, after both the background and the initial detection monitoring sampling events were completed, it was determined that the three wells did not have the level of statistical similarity needed for grouping. As such, it was decided that upgradient well MW-212A would be used to establish background chemistry for the subject aquifer since it exhibited lower concentrations of all the Appendix III parameters than those measured in MW-213A and -215A. MW-213A and -215A were left in place since they are also part of the PADEP groundwater monitoring program and have continued to be sampled as part of the CCR monitoring program should they someday be needed.

Similar to the mine spoil/weathered bedrock aquifer, it was originally intended that upgradient wells MW-212B, -213B, and -215B would be grouped for statistical evaluation purposes. However, after both the background and the initial detection monitoring sampling events were completed it was determined that the availability of sufficient volumes of recoverable water was a recurring problem for MW-212B and -213B. As such, it was decided that only MW-215B would be used to establish background chemistry for the Uniontown Sandstone aquifer as it provided a reliable water yield. MW-212B and -213B were left in place as they also remain part of the PADEP groundwater monitoring program and their water levels have also 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 2019.

2.1.2 Groundwater Monitoring Plan

Consistent with the work performed and summarized in the 2017 and 2018 AGWMCA Reports, the CCR unit's Groundwater Monitoring Plan (GWMP) was followed during all 2019 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 2019.

2.1.3 Background Groundwater Sampling

As documented in the 2017 and 2018 AGWMCA Reports, 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 dataset occurred during 2019.

2.1.4 Statistical Methods

As documented in the 2017 and 2018 AGWMCA Reports, the background dataset discussed in Section 2.1.3 of this Report was used to select the appropriate statistical evaluation methods for each CCR groundwater monitoring parameter to identify any Statistically Significant Increases (SSIs) over background concentrations and determine whether any concentrations were at Statistically Significant Levels (SSLs) above their respective Groundwater Protection Standards (GWPS) established for the site. These statistical methods are available on the facility's publicly accessible website and no changes were made to them during 2019.

2.2 PROBLEMS ENCOUNTERED/RESOLVED

As was noted in the 2018 AGWMCA Report, having sufficient recoverable volumes of groundwater from two of the upgradient wells (MW-212B and -213B) continued to be problematic throughout 2019. These wells have been part of the PADEP groundwater monitoring program for several years and had been able to yield sufficient water even though they have historically exhibited low to moderate standing water column depths. The lack of sufficient recoverable water in these wells was previously believed to be from overstressing them due to the large number of samples that had to be obtained prior to the required CCR groundwater detection monitoring startup date of October 2017. Since the remaining CCR monitoring network still exceeded the minimum required number of downgradient wells, one of the key activities listed in the 2018 AGWMCA Report was to obtain quarterly water levels in MW-212B and -213B and redevelop the wells to determine if one or both of them would be viable for use in the CCR groundwater monitoring network, if they would require a sampling frequency of between six months and one year, as allowed for in 40 CFR § 257.94(d), or if they needed to be abandoned or replaced. Water levels were measured during three of the four quarters of 2019 and are presented below:

Well	Date	Depth to Water (ft)	Total Well Depth (ft)	Total Standing Water Depth (ft)
MW-212B	3/5/2019	206.28	218.6	12.32
	6/17/2019	216.42	218.6	2.18
	7/10/2019	216.11	218.6	2.49
	8/28/2019	213.60	218.6	5.00
MW-213B	3/5/2019	116.63	120.3	3.67
	6/17/2019	116.71	120.3	3.59
	7/10/2019	119.65	120.3	0.65
	8/28/2019	118.40	120.3	1.90

The March, June, July, and August dates listed above correspond to the AM-3, N&E Characterization-1, N&E Characterization-2, and AM-4 sampling events, respectively, that are discussed in Sections 3.0 and 4.0 of this report. During all sampling events both wells dried out during the purging/stabilization stage of sampling and no samples were able to be collected. During the July 2019 sampling event, an attempt was made to redevelop MW-212B and MW-213B via purging and surging; however due to the limited volume of water available redevelopment failed. Based on the water level measurements presented above and the reported field difficulties during well purging, it was determined that using an alternative sampling frequency in accordance with 40 CFR § 257.94(d) would not be viable for MW-212B or -213B. However, given the wells' historical ability to yield sufficient water for sampling, their favorable upgradient positioning, and their continued use in the PADEP monitoring program for providing water levels, it was decided to keep them as part of the CCR groundwater monitoring network for providing water levels. FirstEnergy will continue to assess the viability of keeping the wells in both the

PADEP and CCR monitoring programs by employing a more rigorous redevelopment method such as a surge block/over-pumping with additional water or possibly replacing the wells entirely.

Other than the issues noted above, there were no other significant problems encountered during 2019 with regard to the CCR groundwater monitoring program.

2.3 TRANSITION BETWEEN MONITORING PROGRAMS

As documented in the 2018 AGWMCA Report, the CCR unit transitioned from DM to AM. As part of this transition, all required notifications were issued, appropriate GWPS for Appendix IV parameters were established, and the first two AM sampling events (AM-1 and AM-2) were completed in 2018. The CCR unit remained in Assessment Monitoring throughout 2019, with two additional AM sampling events completed (AM-3 and AM-4) and statistical evaluations of the AM-1, -2, and -3 sampling events being performed. As discussed in Section 4.1 of this Report, statistical evaluations of the AM-1, -2, and -3 data indicated there were SSLs in one or more well comparisons. Based on the parameters for which SSLs were identified, an Appendix IV Alternative Source Demonstration was then undertaken as discussed in Section 4.2 of this Report. However, all of the Appendix IV SSLs that were identified could not be attributed to alternative sources. As such, N&E Characterization activities and an ACM occurred and are discussed in Sections 4.3 and 5.0 of this Report, respectively.

As of December 31, 2019, the CCR unit remained in AM with ongoing N&E Characterization and SoR activities being performed.

2.4 KEY ACTIVITIES PLANNED FOR THE UPCOMING YEAR

The following are the key CCR groundwater compliance activities planned for 2020:

- 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 40 CFR § 257.95(f)] and evaluate the need to update the background data sets and associated UPLs.
- Complete the statistical evaluation of the AM-4 sampling event that occurred in 2019 to determine if there are any other Appendix IV constituent concentrations in the downgradient wells that are at SSLs above applicable GWPS.
- If any new SSLs are identified, provide appropriate notification [per 40 CFR § 257.95(g)] then potentially conduct an Appendix IV ASD [per 40 CFR § 257.95(g)(3)(ii)] to determine if a source other than the CCR unit may be causing the new SSLs. Concurrent with

undertaking an Appendix IV ASD, characterize the Nature and Extent of the new Appendix IV release and provide appropriate notification depending on the findings [per 40 CFR §§ 257.95(g)(1) and (2), respectively].

- If any new SSLs are identified and an ASD is either not undertaken, indicates that an alternative source is not responsible for all the new SSLs identified, or is not completed within 90 days of identifying there are new SSLs, then initiate and perform an Assessment of Corrective Measures for the new SSLs in accordance with 40 CFR § 257.96.
- Continue to assess the viability of keeping MW-212B and/or MW-213B in both the PADEP and CCR monitoring programs or eliminating them from both monitoring programs.
- Conduct SoR activities in compliance with 40 CFR § 257.97(a), which states that as soon as feasible after completion of the ACM, select a remedy that, at a minimum, meets the performance standards listed in 40 CFR § 257.97(b) and the evaluation factors listed in 40 CFR § 257.97(c).
- As required by 40 CFR § 257.97(d), specify, as part of the selected remedy, a schedule(s) for implementing and completing remedial activities. The schedule will require the completion of remedial activities within a reasonable period of time taking into consideration the factors set forth in 40 CFR §§ 257.97(d)(1) through (d)(6).
- As required by 40 CFR § 257.97(a), prepare a semi-annual report describing the progress in selecting and designing the remedy. The first semi-annual report will be prepared in the Spring of 2020.
- Should all required SoR activities be completed in 2020, prepare a final report describing the selected remedy. The final report will include a certification from a qualified professional engineer that the remedy selected meets the requirements of the CCR Rule selection criteria and the final report will be placed in the facility's operating record as required by § 257.105(h)(12).
- As required by 40 CFR § 257.96(e), discuss the results of the ACM at least 30 days prior to the final SoR, in a public meeting with interested and affected parties.

3.0 DETECTION MONITORING INFORMATION

3.1 GROUNDWATER ANALYTICAL RESULTS SUMMARY

As noted in Section 2.3, site-wide Assessment Monitoring was performed throughout 2019. As part of the AM program, all DM (Appendix III) parameters were also analyzed during each AM sampling event. This exceeds the requirements of 40 CFR § 257.95 which only stipulates analyzing Appendix III parameters during every other AM sampling event.

The need to statistically analyze the 2019 Appendix III data to identify SSIs and determine if AM was necessary was precluded by the CCR unit already being in AM during all of 2019, so no statistical analysis of the data was necessary. The 2019 Appendix III data that was collected and validated is presented in Table 3-1 with the intent of using it during the next update of the background dataset and associated UPLs, which will help increase the statistical power of future analyses.

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 2019 consisted of two AM sampling events (AM-3 and AM-4) performed between March 6 and 13, 2019 and between August 28 and September 4, 2019, respectively. For AM-3 and AM-4 all Appendix III and all Appendix IV parameters were analyzed except for combined radium 226/228 during AM-4. This exceeds the requirements of 40 CFR § 257.95(d)(1) which only stipulates analyzing for detected AM parameters during every other AM sampling event. Laboratory analysis and validation of the sample data were completed on July 13, 2019 and January 14, 2020 for AM-3 and AM-4, respectively. Table 3-1 presents the validated analytical results for these events.

Statistical evaluations of AM data performed in 2019 included sampling events AM-1, AM-2, and AM-3. As noted in the 2018 AGWMCA Report, evaluations of data from sampling events AM-1 and AM-2 ended up being completed in January 2019 since receipt of outstanding validated results occurred late in the fourth quarter of that year. Statistical evaluation of AM-3 data was completed in August 2019 while evaluation of AM-4 data remains in-progress as of the end of the 2019 reporting period since receipt of validated AM-4 data occurred late in the fourth quarter of 2019 and a 90-day period is allowed by the CCR Rule for statistical evaluation, which falls in the first quarter of 2020. All statistical evaluation work was performed in accordance with the certified methods included in both the facility's operating record and the publicly accessible website and the results were used to determine whether there were any detected Appendix IV parameters at SSLs above the CCR unit's established GWPS. As documented in the 2018 AGWMCA Report, site-specific Appendix IV GWPS were established for the CCR unit using the higher of the federal Maximum Contaminant Level (MCL) or UPL for each parameter or, for those parameters that don't have MCLs, the higher of the EPA Risk Screening Level (RSL) or the UPL. The site-specific GWPS and the results of the statistical evaluations of AM-1, -2, and -3 are presented in Tables 4-1 and 4-2 for the combined mine spoil/bedrock and Uniontown Sandstone aquifers, respectively, and discussed below.

Statistical evaluation of the AM-1 and AM-2 data identified cobalt and lithium in two mine spoil/bedrock aquifer downgradient monitoring wells and lithium in two Uniontown Sandstone aquifer downgradient monitoring wells as the only parameters detected at concentrations greater than their respective GWPS. In accordance with 40 CFR § 257.106(h)(6), a notice was prepared and posted to the facility's operating record in February 2019, issued to the PADEP, and then posted on the facility's publicly accessible website in April 2019, to provide notification of the SSLs for cobalt and lithium at the CCR unit. During this same notification period and in accordance with 40 CFR § 257.95(g)(3)(ii), an Appendix IV ASD was initiated to assess the AM-1 and AM-2 findings (and later incorporated the AM-3 findings), as discussed in Section 4.2 of this Report. Results from statistical analysis of the AM-3 data were consistent with the previous AM results for cobalt and lithium with the exception that lithium was found at a concentration below its GWPS in one of the Mine spoil/bedrock aquifer wells (MW-220A) where it had previously been above the GWPS in AM-1 and AM-2. As shown in Tables 4-1 and 4-2, to date, no other Appendix IV constituents have been detected at SSLs above the their GWPS under the facility's AM program.

4.2 APPENDIX IV ALTERNATIVE SOURCE DEMONSTRATION

40 CFR § 257.95(g)(3)(ii) allows the owner or operator of a CCR unit 90 days from the date of determining that an SSL has occurred to demonstrate that a source other than the CCR unit caused the SSL or that the apparent SSL was from a source other than the CCR unit or that it had resulted from errors in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Pursuant to § 257.94(g)(3)(ii), an ASD was undertaken to assess if the Appendix IV SSLs determined for AM-1, -2, and -3 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 IV ASD activities and findings is included as Attachment A of this Report and summarized below.

For the Appendix IV 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 AM statistics (ASD Type IV); and Potential natural or anthropogenic sources (ASD Type V). As detailed in Attachment A, LOE Types I through V were assessed along with the following additional site-specific Type V LOEs: Regional groundwater chemistry studies/reports; Potential for groundwater impacts related to mine spoil; and Potential for groundwater impacts related to historical vehicle maintenance activities conducted at the site.

Based on the information and data included in Attachment A, the lithium SSLs that were identified for the AM-1, -2, and -3 events could not be solely attributed to sources other than the CCR unit, to errors in sampling, analysis, or statistical evaluation, or from natural variation in groundwater quality. However, for cobalt, evidence exists that the CCR unit, combined with impacts from an as-yet unidentified alternate source (e.g., historical maintenance activities conducted near the LSI), are likely the causes of elevated cobalt concentrations observed in MW-216A and MW-220A, which were the only wells to exhibit cobalt SSLs. Based on the Appendix IV ASD findings and recommendations, a transition to the applicable requirements of ACM for lithium per § 257.96 of the CCR Rule was determined to be warranted along with continued AM of cobalt.

4.3 NATURE AND EXTENT OF RELEASE CHARACTERIZATION

Pursuant to 40 CFR § 257.95(g)(1), following identification of SSLs greater than their respective GWPS and concurrent with performing the Appendix IV ASD, a N&E Characterization was initiated at the site. The N&E Characterization program is discussed in detail in the ACM Report prepared for the CCR unit and posted on the facility's publicly accessible website. The scope of the N&E Characterization program included the following:

- Reviewing background information on the occurrence of lithium and fate and migration characteristics of lithium in groundwater.
- Evaluating groundwater flow patterns at the site to establish that the existing CCR and PADEP well networks fulfilled the requirement of 40 CFR § 257.95(g)(3)(iii) of having at least one monitoring well positioned at the facility boundary in the direction of contaminant migration and that installation of additional monitoring wells did not appear necessary for N&E Characterization. Eleven additional existing monitoring wells were sampled as part of two rounds of N&E Characterization performed at the site.
- Establishing a N&E Characterization sampling and analysis program which consisted of the two regularly scheduled 2019 AM events (AM-3 and AM-4) for the CCR monitoring wells at the site and two sampling events performed in June and July 2019 dedicated solely to N&E Characterization including the eleven additional monitoring wells noted above and as discussed in greater detail in the 2019 ACM Report.
- Delineating the extent of lithium in site groundwater based on the N&E Characterization sampling and analysis program.

The N&E Characterization found that the highest concentrations of lithium occur in the wells and piezometers surrounding the LSI (east of the CCR unit). The next highest concentrations occur along the northern edge of the CCR unit in wells that encompass both the Mine Spoil/weathered bedrock and Uniontown Sandstone aquifers. It appears that downgradient attenuation of the lithium concentrations to the background UPLs is occurring along both the northern and eastern directions of flow based on interpolation of the measured concentration gradients in several areas along the parcel boundary. Based on these interpretations, lithium concentrations in groundwater that are at or slightly above the site's GWPS are located between 500 and 5,000 feet upgradient of the FE property line and that lithium does not appear to be migrating off-site. In response to these findings, N&E Characterization work was determined to be completed.

Potentially impacted groundwater flows downgradient of the landfill (to the north and east) are expected to undergo additional attenuation based on a combination of advection, dispersion, and, potentially, natural dilution, resulting in concentrations that are anticipated to be below the lithium GWPS before flow reaches a potential receptor, with the nearest potential groundwater supply user in the downgradient flow path being located several thousand feet away from the facility boundary and across the Monongahela River, which acts as a hydraulic divide. However, since lithium concentrations greater than the GWPS could potentially occur on FE property in the area situated immediately downgradient of the facility boundary and potentially interact with nearby surface water features, an ACM was performed as discussed in Section 5.0 of this Report.

5.0 ASSESSMENT OF CORRECTIVE MEASURES

5.1 ACM NOTIFICATIONS

As discussed in Section 4.0, CCR Rule groundwater assessment monitoring conducted at the site identified lithium concentrations in certain downgradient CCR monitoring wells which were at SSLs that exceeded the GWPS for lithium, resulting in the need to conduct an ACM per 40 CFR § 257.96. The following summarizes the notifications related to the ACM:

- On April 15, 2019, pursuant to 40 CFR §§ 257.95(g)(3)(i) and 257.105(h)(9), FE provided notification in the facility's operating record that an ACM had been initiated for lithium and cobalt in groundwater at the site. The notification was posted to the publicly accessible website on June 12, 2019.
- On July 15, 2019, pursuant to 40 CFR § 257.96(a), FE provided a demonstration in the facility's operating record that, based on hydraulic characteristics of the uppermost aquifer at the site, an additional 60 days was required to complete the ACM.
- Pursuant to 40 CFR § 257.96(d), the ACM Report was posted in the operating record and to the publicly accessible website by October 16, 2019.

5.2 ACM REPORT SUMMARY

As required by 40 CFR § 257.96(c), the ACM included an analysis of the effectiveness of potential corrective measures in meeting the remedy requirements and objectives as described under 40 CFR § 257.97. The ACM Report evaluated the following corrective measures against the referenced criteria: Source Control, Groundwater Extraction and Treatment, In-Situ Technologies and Monitored Natural Attenuation.

Based on the evaluation of viable remediation technologies, Monitored Natural Attenuation (MNA), combined with source control by continued operation of the Phase I/II underdrain and treatment wetland systems, and the eventual installation of the CCBL's state-permitted composite cover system, ranked highest among the evaluated options. Also, additional sampling of the groundwater monitoring well network inclusive of the eleven wells added as part of N&E Characterization was recommended to confirm there are not seasonal changes that could impact remedy effectiveness. The candidate corrective measures will be further evaluated in 2020 as part of the Selection of Remedy process discussed in Section 7.0 of the ACM Report.

TABLES

TABLE 2-1
CCR RULE GROUNDWATER MONITORING SYSTEM WELL SUMMARY
HATFIELD CCB LANDFILL – 2019 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
Upgradient (Background)							
MW-212A	2005	Mine Spoil/ Weathered Bedrock	1188.50	145.5	125.5 – 145.5	1043.00 – 1063.00	2" - Sch. 40 PVC
MW-213A	2005	Mine Spoil/ Weathered Bedrock	1083.80	54.5	34.5 – 54.5	1029.30 – 1049.30	2" - Sch. 40 PVC
MW-215A	2005	Mine Spoil/ Weathered Bedrock	1103.90	80.0	60.0 – 80.0	1023.90 – 1043.90	2" - Sch. 40 PVC
MW-212B*	2005	Uniontown SS	1188.80	216.0	196.0 – 216.0	972.80 – 992.80	2" - Sch. 40 PVC
MW-213B*	2005	Uniontown SS	1083.00	118.0	98.0 – 118.0	965.00 – 985.00	2" - Sch. 40 PVC
MW-215B	2005	Uniontown SS	1104.40	143.5	123.5 – 143.5	960.90 – 980.90	2" - Sch. 40 PVC
Downgradient							
MW-216A	2005	Mine Spoil/ Weathered Bedrock	1059.50	42.3	22.0 – 42.0	1017.50 – 1037.50	2" - Sch. 40 PVC
MW-220A	2016	Mine Spoil/ Weathered Bedrock	1062.25	57.3	47.0 – 57.0	1005.25 – 1015.25	2" - Sch. 40 PVC
MW-202B	1993	Uniontown SS	969.59	38.0	28.0 – 38.0	931.59 – 941.59	2" - Sch. 40 PVC
MW-203B	1993	Uniontown SS	976.49	42.4	22.4 – 42.4	934.09 – 954.09	2" - Sch. 40 PVC
MW-204B	1993	Uniontown SS	974.89	40.0	20.0 – 40.0	934.89 – 954.89	2" - Sch. 40 PVC
Piezometer							
PZ-221A*	2016	Mine Spoil/ Weathered Bedrock	1084.77	55.2	45.0 – 55.0	1029.77 – 1039.77	2" - Sch. 40 PVC

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

TABLE 3-1

CCR RULE GROUNDWATER ASSESSMENT MONITORING ANALYTICAL RESULTS SUMMARY

HATFIELD CCB LANDFILL - 2019 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
13 (AM-3)	MW-202B	3/7/2019	12.336	640	--	--	--	--	--	0.00107 U	0.00035	0.01121 U	0.00166	0.00067 U	0.00145 U	0.00723	0.00052 U	0.14286	0.00016 U	0.00113 U	0.0034 U	0.00017 U	0.0217 U	0.136 U
13 (AM-3)	MW-202B	3/13/2019	--	--	3.44	0.137 J-	6.54	2200	14000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
16 (AM-4)	MW-202B	8/28/2019	12.2	583	3.77	0.15 J-	6.55 J	2260	6600	0.00107 U	0.00035 U	0.0136 U	0.00063	0.00067 U	0.00145 U	0.00798	0.00052 U	0.14088	0.00016 U	0.00113 U	0.0034 U	0.00017 U	--	--
13 (AM-3)	MW-203B	3/12/2019	5.7	461	17.9	0.101	6.55	1130	2346.667	0.00107 U	0.00035 U	0.0144	0.00071	0.00067 U	0.00145 U	0.0009 J	0.00052 U	0.02572	0.00016 U	0.00113 U	0.0034 U	0.00017 U	-0.00088 U	0.265 U
16 (AM-4)	MW-203B	8/28/2019	3.57	319	7.39	0.117 J-	6.71 J	3660	1813.333	0.00107 U	0.00035 U	0.0136 U	0.00022 U	0.00067 U	0.00145 U	0.00051 J	0.00052 U	0.02757	0.00016 U	0.00113 U	0.0034 U	0.00017 U	--	--
13 (AM-3)	MW-204B	3/7/2019	10.698	514	--	--	--	--	--	0.00107 U	0.00035 U	0.01377	0.0012	0.00067 U	0.00145 U	0.00099 J	0.001	0.09308	0.00016 U	0.00113 U	0.0034 U	0.00017 U	-0.0229 U	0.656
13 (AM-3)	MW-204B	3/13/2019	--	--	2.84	0.084 J	6.56	1860	5100	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
16 (AM-4)	MW-204B	8/28/2019	11.961	546	3.12	0.142 J-	6.56 J	2210	6133.333	0.00107 U	0.00035 U	0.0136 U	0.00055	0.00067 U	0.00145 U	0.00088 J	0.00052 U	0.13088	0.00016 U	0.00113 U	0.0034 U	0.00017 U	--	--
13 (AM-3)	MW-212A	3/12/2019	2.2	47.7	1.68	0.025 U	7.54	113	1433.333	0.00107 U	0.00035 U	0.02461	0.00034	0.00067 U	0.00145 U	0.00047 U	0.00052 U	0.05135	0.00016 U	0.00194	0.0034 U	0.00017 U	0.00278 U	0.244 U
16 (AM-4)	MW-212A (D)	9/3/2019	2.76	82.181	1.12	0.176	7.8 J	752	1696	0.00107 U	0.00035 U	0.028 J	0.00043 J	0.00067 U	0.00145 U	0.00047 U	0.00052 U	0.06856	0.00016 U	0.00332 J	0.0034 U	0.00017 U	--	--
16 (AM-4)	MW-212A	9/4/2019	2.7	80.336	1.09	0.161	7.7 J	748	1793.333	0.00107 U	0.00035 U	0.02847 J	0.00043 J	0.00067 U	0.00145 U	0.00047 U	0.00052 U	0.06556	0.00016 U	0.00333 J	0.0034 U	0.00017 U	--	--
13 (AM-3)	MW-212B	3/12/2019	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]
16 (AM-4)	MW-212B	9/3/2019	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]
13 (AM-3)	MW-213A	3/6/2019	5.36	83.264	2.72	0.12	8.5	153	372	0.00398	0.02246	0.04812	0.00067	0.00067 U	0.00145 U	0.00047 U	0.00052 U	0.03538	0.00016 U	0.05353	0.0034 U	0.00017 U	0.0699 U	0.111 U
16 (AM-4)	MW-213A	9/3/2019	4.209	80.931	2.66	0.153	8.1 J	128	388	0.00151 J	0.02093	0.05123 J	0.00068 J	0.00067 U	0.00145 U	0.00047 U	0.00052 U	0.02863	0.00016 U	0.04787	0.0034 U	0.00017 U	--	--
13 (AM-3)	MW-213B	3/6/2019	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]
16 (AM-4)	MW-213B	9/3/2019	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	NS[4]	--	--
13 (AM-3)	MW-215A	3/6/2019	10.941	395	3.34 J-	0.204 J-	6.71 J	1950	4120	0.00107 U	0.00035 U	0.0136 U	0.00127	0.00067 U	0.00145 U	0.00083 J	0.00052 U	0.12613	0.00016 U	0.00113 U	0.0034 U	0.00017 U	0.0981	-0.186 U
16 (AM-4)	MW-215A	9/4/2019	12.738	390	3.53	0.178	6.51 J	1870	3400	0.00107 U	0.00035 U	0.0136 U	0.00193	0.00067 U	0.00145 U	0.00128	0.00052 U	0.12939	0.00016 U	0.00113 U	0.0034 U	0.00017 U	--	--
13 (AM-3)	MW-215B	3/6/2019	0.4329	13.142	8.49 J-	1.77 J-	7.69 J	400	1350	0.00107 U	0.00035 U	0.03096	0.00022 U	0.00067 U	0.00145 U	0.00047 U	0.00052 U	0.0815	0.00016 U	0.00387	0.0034 U	0.00017 U	0.116	0.0433 U
16 (AM-4)	MW-215B	9/4/2019	0.4027	14.662	7.86	1.69	7.44 J	431	1255	0.00107 U	0.00035 U	0.06563	0.00022 U	0.00067 U	0.00145 U	0.0006 J	0.00052 U	0.07944	0.00016 U	0.00194	0.0034 U	0.00017 U	--	--
13 (AM-3)	MW-216A (D)	3/7/2019	5.38	373	--	--	--	--	--	0.00107 U	0.0014	0.0136 U	0.0008	0.00067 U	0.00145 U	0.4864	0.00052 U	0.12247	0.00016 U	0.00113 U	0.00398	0.00017 U	0.0763 U	0.745
13 (AM-3)	MW-216A	3/7/2019	5.25	358	--	--	--	--	--	0.00107 U	0.00153	0.0136 U	0.00081	0.00067 U	0.00145 U	0.48832	0.00052 U	0.12509	0.00016 U	0.00113 U	0.00419	0.00017 U	0.134	0.726
13 (AM-3)	MW-216A (D)	3/13/2019	--	--	4.43	0.079 J	5.65	1650	2720	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
13 (AM-3)	MW-216A	3/13/2019	--	--	4.42	0.049 J	5.7	1640	3625	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
16 (AM-4)	MW-216A	8/28/2019	7.25	340	5.26	0.09 J	5.64 J	1520	3475	0.00107 U	0.00132	0.01463	0.0005	0.00067 U	0.00145 U	0.40818	0.00052 U	0.13142	0.00016 U	0.00113 U	0.00419	0.00017 U	--	--
13 (AM-3)	MW-220A	3/7/2019	4.08	351	--	--	--	--	--	0.00107 U	0.00416	0.0178	0.00059	0.00067 U	0.00145 U	0.12682	0.00052 U	0.08263	0.00016 U	0.00113 U	0.0034 U	0.00017 U	0.109	0.291 U
13 (AM-3)	MW-220A	3/12/2019	--	--	5.65	0.025 U	5.96	1370	2326.667	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
16 (AM-4)	MW-220A	8/29/2019	4.14	340	5.31	0.053 J	5.92 J	1470	2600	0.00107 U	0.0049	0.01814 J	0.00066 J	0.00067 U	0.00145 U	0.14876	0.00052 U	0.08708	0.00016 U	0.00113 U	0.0034 U	0.00017 U	--	--

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: 68-00340, EPA Region: 3, Expiration Date: 08-31-20.

[2] Event Nos. 13 and 16 correspond to Assessment Monitoring (AM) sampling events AM-3 and AM-4, respectively.

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

[4] NS = not sampled. For MW-212B and MW-213B this was due to insufficient volumes of recoverable water in both wells.

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 4-1
CCR RULE INTERWELL COMPARISON OF SAMPLING EVENT AM-1, -2, AND -3 APPENDIX IV DATA

Mine Spoil/Bedrock							Event 11 (AM-1) Downgradient Wells					
Parameter	Units	Data Distribution for Upgradient Well MW-212A	UPL Type	UPL Value[a,b]	Federal MCLs/RSLs	GWPS	MW-216A	MW-220A				
Antimony	mg/L	Unknown[c]	DQ[d]	NA	0.006	0.006	<0.00017	<0.00017				
Arsenic	mg/L	Normal	Parametric	0.000562	0.01	0.01	<0.001	<0.00017				
Barium	mg/L	Normal	Parametric	0.027541	2	2	0.0137	0.01533				
Beryllium	mg/L	Unknown[c]	DQ[d]	NA	0.004	0.004	<0.00022	<0.00044				
Cadmium	mg/L	Unknown[c]	DQ[d]	NA	0.005	0.005	0.00018	<0.00017				
T. Chromium	mg/L	Unknown[c]	DQ[d]	NA	0.1	0.1	<0.00045	<0.00045				
Cobalt	mg/L	Unknown	Poisson	0.00849	0.006	0.00849	0.37723	0.09809				
Fluoride	mg/L	Normal	Parametric	0.272	4	4	0.071	0.062				
Lead	mg/L	Unknown[c]	DQ[d]	NA	0.015	0.015	<0.00052	<0.00052				
Lithium	mg/L	Normal	Parametric	0.083052	0.04	0.083052	0.12895	0.0852				
Mercury	mg/L	Unknown	Poisson	0.00032	0.002	0.002	<0.00004	<0.00004				
Molybdenum	mg/L	Normal	Parametric	0.01763	0.1	0.1	<0.00028	<0.00028				
Selenium	mg/L	Unknown[c]	DQ[d]	NA	0.5	0.5	<0.0011	<0.0011				
Thallium	mg/L	Unknown[c]	DQ[d]	NA	0.002	0.002	<0.00017	<0.00017				
Sum Ra226+Ra228	pCi/L	Unknown	Non-parametric	1.174	5	5	<0.516	<0.419				

Event 11 (AM-1) Upgradient Well MW-212A	
0.00017	U
0.000183	J
0.023135	
0.00022	U
0.00017	U
0.00045	U
0.00047	U
0.251	
0.00052	U
0.05929	
0.00004	U
0.00237	J
0.00097	J
0.00017	U
<0.230	U

[a]Prediction Limits calculated using 5% alpha.
[b]Upper Prediction Limit used for all parameters.
[c]Data distribution set to Unknown if all values non-detect in upgradient well.
[d]DQ is Double Quantification Rule. If Event 11 sample is detectible, will need to resample the downgradient well to see if two successive, independent detected values occur. If so, that would be an SSI. If value was detected in upgradient well in Event 11, would use Poisson PL instead.

#.#### = UPL > Result > MCL/RSL
= SSI < GWPS
= SSI > GWPS
= DQ Parameter with Verification Sampling Needed

Mine Spoil/Bedrock							Event 12 (AM-2) Downgradient Wells					
Parameter	Units	Data Distribution for Upgradient Well MW-212A	UPL Type	UPL Value[a,b]	Federal MCLs/RSLs	GWPS	MW-216A	MW-220A				
Antimony	mg/L	Unknown[c]	DQ[d]	NA	0.006	0.006	<0.00017	<0.00017				
Arsenic	mg/L	Normal	Parametric	0.000562	0.01	0.01	0.00081	0.00452				
Barium	mg/L	Normal	Parametric	0.027541	2	2	0.013	0.01511				
Beryllium	mg/L	Unknown[c]	DQ[d]	NA	0.004	0.004	<0.00022	<0.00044				
Cadmium	mg/L	Unknown[c]	DQ[d]	NA	0.005	0.005	0.00021	<0.00017				
T. Chromium	mg/L	Unknown[c]	DQ[d]	NA	0.1	0.1	<0.00045	<0.00045				
Cobalt	mg/L	Unknown	Poisson	0.00849	0.006	0.00849	0.43337	0.11075				
Fluoride	mg/L	Normal	Parametric	0.272	4	4	0.096	0.067				
Lead	mg/L	Unknown[c]	DQ[d]	NA	0.015	0.015	<0.00052	<0.00052				
Lithium	mg/L	Normal	Parametric	0.083052	0.04	0.083052	0.15065	0.09511				
Mercury	mg/L	Unknown	Poisson	0.00032	0.002	0.002	<0.00004	0.00014				
Molybdenum	mg/L	Normal	Parametric	0.01763	0.1	0.1	<0.00028	<0.00028				
Selenium	mg/L	Unknown[c]	DQ[d]	NA	0.5	0.5	<0.0011	<0.0011				
Thallium	mg/L	Unknown[c]	DQ[d]	NA	0.002	0.002	<0.00017	<0.00017				
Sum Ra226+Ra228	pCi/L	Unknown	Non-parametric	1.174	5	5	1.124	<1.457				

Event 12 (AM-2) Upgradient Well MW-212A	
0.00017	U
0.00039	J
0.02374	
0.00022	U
0.00017	U
0.00045	U
0.00047	U
0.215	
0.00052	U
0.0615	
0.00004	U
0.00269	J
0.0011	U
0.00017	U
<1.127	U

[a]Prediction Limits calculated using 5% alpha.
[b]Upper Prediction Limit used for all parameters.
[c]Data distribution set to Unknown if all values non-detect in upgradient well.
[d]DQ is Double Quantification Rule. If Event 12 sample is detectible but Event 11 was ND, need to resample the well to see if two successive, independent detected values occur. If so, that would be an SSI. If value was detected in upgradient well in Event 12, would use Poisson PL instead.

#.#### = UPL > Result > MCL/RSL
= SSI < GWPS
= SSI > GWPS
= DQ Parameter with Verification Sampling Needed

TABLE 4-1
CCR RULE INTERWELL COMPARISON OF SAMPLING EVENT AM-1, -2, AND -3 APPENDIX IV DATA

Mine Spoil/Bedrock							Event 13 (AM-3) Downgradient Wells					
Parameter	Units	Data Distribution for Upgradient Well MW-212A	UPL Type	UPL Value[a,b]	Federal MCLs/RSLs	GWPS	MW-216A	MW-220A				
Antimony	mg/L	Unknown[c]	DQ[d]	NA	0.006	0.006	<0.00107	<0.00107				
Arsenic	mg/L	Normal	Parametric	0.000562	0.01	0.01	0.001465	0.00416				
Barium	mg/L	Normal	Parametric	0.027541	2	2	<0.0136	0.0178				
Beryllium	mg/L	Unknown[c]	DQ[d]	NA	0.004	0.004	0.000805	0.00059				
Cadmium	mg/L	Unknown[c]	DQ[d]	NA	0.005	0.005	<0.00067	<0.00067				
T. Chromium	mg/L	Unknown[c]	DQ[d]	NA	0.1	0.1	<0.00145	<0.00145				
Cobalt	mg/L	Unknown	Poisson	0.00849	0.006	0.00849	0.48736	0.12682				
Fluoride	mg/L	Normal	Parametric	0.272	4	4	0.064	<0.025				
Lead	mg/L	Unknown[c]	DQ[d]	NA	0.015	0.015	<0.00052	<0.00052				
Lithium	mg/L	Normal	Parametric	0.083052	0.04	0.083052	0.12378	***0.08263***				
Mercury	mg/L	Unknown	Poisson	0.00032	0.002	0.002	<0.00016	<0.00016				
Molybdenum	mg/L	Normal	Parametric	0.01763	0.1	0.1	<0.00113	<0.00113				
Selenium	mg/L	Unknown[c]	DQ[d]	NA	0.5	0.5	0.004085	<0.0034				
Thallium	mg/L	Unknown[c]	DQ[d]	NA	0.002	0.002	<0.00017	<0.00017				
Sum Ra226+Ra228	pCi/L	Unknown	Non-parametric	1.174	5	5	0.8216	0.2545				

Parameter	Event 13 (AM-3) Upgradient Well MW-212A	
Antimony	0.00107	U
Arsenic	0.00035	U
Barium	0.02461	
Beryllium	0.00034	
Cadmium	0.00067	U
T. Chromium	0.00145	U
Cobalt	0.00047	U
Fluoride	0.025	U
Lead	0.00052	U
Lithium	0.05135	
Mercury	0.00016	U
Molybdenum	0.00194	
Selenium	0.0034	U
Thallium	0.00017	U
Sum Ra226+Ra228	0.2468	U

[a]Prediction Limits calculated using 5% alpha.

[b]Upper Prediction Limit used for all parameters.

[c]Data distribution set to Unknown if all values non-detect in upgradient well.

[d]DQ is Double Quantification Rule. If Event 13 sample is detectible but Event 12 was ND, need to resample the well to see if two successive, independent detected values occur. If so, that would be an SSI. If value was detected in upgradient well in Event 13, would use Poisson PL instead.

#.#### = UPL > Result > MCL/RSL

(green) = SSI < GWPS

(red) = SSI > GWPS

(yellow) = DQ Parameter with Verification Sampling Needed

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TABLE 4-2
CCR RULE INTERWELL COMPARISON OF SAMPLING EVENT AM-1, -2, AND -3 APPENDIX IV DATA

Uniontown Sandstone							Event 11 (AM-1) Downgradient Wells						Event 11 (AM-1) Upgradient Well MW-215B	
Parameter	Units	Data Distribution for Upgradient Well MW-215B	UPL Type	UPL Value[a,b]	Federal MCLs/RSLs	GWPS	MW-202B	MW-203B	MW-204B					
Antimony	mg/L	Unknown[c]	DQ[d]	NA	0.006	0.006	<0.00017	<0.00017	<0.00017				0.00017	U
Arsenic	mg/L	Unknown	Poisson	0.00151	0.01	0.01	<0.001	<0.001	<0.00015				0.000183	J
Barium	mg/L	Unknown	Non-parametric	0.18841	2	2	0.01463	0.01382	0.01305				0.023135	
Beryllium	mg/L	Unknown[c]	DQ[d]	NA	0.004	0.004	<0.00022	<0.00022	<0.00022				0.00022	U
Cadmium	mg/L	Unknown[c]	DQ[d]	NA	0.005	0.005	<0.00017	<0.00017	<0.00017				0.00017	U
T. Chromium	mg/L	Unknown	Poisson	0.00716	0.1	0.1	<0.00045	<0.00045	<0.00045				0.00045	U
Cobalt	mg/L	Unknown	Poisson	0.00806	0.006	0.00806	***0.00606***	<0.00047	0.00051				0.00047	U
Fluoride	mg/L	Normal	Parametric	2.228	4	4	0.122	0.101	0.109				0.251	
Lead	mg/L	Unknown	Poisson	0.00442	0.015	0.015	<0.00052	<0.00052	<0.00052				0.00052	U
Lithium	mg/L	Unknown	Non-parametric	0.07311	0.04	0.07311	0.12968	0.02729	0.08379				0.05929	
Mercury	mg/L	Unknown	Poisson	0.00033	0.002	0.002	<0.00004	<0.00004	<0.00004				0.00004	U
Molybdenum	mg/L	Log-Normal	Parametric	0.014009	0.1	0.1	0.00153	<0.00028	<0.00028				0.00237	J
Selenium	mg/L	Unknown	Poisson	0.0073	0.5	0.5	<0.0011	<0.0011	<0.0011				0.00097	J
Thallium	mg/L	Unknown[c]	DQ[d]	NA	0.002	0.002	<0.00017	<0.00017	<0.00017				0.00017	U
Sum Ra226+Ra228	pCi/L	Unknown	Poisson	0.95	5	5	0.249	<0.393	<0.0690				<0.230	U

[a]Prediction Limits calculated using 5% alpha.
[b]Upper Prediction Limit used for all parameters.
[c]Data distribution set to Unknown if all values non-detect in upgradient well.
[d]DQ is Double Quantification Rule. If Event 11 sample is detectible, will need to resample the downgradient well to see if two successive, independent detected values occur. If so, that would be an SSI. If value was detected in upgradient well in Event 11, would use Poisson PL instead.

#.#### = UPL > Result > MCL/RSL
(green) = SSI < GWPS
(red) = SSI > GWPS
(yellow) = DQ Parameter with Verification Sampling Needed

Uniontown Sandstone							Event 12 (AM-2) Downgradient Wells						Event 12 (AM-2) Upgradient Well MW-215B	
Parameter	Units	Data Distribution for Upgradient Well MW-215B	UPL Type	UPL Value[a,b]	Federal MCLs/RSLs	GWPS	MW-202B	MW-203B	MW-204B					
Antimony	mg/L	Unknown[c]	DQ[d]	NA	0.006	0.006	<0.00017	<0.00017	<0.00017				0.00017	U
Arsenic	mg/L	Unknown	Poisson	0.00151	0.01	0.01	0.00031	0.00015	<0.00015				0.00015	U
Barium	mg/L	Unknown	Non-parametric	0.18841	2	2	0.01076	0.01083	0.01659				0.04526	
Beryllium	mg/L	Unknown[c]	DQ[d]	NA	0.004	0.004	<0.00022	<0.00022	<0.00022				0.00022	U
Cadmium	mg/L	Unknown[c]	DQ[d]	NA	0.005	0.005	<0.00017	<0.00017	<0.00017				0.00017	U
T. Chromium	mg/L	Unknown	Poisson	0.00716	0.1	0.1	<0.00045	<0.00045	<0.00045				0.00045	U
Cobalt	mg/L	Unknown	Poisson	0.00806	0.006	0.00806	***0.00637***	0.0004075	0.00054				0.00047	U
Fluoride	mg/L	Normal	Parametric	2.228	4	4	0.17	0.1125	0.124				1.93	
Lead	mg/L	Unknown	Poisson	0.00442	0.015	0.015	<0.00052	<0.00052	<0.00052				0.00052	U
Lithium	mg/L	Unknown	Non-parametric	0.07311	0.04	0.07311	0.15577	0.031955	0.12274				0.07571	
Mercury	mg/L	Unknown	Poisson	0.00033	0.002	0.002	<0.00004	0.00008	<0.00004				0.00004	U
Molybdenum	mg/L	Log-Normal	Parametric	0.014009	0.1	0.1	0.00058	<0.00028	<0.00028				0.00192	J
Selenium	mg/L	Unknown	Poisson	0.0073	0.5	0.5	<0.0011	<0.0011	<0.0011				0.0011	U
Thallium	mg/L	Unknown[c]	DQ[d]	NA	0.002	0.002	<0.00017	<0.00017	<0.00017				0.00017	U
Sum Ra226+Ra228	pCi/L	Unknown	Poisson	0.95	5	5	<1.241	<1.075	<1.147				1.109	U

[a]Prediction Limits calculated using 5% alpha.
[b]Upper Prediction Limit used for all parameters.
[c]Data distribution set to Unknown if all values non-detect in upgradient well.
[d]DQ is Double Quantification Rule. If Event 12 sample is detectible but Event 11 was ND, need to resample the well to see if two successive, independent detected values occur. If so, that would be an SSI. If value was detected in upgradient well in Event 12, would use Poisson PL instead.

#.#### = UPL > Result > MCL/RSL
(green) = SSI < GWPS
(red) = SSI > GWPS
(yellow) = DQ Parameter with Verification Sampling Needed

TABLE 4-2
CCR RULE INTERWELL COMPARISON OF SAMPLING EVENT AM-1, -2, AND -3 APPENDIX IV DATA

Uniontown Sandstone							Event 13 (AM-3) Downgradient Wells						Event 13 (AM-3) Upgradient Well MW-215B	
Parameter	Units	Data Distribution for Upgradient Well MW-215B	UPL Type	UPL Value[a,b]	Federal MCLs/RSLs	GWPS	MW-202B	MW-203B	MW-204B					
Antimony	mg/L	Unknown[c]	DQ[d]	NA	0.006	0.006	<0.00107	<0.00107	<0.00107				0.00107	U
Arsenic	mg/L	Unknown	Poisson	0.00151	0.01	0.01	0.00035	<0.00035	<0.00035				0.00035	U
Barium	mg/L	Unknown	Non-parametric	0.18841	2	2	<0.01121	0.0144	0.01377				0.03096	
Beryllium	mg/L	Unknown[c]	DQ[d]	NA	0.004	0.004	0.00166	0.00071	0.0012				0.00022	U
Cadmium	mg/L	Unknown[c]	DQ[d]	NA	0.005	0.005	<0.00067	<0.00067	<0.00067				0.00067	U
T. Chromium	mg/L	Unknown	Poisson	0.00716	0.1	0.1	<0.00145	<0.00145	<0.00145				0.00145	U
Cobalt	mg/L	Unknown	Poisson	0.00806	0.006	0.00806	***0.00723***	0.0009	0.00099				0.00047	U
Fluoride	mg/L	Normal	Parametric	2.228	4	4	0.137	0.101	0.084				1.77	J-
Lead	mg/L	Unknown	Poisson	0.00442	0.015	0.015	<0.00052	<0.00052	0.001				0.00052	U
Lithium	mg/L	Unknown	Non-parametric	0.07311	0.04	0.07311	0.14286	0.02572	0.09308				0.0815	
Mercury	mg/L	Unknown	Poisson	0.00033	0.002	0.002	<0.00016	<0.00016	<0.00016				0.00016	U
Molybdenum	mg/L	Log-Normal	Parametric	0.014009	0.1	0.1	<0.00113	<0.00113	<0.00113				0.00387	
Selenium	mg/L	Unknown	Poisson	0.0073	0.5	0.5	<0.0034	<0.0034	<0.0034				0.0034	U
Thallium	mg/L	Unknown[c]	DQ[d]	NA	0.002	0.002	<0.00017	<0.00017	<0.00017				0.00017	U
Sum Ra226+Ra228	pCi/L	Unknown	Poisson	0.95	5	5	0.1577	<0.265	0.656				0.13765	

[a]Prediction Limits calculated using 5% alpha.

[b]Upper Prediction Limit used for all parameters.

[c]Data distribution set to Unknown if all values non-detect in upgradient well.

[d]DQ is Double Quantification Rule. If Event 13 sample is detectible but Event 12 was ND, need to resample the well to see if two successive, independent detected values occur. If so, that would be an SSI. If value was detected in upgradient well in Event 13, would use Poisson PL instead.

#.#### = UPL > Result > MCL/RSL

(green) = SSI < GWPS

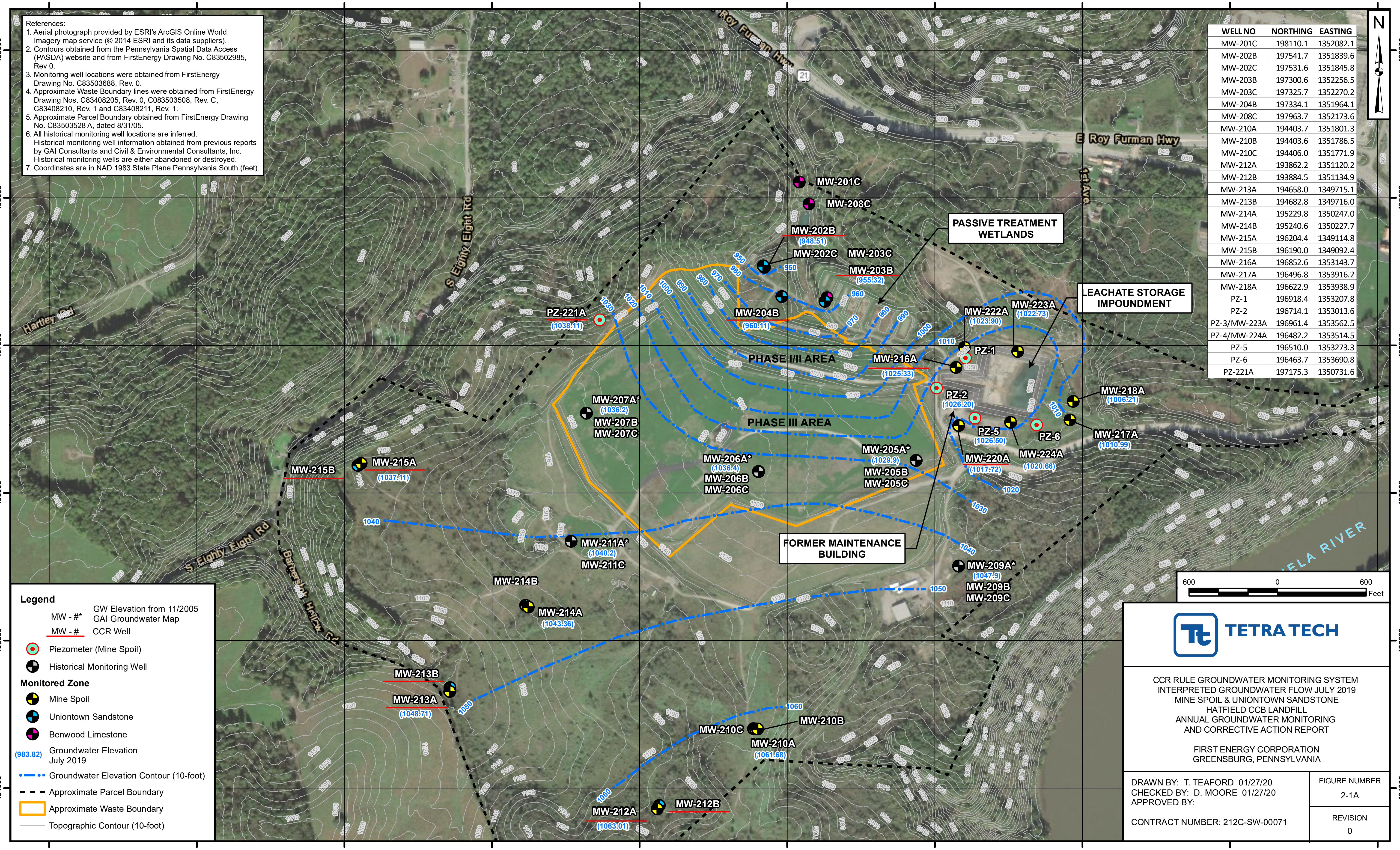
(red) = SSI > GWPS

(yellow) = DQ Parameter with Verification Sampling Needed

TETRA TECH

FIGURES

PGH P:\GIS\FIRST_ENERGY\MAPDOCS\HATFIELDSFERRY_GROUNDWATERCONTOUR_MINESPOIL_UNIONTOWNSS_JULY2019.MXD 01/27/20 TT



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 Pennsylvania Spatial Data Access (PASDA) website and from FirstEnergy Drawing No. C83502985, Rev 0.
3. Monitoring well locations were obtained from FirstEnergy Drawing No. C83503688, Rev. 0.
4. Approximate Waste Boundary lines were obtained from FirstEnergy Drawing Nos. C83408205, Rev. 0, C083503508, Rev. C, C83408210, Rev. 1 and C83408211, Rev. 1.
5. Approximate Parcel Boundary obtained from FirstEnergy Drawing No. C83503528 A, dated 8/31/05.
6. All historical monitoring well locations are inferred. Historical monitoring well information obtained from previous reports by GAI Consultants and Civil & Environmental Consultants, Inc. Historical monitoring wells are either abandoned or destroyed.
7. Coordinates are in NAD 1983 State Plane Pennsylvania South (feet).

WELL NO	NORTHING	EASTING
MW-201C	198110.1	1352082.1
MW-202B	197541.7	1351839.6
MW-202C	197531.6	1351845.8
MW-203B	197300.6	1352256.5
MW-203C	197325.7	1352270.2
MW-204B	197334.1	1351964.1
MW-208C	197963.7	1352173.6
MW-210A	194403.7	1351801.3
MW-210B	194403.6	1351786.5
MW-210C	194406.0	1351771.9
MW-212A	193862.2	1351120.2
MW-212B	193884.5	1351134.9
MW-213A	194658.0	1349715.1
MW-213B	194682.8	1349716.0
MW-214A	195229.8	1350247.0
MW-214B	195240.6	1350227.7
MW-215A	196204.4	1349114.8
MW-215B	196190.0	1349092.4
MW-216A	196852.6	1353143.7
MW-217A	196496.8	1353916.2
MW-218A	196622.9	1353938.9
PZ-1	196918.4	1353207.8
PZ-2	196714.1	1353013.6
PZ-3/MW-223A	196961.4	1353562.5
PZ-4/MW-224A	196482.2	1353514.5
PZ-5	196510.0	1353273.3
PZ-6	196463.7	1353690.8
PZ-221A	197175.3	1350731.6

Legend

- MW - #* — GW Elevation from 11/2005 GAI Groundwater Map
- MW - # — CCR Well
- Piezometer (Mine Spoil)
- Historical Monitoring Well

Monitored Zone

- Mine Spoil
- Uniontown Sandstone
- Benwood Limestone
- (983.82) — Groundwater Elevation July 2019
- Groundwater Elevation Contour (10-foot)
- Approximate Parcel Boundary
- Approximate Waste Boundary
- Topographic Contour (10-foot)

TETRA TECH

CCR RULE GROUNDWATER MONITORING SYSTEM
INTERPRETED GROUNDWATER FLOW JULY 2019
MINE SPOIL & UNIONTOWN SANDSTONE
HATFIELD CCB LANDFILL
ANNUAL GROUNDWATER MONITORING
AND CORRECTIVE ACTION REPORT

FIRST ENERGY CORPORATION
GREENSBURG, PENNSYLVANIA

DRAWN BY: T. TEAFORD 01/27/20
CHECKED BY: D. MOORE 01/27/20
APPROVED BY:

CONTRACT NUMBER: 212C-SW-00071

FIGURE NUMBER 2-1A

REVISION 0

ATTACHMENT A

CCR Rule Appendix IV Alternative Source Demonstration Report
2018/2019 Assessment Monitoring

Coal Combustion Byproduct Landfill

Hatfield's Ferry Power Station
Greene County, Pennsylvania

Prepared for:

FirstEnergy

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Greensburg, PA 15601

Prepared by:

Tetra Tech, Inc.

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Tetra Tech Project No. 212C-SW-00071

October 2019

CCR RULE APPENDIX IV ALTERNATIVE SOURCE DEMONSTRATION REPORT
2018/2019 ASSESSMENT MONITORING

COAL COMBUSTION BYPRODUCT LANDFILL

HATFIELD'S FERRY POWER STATION
GREENE COUNTY, PENNSYLVANIA

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Tetra Tech Project No. 212C-SW-00071

October 2019

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1.0 INTRODUCTION/BACKGROUND

FirstEnergy (FE) owns the coal-fired Hatfield's Ferry Power Station (hereinafter referred to as the "Station") located in Greene County, Pennsylvania. The Station has been closed since 2013 but, historically, Coal Combustion Residuals (CCRs) produced at the Station were placed in the facility's captive dry disposal landfill (referred to as the Coal Combustion Byproduct Landfill or "CCBL"), which is located approximately one mile west-southwest of the Station. The landfill is regulated under Pennsylvania Department of Environmental Protection (PADEP) Solid Waste Permit No. 300370, 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"). Although CCR waste generation ceased when the Station closed in 2013, a September 2015 modification to the permit allowed coal combustion wastes generated at other FE facilities to be disposed at the CCBL; however, no disposal from any other facilities has occurred to date. Because of its potential to begin receiving CCRs again in the future, the landfill is categorized under the Rule as an active CCR unit and is subject to the groundwater monitoring requirements of 40 CFR §§ 257.90 through 257.98.

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 the 2017 Annual Groundwater Monitoring and Corrective Action Report (2017 AGWMCA 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 boron, calcium, chloride, pH, sulfate, and total dissolved solids (TDS) were determined. Based on the various parameters for which SSIs were identified, an Appendix III ASD was undertaken as discussed in the 2018 AGWMCA Report (Tetra Tech, 2019). However, all the Appendix III SSIs that were identified for DM-1 could not be attributed to alternative sources.

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 in March 2018, with laboratory analysis and data validation completed by May 2018. However, before statistical evaluation of the DM-2 data commenced, it was determined that a transition to Assessment Monitoring (AM) was required which precluded the need to statistically evaluate the DM-2 data. As such, a transition to the applicable requirements of Assessment Monitoring per § 257.95 of the CCR Rule commenced.

In accordance with 40 CFR § 257.95(b) and (d)(1), two AM sampling events (AM-1 and AM-2) were performed in June and August 2018. 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 PADEP in August 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 in September 2018. Analytical data summary tables and a description of the 2018 AM program results can be found in the 2018 AGWMCA Report (Tetra Tech, 2019). Once initiated, the AM program continued in 2019 with two additional sampling events performed in February (AM-3) and August (AM-4).

Statistical evaluation of the AM sampling events was completed in January 2019 for AM-1 and -2 and in August 2019 for AM-3 (validated AM-4 results were not available in time to be included in this report). The statistical evaluations indicated Appendix IV constituent concentrations in downgradient wells existed at Statistically Significant Levels (SSLs) above applicable Groundwater Protection Standards (GWPS). The CCR Rule Appendix IV parameters determined in the downgradient monitoring wells (labeled "MW-#") to be above their respective GWPS are summarized in the following table:

	Mine Spoil / Weathered Bedrock (Upgradient Well MW-212A)		**Uniontown Sandstone (Upgradient Well MW-215B)**	
Appendix IV Parameters	**MW-216A (mg/L)**	**MW-220A (mg/L)**	**MW-202B (mg/L)**	**MW-204B (mg/L)**
Cobalt (Co)	**GWPS = 0.00849**		**GWPS = 0.00806**	
AM-1	0.37723	0.09809	< GWPS	< GWPS
AM-2	0.43337	0.11075	< GWPS	< GWPS
AM-3	0.48736	0.12682	< GWPS	< GWPS
Lithium (Li)	**GWPS = 0.083052**		**GWPS = 0.07311**	
AM-1	0.12895	0.08520	0.12968	0.08379
AM-2	0.15065	0.09511	0.15577	0.12274
AM-3	0.12378	< GWPS	0.14286	0.09308

In accordance with 40 CFR § 257.106(h)(6), a notice was prepared and posted to the facility's Operating Record, issued to the PADEP, and then posted on the facility's publicly accessible website in April 2019, to provide notification of the SSLs for cobalt and lithium at the CCR unit. During this same notification period and in accordance with 40 CFR § 257.95(g)(3)(ii), an Appendix IV ASD was initiated to assess if the SSLs determined for the AM-1 and AM-2 events were attributable to a release from the CCR unit, from a demonstrable alternative source(s), or if they resulted from errors in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Pursuant to § 257.95(g)(4), if a successful ASD has not been completed within 90 days from the date of determining that an SSL has occurred, the CCR unit owner or operator must initiate an Assessment of Corrective Measures (ACM) in accordance with 40 CFR § 257.96. Due to the additional monitoring points, sampling events, laboratory analyses, and evaluations needed to complete a successful ASD, the work could not be completed within the 90-day timeframe. Therefore, and in accordance with 40 CFR § 257.106(h)(7), a separate notice was prepared and posted to the facility's Operating Record, issued to the PADEP, and then posted on the facility's publicly accessible website in April 2019, to provide notification of the initiation of an ACM for cobalt and lithium at the Site.

After initiating an ACM, the ongoing ASD activities were continued as they indicated a strong possibility that the cobalt SSLs were attributable to demonstrable alternative source(s). As such, this ASD report has been prepared to document the evaluation of the AM-1, AM-2, and AM-3 Appendix IV SSLs and to incorporate the findings into the CCR unit's ACM.

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 AM 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. These checklists include:

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

For this ASD all three checklists 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 additional evaluations of the following site-specific LOEs were warranted:

- Regional groundwater chemistry studies/reports;
- Potential for mine spoil impacts; and
- Potential for impacts related to historical maintenance activities conducted on-site.

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 most potential sampling, laboratory, or statistical evaluation causes, no instances/issues/indications were identified. For those potential causes where some issues were identified, it was determined that they most likely did not contribute to the Appendix IV SSLs. Based on these LOE findings, sampling, laboratory analysis, and statistical evaluations are not demonstrable alternative sources of the Appendix IV SSLs determined for the AM-1, -2, and -3 events.

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, DM, and AM) for both Appendix III and IV parameters, leachate data (specifically for lithium and cobalt) for the CCR unit provided by FE, and hydrogeologic and design information and data included in *CCR Rule Groundwater Monitoring System Evaluation Report for The Hatfield's Ferry 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 June and July 2019 sampling events at the CCR unit (four locations – DP1WD, DP2WD, LCSC1, AND LCSC2), in which lithium and cobalt (not historically sampled for at the Site) were added to the leachate sampling parameter list, were compared against the July 2019 groundwater monitoring well analytical results developed as part of nature and extent of release (N&E) sampling (these results are

provided in Table 4 of this report). The comparison of leachate data indicates that the SSLs for cobalt in the mine spoil/weathered bedrock combined aquifer are likely attributable to an alternative source as concentrations in downgradient wells MW-216A and MW-220A are higher than those in both the upgradient well MW-212A and the average of the applicable leachate samples. Alternatively, concentrations of lithium in leachate samples are orders of magnitude higher than those of background and downgradient wells in both the mine spoil/weathered bedrock combined aquifer and Uniontown Sandstone aquifer indicating that the lithium SSLs in groundwater are likely attributable to a release from the CCR Unit. These leachate results and associated comparisons are attached as Table 5 of this report.

- Site Hydrogeology - As discussed in the *CCR Rule Groundwater Monitoring System Evaluation Report* (Tetra Tech, 2017), groundwater in the CCBL area occurs primarily within a layer of surficial mine spoil and underlying fractured bedrock of the Monongahela Group. The uppermost aquifer in the CCBL area is, collectively, the mine spoil/weathered bedrock aquifer (shallow aquifer) and the underlying Uniontown sandstone aquifer which form a single, interconnected flow unit along the northern end of the site. As shown on Figure 1, the CCR groundwater monitoring well network at the site consists of three upgradient (background) wells in the mine spoil/bedrock aquifer (MW-212A, -213A, and -215A), three upgradient (background) wells in the Uniontown sandstone aquifer (MW-212B, -213B, and -215B), five downgradient wells to monitor the combined aquifer (MW-216A, -220A, -202B, -203B, and -204B), and one piezometer (PZ-221A). As detailed in the 2017 and 2018 AGWMCA Reports (Tetra Tech 2018 and 2019, respectively), MW-212A is currently used for interwell comparisons due to its overall lower UPLs, and MW-215B is currently used for interwell comparisons due to MW-212B and -213B often having insufficient water available for sampling. Based on historic and recent groundwater data from the site wells, groundwater flow within the mine spoil/weathered bedrock aquifer is primarily to the north along the slope of the top of bedrock, with a portion of the shallow groundwater along the northeast side of the CCBL flowing eastward as shown on Figure 2. Groundwater in the Uniontown sandstone aquifer migrates primarily to the northeast and east towards outcrop areas along major drainage features in the area as shown on Figure 3. Geologic and hydrogeologic characteristics of the site and the CCR monitoring well network are both discussed in greater detail in the above-referenced report.
- CCR Unit Design - As shown on Figure 1, the CCR unit consists of three permitted disposal areas: Phases I, II, and III. The Phase I and II areas are unlined but do include

an underdrain blanket system and are largely overlain by the Phase III area, which has a Pennsylvania Class I Residual Solid Waste liner system that includes two geomembranes, a geosynthetic clay liner (GCL), a leachate collection system, and a leak detection zone. Disposal operations were performed in the Phase I and II areas until 2010, at which time all operations were transitioned to the Phase III area. Underdrain flows collected from the Phase I and II areas are routed to two concrete sumps where they are then pumped to a passive wetland treatment system located northeast of the Phase II disposal area. Surface water runoff and leachate collected from the Phase III area are routed to the landfill's Leachate Storage Impoundment (LSI), which is located east of the Phase II and Phase III disposal areas. Like the Phase III area, the LSI has a Class I liner system.

Based on the LOE findings presented in Table 2, the lithium SSLs determined for the AM-1, -2, and -3 events can most likely be attributed to a release from the CCR unit, while the cobalt SSLs can most likely be attributed to a source other than the CCR unit.

3.3 ASD CHECKLIST 3

ASD Checklist 3 is attached as Table 3 of this report. The checklist evaluations were performed in a similar manner to those of ASD Checklist 2 by re-reviewing the groundwater analytical results (background, DM, and AM) for both Appendix III and IV parameters, leachate data (specifically for lithium and cobalt) for the CCR unit provided by FE, and hydrogeologic and design information and data included in *CCR Rule Groundwater Monitoring System Evaluation Report for The Hatfield's Ferry Power Station* (Tetra Tech, 2017). For the LOEs in Checklist 3, the following evaluation criteria were used in addition to those used for ASD Checklist 2:

- Results from the site-wide N&E of release sampling (Table 4) that was performed to evaluate the mine spoil and/or other alternative sources of cobalt and lithium SSLs, indicate the source of cobalt is emanating from the vicinity of the LSI and former maintenance building area, near downgradient wells MW-216A and MW-220A. Historical activities conducted at the building and surrounding area included mechanical maintenance and repair of heavy earthmoving equipment (dump trucks, excavators, bulldozers, etc.), support vehicles, and ancillary equipment (e.g., pumps). These types of activities are noted in the EPRI 2017 ASD guidance document as being potential alternate sources of cobalt. Based on the location of these historic activities directly upgradient of the wells with cobalt SSLs, they are likely the sources of cobalt in this area. These results and associated comparisons are discussed in greater detail in Sections 3.5 and 3.6 of this report.

Based on the LOE findings presented in Table 3, the lithium SSLs determined for the AM-1, -2, and -3 events can most likely be attributed to a release from the CCR unit, while the cobalt SSLs can most likely be attributed to a source other than the CCR unit.

3.4 REGIONAL GROUNDWATER STUDY

As previously noted, the monitored CCR aquifer consists of a combination of the mine spoil /weathered bedrock aquifer and the fractured bedrock of the Uniontown sandstone. While there is a brief discussion of the impact of historical surface mining on groundwater quality in this section, the interpreted impact of mine spoil on the monitored aquifer is discussed in greater detail in the following section of this report. In an effort to evaluate the natural variation in groundwater quality in the Uniontown sandstone relative to SSI constituents, the *Water Resources and the Effects of Coal Mining, Greene County, Pennsylvania, Water Resources Report 63* (PaDER, 1987a) was reviewed. This is referred to as the “subject report” below. Also reviewed was the *Geologic Map of Greene County, Pennsylvania, Showing the Locations of Wells, Springs, and Hydrologic Sampling and Testing Sites* (PaDER, 1987b).

As noted in Section 1.0, for downgradient wells screened in the Uniontown sandstone, SSLs for lithium were identified during the AM-1, -2, and -3 sampling events. The subject report had minimal information on groundwater quality for the Uniontown sandstone, particularly with regard to this SSL constituent.

3.5 MINE SPOIL

As discussed in in the *CCR Rule Groundwater Monitoring System Evaluation Report* (Tetra Tech, 2017), the original topography of the CCBL area has been altered by surface mining of the Waynesburg coal that was performed during the 1970s and 1980s throughout much of the central portion of the permitted site. Mine spoil, in some cases mixed with fly ash, was used as backfill for mined areas, and comprises the unconsolidated subsurface materials across most of the site, including those beneath the existing Phase I, II, and III landfill and the areas upgradient of the existing Phase I, II, and III landfill. The mine spoil consists of sandstone, mudstone and limestone-derived rock fragments ranging in size from soil-sized particles to cobble/boulder-sized rock fragments and varies in thickness from a few feet to over 100 feet across the permitted CCBL area. During permitting and design of the Phase III disposal area, thirteen monitoring wells were installed within the mine spoil/weathered bedrock aquifer to support the initial geologic/hydrogeologic characterization of the site. The locations of these wells are shown on Figure 1 and they are denoted with an “A” suffix in their identification numbers. Five of these wells (MW-205A, -206A, -207A, -209A, and -211A) have since been abandoned as they were situated within the footprint of the Phase III landfill, two others (MW-210A and -214A) were rendered inactive once the hydrogeologic site characterization was complete, and another two (MW-217A and -218A) are positioned such that they’re downgradient of the LSI and not the landfill. As seen on Figure 1, the wells that are inactive or that have been abandoned are located between the CCR monitoring program upgradient wells MW-212A, -213A, and -215A and downgradient wells MW-216A, -220A, -202B, -203B, and -204B.

To evaluate the potential of the mine spoil as a source of the cobalt and lithium SSLs identified during the AM sampling events, historical groundwater data for the CCR unit dating back to 2005 was reviewed. However, neither cobalt nor lithium analyses were completed during that time as those constituents were not required under the facility’s PADEP groundwater monitoring program. The current CCR data set was therefore augmented with additional analytical data from active and inactive PADEP monitoring wells located upgradient and downgradient of the CCR unit. These wells were sampled during June and July of 2019 as part of N&E of release activities in the event that this ASD Report determined that the CCR unit was the source of the SSLs or that further delineation of lithium and cobalt concentrations in groundwater proved necessary.

Site-wide groundwater analytical results indicate that lithium is present in mid-gradient wells (MW-214A and MW-210A) for the mine spoil/combined aquifer at concentrations greater than the upgradient well MW-212A UPL, but lower than the applicable leachate average (refer to Table 4). This indicates that fly ash mixed within the mine spoil during reclamation activities may present a component of lithium in mine spoil/weathered bedrock groundwater as shown on Figure 4. Additionally, lithium concentrations greater than the Uniontown Sandstone aquifer upgradient well UPL were observed in numerous mid-gradient wells, indicating the lithium impacts in the shallower mine spoil/weathered bedrock combined aquifer may be vertically migrating down into the Uniontown Sandstone as shown on Figure 5.

In summary, the data for lithium indicates moderate potential for the mine spoil to be a source of the SSLs identified; however, due to historical changes in the mine spoil/weathered bedrock combined aquifer flow paths (that could have occurred during on-site mining activities) in combination with the orders of magnitude higher lithium concentrations in leachate, the CCR unit cannot be ruled out as the likely source of the lithium SSLs. The data for cobalt indicate a low potential for the mine spoil to be a source of the SSLs identified, however, an alternative source as discussed in Section 3.6 is likely.

3.6 HISTORICAL MAINTENANCE ACTIVITIES NEAR THE LSI

To evaluate the potential of historical maintenance activities near downgradient monitoring wells MW-216A and MW-220A as a potential source of the cobalt SSLs identified during the AM-1, -2, and -3 sampling events, historical groundwater data for the CCR unit dating back to 2005 was reviewed; however, cobalt analyses were not completed during that time as that constituent was not required under the facility's PADEP groundwater monitoring program. As such, the current CCR data set was augmented with additional analytical data from active and inactive PADEP monitoring wells located upgradient and downgradient of the CCR unit. These wells were sampled during June and July of 2019 as part of N&E of release activities in the event that this ASD Report determined that the CCR unit was the source of the SSLs or that further delineation of cobalt concentrations in groundwater proved necessary.

Site-wide groundwater analytical results indicate that cobalt is only present in downgradient wells around the LSI within the mine spoil/combined aquifer at concentrations greater than the upgradient well MW-212A UPL, while also being higher than the applicable leachate average for cobalt (refer to Table 5). These results indicate that the source of cobalt is emanating from the vicinity of the former maintenance building as shown on Figure 6. Historical activities conducted at the building and surrounding area included mechanical maintenance and repair of heavy earthmoving equipment (dump trucks, excavators, bulldozers, etc.), support vehicles, and ancillary equipment (e.g., pumps). These types of activities are noted in the EPRI 2017 ASD guidance document as being potential alternate sources of cobalt. Based on the location of these historic activities directly upgradient of the wells with cobalt SSLs, they are likely the sources of cobalt in this area.

4.0 CERTIFICATION STATEMENT

In accordance with § 257.95(g)(3)(ii) of the CCR Rule, an ASD for Appendix IV constituents was undertaken for the CCR unit identified herein. Based on the information and data that were available for review, the lithium SSLs in both the mine spoil/weathered bedrock combined aquifer and Uniontown Sandstone aquifer that were identified for the AM-1, -2, and -3 events could not be attributed to sources other than the CCR unit, to errors in sampling, analysis, or statistical evaluation, or from natural variation in groundwater quality. As such, a transition to the applicable requirements of assessment of corrective measures for lithium per § 257.96 of the CCR Rule appears to be warranted and assessment monitoring will continue.

The SSLs for cobalt that were identified in the mine spoil/weathered bedrock combined aquifer during the AM-1, -2, and -3 events are attributed to sources other than the CCR unit. As such, in accordance with the applicable requirements of § 257.95 of the CCR rule, no corrective measures are required and assessment monitoring for cobalt will continue.

5.0 REFERENCES

PaDER, 1987a. *Water Resources and the Effects of Coal Mining, Greene County, Pennsylvania, Water Resources Report 63*. Pennsylvania Department of Environmental Resources, Pennsylvania Geologic Survey, 1987.

PaDER, 1987b. *Geologic Map of Greene County, Pennsylvania, Showing the Locations of Wells, Springs, and Hydrologic Sampling and Testing Sites*. Pennsylvania Department of Environmental Resources, Pennsylvania Geologic Survey, 1987.

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

Tetra Tech, 2017. *CCR Rule Groundwater Monitoring System Evaluation Report, Hatfield's Ferry 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, Hatfield's Ferry Power Station*. Tetra Tech, Inc., Pittsburgh, PA, January 2018. http://ccrdocs.firstenergycorp.com/

Tetra Tech, 2019. *2018 Annual CCR Groundwater Monitoring and Corrective Action Report, Coal Combustion Byproduct Landfill, Hatfield's Ferry Power Station*. Tetra Tech, Inc., Pittsburgh, PA, January 2019. 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 lab identifiers and COCs and Data Validation Reports, except for 2 cases: 1) MW-212A was mislabeled in Event 4 but corrected in database and Data Validation Report; and 2) MW-212A and MW 215A had been mislabeled in Event 12 COC, but later corrected, and were correct in lab report, Data Validation Report, and database.
	Contamination	Field blanks had no detections of Cobalt or Lithium.
	Sampling technique	Used hydrasleeves in MW-202B in Event 10. Upgradient wells MW-212B and MW-213B had insufficient water for sampling in all events.
	Turbidity	Turbidity after stabilization < 10 NTU in all wells, so not a concern.
	Sampling anomalies	No other anomalies noted in field records.
Laboratory Causes (ASD Type II)	Calibration	No comments on lab calibration in Data Validation Reports for Appendix IV parameters.
	Contamination	Lab blanks had no Cobalt or Lithium.
	Digestion methods	No differences for Appendix IV parameters.
	Dilution corrections	Dilution factors in some events different for Co and Li between wells in same event, but most values detected, so no errors in detection limits.
	Interference	No concerns mentioned in Data Validation Reports.
	Analytical methods	Methods same as CCR Groundwater Monitoring Plans for Co and Li.
	Laboratory technique / qualifier flags	Had low recoveries for MS/MSD for Co in Event 6 (MW-220A and field duplicate) and in Event 10 (MW-216A and field duplicate, MW-202B, and MW-203B). Had low recoveries for MS/MSD for Li in Event 6 (MW-220A). Qualifier flags used appropriately.
	Transcription error(s)	None identified.
Statistical Evaluation Causes (ASD Type III)	Lack of statistical independence	Sampling interval was monthly or longer in upgradient wells MW-212A and MW-215B and well diameters are small (2-inch), so not likely to be a concern.
	Outliers	None identified in wells used for Assessment Monitoring.
	False positives	In 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	In upgradient wells MW-212A and MW-215B, had all but 1 non-detect values for Co. Both wells had all detected values for Li. Co and Li detected in 5 wells used for Assessment Monitoring (MW-216A, MW-220A, MW-202B, MW-203B, MW-204B).
	Background data / change in normality	No new background data used for Assessment Monitoring (Events 11,12, and 13 [AM-1, -2, and -3, respectively]).

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	Mine Spoil: Boron SSIs in MW-216A and -220A, and -24; Sulfate SSI in MW-216A. Uniontown Sandstone: Boron and Sulfate SSIs in MW-202B, -203B, and -204B.
1b	If the CCR unit contains FGD gypsum (only) is there an SSI/SSL for sulfate?	Yes	CCR Release	Key	Monitoring Point	FGD gypsum has only been co-disposed with fly ash in the Phase 3 landfill area. Mine Spoil: Sulfate SSI in MW-216A. Uniontown Sandstone: Sulfate SSIs in MW-202B, -203B, and -204B.
1c	Are there other constituents in the groundwater that represent primary indicators? List the applicable constituents.	Yes	CCR Release	Supporting	Monitoring Point	Mine Spoil: Calcium and Chloride are found at detectible levels in multiple downgradient monitoring wells; Lithium is an SSL for downgradient wells MW-216A and MW-220A Uniontown Sandstone: Calcium is found at detectible levels in multiple downgradient monitoring wells; Lithium is an SSL for downgradient wells MW-202B and MW-204B.
1d	Is there an SSI/SSL for any of the other primary indicators?	Yes	CCR Release	Key if No	Monitoring Point	Mine Spoil: Calcium (MW-216A and -220A) and Chloride (MW-216A and -220A) have exhibited SSIs. Lithium (MW-216A and MW-220A) has exhibited SSLs during 2018 assessment monitoring. Uniontown Sandstone: Calcium (MW-202B, -203B, and -204B) has exhibited SSIs. Lithium (MW-202B and -204B) has exhibited SSLs during 2018 assessment monitoring.
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	Mine Spoil: Calcium, Chloride, and Sulfate – Yes; Boron is indeterminate as it is not analyzed as part of the site's leachate sampling and analysis program. It is noted that statistical analysis has not been performed on leachate results -- evaluation based on the November 2017 leachate sampling event; Lithium – Yes. Uniontown Sandstone: Calcium and Sulfate – Yes; Boron is indeterminate as it is not analyzed as part of the site's leachate sampling and analysis program. It is noted that statistical analysis has not been performed on leachate results; evaluation based on the November 2017 leachate sampling event; Lithium – Yes.
1f	Are concentrations for the primary indicators increasing?	No	Uncertain	Supporting	Monitoring Point	Mine Spoil: No. It should be noted that the CCR dataset covers a very limited time range (~1.5 years) for trend analysis. Uniontown Sandstone: No. It should be noted that the CCR dataset covers a very limited time range (~1.5 years) 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	Mine Spoil: SSIs for pH (MW-216A and -220A) and TDS (MW-216A). Arsenic (MW-216A and -220A): SSLs for Cobalt (MW-216A and -220A) identified during AM events conducted in 2018

	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.)					Uniontown Sandstone: SSIs for pH (MW-202B, -203B, and -204B) and TDS (MW-202B and -204B). Radium 226+228 (MW-202B) has exhibited elevated downgradient concentrations as compared to upgradient concentrations.
2b	Are the constituents identified in 2a present in leachate in concentrations statistically higher than background?	Yes / No	Uncertain	Key if No	Constituent	Mine Spoil: pH (below Lower Prediction Limit) and TDS – Yes. Arsenic and Cobalt – No. Uniontown Sandstone: pH (below Lower Prediction Limit) and TDS – Yes. Radium 226+228 is indeterminate as it's not analyzed as part of the site's leachate sampling and analysis program. It is noted that statistical analysis has not been performed on leachate results; evaluation based on the November 2017 leachate sampling event.
2c	Are concentrations for any of the secondary indicators increasing? List the applicable constituents.	No	Uncertain	Supporting	Monitoring Point	Mine Spoil: No. It should be noted that the CCR dataset covers a very limited time range (~1.5 years) for trend analysis. Uniontown Sandstone: No. It should be noted that the CCR dataset covers a very limited time range (~1.5 years) 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?	Yes	CCR Release	Key	Monitoring Point	Major ion chemistry analysis completed as Stiff diagrams indicate downgradient well chemistry similar to that of leachate.
3c	Does major ion chemistry suggest a mixture of leachate and background groundwater?	Yes	CCR Release			Major ion chemistry analysis completed as Stiff diagrams suggest a mixture of leachate and background groundwater.
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 late 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 IV 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 and Cobalt and Lithium SSLs were identified in the downgradient wells, all of which are positioned downgradient of the landfill 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	**Mine Spoil** Boron - CCR Leachate Release (Row a) Calcium - CCR Leachate Release (Row a) Chloride - CCR Leachate Release (Row a) Cobalt – Possible CCR Leachate Release + Possible Alternative Source (row a) Lithium - CCR Leachate Release (Row a) pH – CCR Leachate Release (Row a) Sulfate – CCR Leachate Release (Row c) TDS - CCR Leachate Release (Row c) **Uniontown Sandstone** Boron - Indeterminate Calcium - CCR Leachate Release + Possible Alternative Source (Row c) Lithium - CCR Leachate Release (Row b) pH – CCR Leachate Release (Row a) Sulfate - CCR Leachate Release + Possible Alternative Source (Row b) TDS - CCR Leachate Release + Possible Alternative Source (Row b)
4c	Is the CCR unit immediately underlain by clay, shale, or other geologic media with low hydraulic conductivity?	No	CCR Release	Supporting	Unit	Almost the entire landfill footprint (Phases 1, 2, and 3) sits atop coal strip mine backfill materials that have mid-range hydraulic conductivities.
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 CCR Rule-defined uppermost aquifer at the site is comprised of two water-bearing strata that are hydraulically connected. Both of the site's upgradient wells (MW-212A and MW-215B) are located along the appropriate groundwater flow paths to their corresponding downgradient wells.

	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?	No / Yes	CCR Release / Potential Alternate Source	Supporting	Unit	The Phase 1 and 2 disposal areas are unlined while the Phase 3 disposal area (currently developed through Steps 1, 2, and 3-1) is double-lined.
5b	If the facility is lined, is it a composite liner?	Yes	Potential Alternate Source	Supporting	Unit	The Phase 3 disposal area is double-lined and utilizes a composite secondary 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?	No / Yes	CCR Release / Potential Alternate Source	Supporting	Unit	The Phase 1 and 2 disposal areas do have a bottom ash blanket underdrain while the Phase 3 disposal area (currently developed through Steps 1, 2, and 3-1) has both a leachate collection system and a leak detection system.
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	The unlined Phase 1 and 2 disposal areas are situated within tributary ravines and the CCR Rule-defined uppermost aquifer at the site is comprised of two water-bearing strata that are hydraulically connected. The higher water-bearing stratum outcropped within the ravines before the disposal site was developed so it is very likely that groundwater intersects some Phase 1 and 2 CCRs.

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: ASD Checklist 3: Lines of Evidence Associated with Alternative Natural and Anthropogenic Sources

	Line of Evidence (LOE)	Determination[1] (Yes, No, ND, N/A)	Indication	LOE Type[2]	Applies to[3]	Weight of Evidence Determination / Basis
General						
6a	Are there any known alternative sources for any of the constituents of concern on-site or off-site?	Yes	Potential Alternate Source	Supporting	Monitoring Point	Historical surface mining and reclamation activities have the potential to cause metals and other contaminants to leach to groundwater. Historical maintenance activities near the LSI have the potential to act as a source of CCR-related contaminants in addition to non-CCR related contaminants. These potential alternative sources were assessed during this Appendix IV ASD.
6b	Are any current or former potential alternative sources background of the monitoring location?	Yes	Potential Alternate Source	Supporting	Monitoring Point	Mine spoil was placed in upgradient (background) areas of the site. Based on groundwater flow mapping, the former maintenance building near the LSI is upgradient (background) of wells exhibiting SSLs for cobalt (MW-216A and -220A).
6c	Do monitoring locations between a potential background source and CCR unit have concentrations at SSI/SSL levels?	Yes/No	Potential Alternate Source	Supporting	Constituent	Lithium – Side- to mid-gradient wells MW-214A/B, MW-210A contain concentrations of lithium above the GWPS in the mine spoil/weathered bedrock aquifer and the Uniontown Sandstone aquifer. Mid-gradient piezometer PZ-2 contains concentrations of lithium below the GWPS in the mine spoil/weathered bedrock aquifer. Cobalt – There are no monitoring locations between the potential background source and CCR unit that have concentrations that constitute an SSI and/or SSL.
On-Site Alternative Source						
7a	Is the monitoring point downgradient of or near a coal pile, or coal pile runoff, or coal pile leachate management area?	No	No Alternate Source	Supporting	Monitoring Point	There are no coal pile, coal pile runoff, or coal pile leachate management areas near the downgradient monitoring points.
7b	Are there former coal mines, mine spoil, or conveyers near the CCR unit or background from the facility?	Yes	Potential Alternate Source	Supporting	Unit	The entire area underlying the CCR unit waste boundary and upgradient areas have been historically surface mined for the Waynesburg Coal. Mine spoil and fly ash were used to reclaim the surface-mined areas.
7c	Does the site have other CCR units that are background or side gradient of the affected monitoring location?	No	No Alternate Source	Supporting	Monitoring Point	There are no other CCR units located upgradient or side gradient of the affected monitoring locations.
7d	Is the CCR unit built on top of a former CCR disposal area (i.e., has a lined impoundment been built on top of a former unlined impoundment, or has a lined landfill been built on top of a portion of an unlined impoundment)?	Yes	Potential Alternate Source	Supporting	Unit	The Phase 1 and 2 disposal areas are unlined while the Phase 3 disposal area (currently developed through Steps 1, 2, and 3-1) is double-lined.

	Line of Evidence (LOE)	Determination[1] (Yes, No, ND, N/A)	Indication	LOE Type[2]	Applies to[3]	Weight of Evidence Determination / Basis
On-Site Alternative Source (Continued)						
7e	Do the CCR unit or adjacent units have an active underdrain piping system or groundwater pumping system, or are there any groundwater pumping activities nearby, that could have localized influence on groundwater flow and quality?	Yes/No	Potential Alternate Source	Supporting	Unit	The Phase 1 and 2 disposal areas do have a bottom ash blanket underdrain while the Phase 3 disposal area (currently developed through Steps 1, 2, and 3-1) has both a leachate collection system and a leak detection system.
7f	Is there evidence that water used for dust suppression on uncovered CCR or coal piles flowed off the footprint of the liner or runoff containment system near the monitoring point?	No	No Alternate Source	Supporting	Monitoring Point	There is no evidence of dust suppression water to have flowed off the footprint of the liner system and near the monitoring points.
7g	Is leachate or sluice water used for dust control close to the monitoring location?	No	No Alternate Source	Supporting	Monitoring Point	Historical and any current dust control is performed using river water (direct withdrawal).
7h	Is the monitoring point downgradient of or near a CCR handling area (silo, storage area, dewatering bin, sump, truck loading/unloading or washing area, etc.) or haul road?	Yes	Potential Alternate Source	Supporting	Monitoring Point	MW-216A and MW-220A are located downgradient of a former haul road and maintenance area.
7i	Is the monitoring point downgradient of or near sluice water lines, handling equipment, or storage areas?	Yes	Potential Alternate Source	Supporting	Monitoring Point	MW-216A and MW-220A are located downgradient of former maintenance building.
7j	Is the monitoring point downgradient of or close to a leachate collection pipeline or leachate storage structure?	Yes	Potential Alternate Source	Supporting	Monitoring Point	MW-216A and MW-220A are located close to the LSI.
7k	Have there been any documented spills of CCR or leachate or sluice water in background or nearby locations?	No	No Alternate Source	Supporting	Monitoring Point	There are no documented spills of CCR or leachate or sluice water in upgradient or nearby locations.

	Line of Evidence (LOE)	Determination[1] (Yes, No, ND, N/A)	Indication	LOE Type[2]	Applies to[3]	Weight of Evidence Determination / Basis
On-Site Alternative Source (Continued)						
7l	Were CCRs ever drained or stockpiled in unlined areas and/or without run-off/leachate control in background or nearby areas?	No	No Alternate Source	Supporting	Monitoring Point	CCRs have historically been dry disposed at the site in both lined and unlined areas with appropriate run-off and leachate control measures (refer to LOEs 5a through 5c).
7m	Is there any history of on-site or background oil or chemical spills or leaking underground storage tanks?	No	No Alternate Source	Supporting	Monitoring Point	No history of on-site or upgradient oil or chemical spills or use of underground storage tanks.
7n	Does a significant amount of road salting occur on-site? (also see 9b)	No	No Alternate Source	Supporting	Monitoring Point	Road salting has historically not been performed at the site.
7o	Are fertilizers being used on-site for cap vegetation or other uses?	Yes	Potential Alternate Source	Supporting	Monitoring Point	Fertilizers are used in the hydroseeding of all disturbed areas at the site (capped areas, borrow areas, etc.)
7p	Is there any history of on-site or background ash utilization (structural fill, landfill, road base, berm construction, soil stabilization, etc.)?	Yes	Potential Alternate Source	Supporting	Monitoring Point	Fly ash was commingled with mine spoil during surface mine reclamation activities across the site.
7q	Was the power plant site subgrade prepared with CCR, dredge spoils, incinerator residue, construction debris, industrial waste, or non-native soils?	N/A	N/A	Supporting	Monitoring Point	The Power Plant is located downgradient of, and not near the CCR unit.
Natural Variation						
8a	Are background wells screened in the same geomedia as the monitoring point?	Yes	No Alternate Source	Supporting	Monitoring Point	The CCR Rule-defined uppermost aquifer at the site is comprised of two water-bearing strata that are hydraulically connected. Both of the site's upgradient wells (MW-212A and MW-215B) are located along the appropriate groundwater flow paths to their corresponding downgradient wells.
8b	Is the aquifer comprised of poorly buffered media such as sand and gravel?	No	No Alternate Source	Supporting	Unit	The aquifers are comprised of mine spoil/weathered bedrock and Uniontown Sandstone which is not considered to be a poorly buffered media.

	Line of Evidence (LOE)	Determination[1] (Yes, No, ND, N/A)	Indication	LOE Type[2]	Applies to[3]	Weight of Evidence Determination / Basis
Natural Variation (Continued)						
8c	Is the pH at the monitoring point similar to the background pH?	No	Potential Alternate Source	Supporting	Monitoring Point	Mine Spoil: pH of upgradient background well MW-212A is 7.54, while downgradient wells MW-216A and MW-220A are 5.70 and 5.96, respectively. Uniontown Sandstone: pH of upgradient background well MW-215B is 7.69, while downgradient wells MW-202B and MW-204B are 6.54, and 6.55, respectively.
8d	Is the monitoring point near a river?	No	No Alternate Source	Supporting	Monitoring Point	None of the monitoring points are located near a river.
8e	Is the constituent chemically reactive in groundwater, such that dissolution or desorption is possible (EPRI, Table A-3)?	Yes/No	Potential Alternate Source/No Alternate Source	Supporting	Constituent	Cobalt: Cobalt is reactive and occurs in combination with arsenic and sulfur; it may be sorbed to mineral oxides. Lithium: Lithium is non-reactive.
8f	Is there a difference in redox indicators between background and compliance monitoring data?	ND	ND	Supporting	Monitoring Point	Redox parameters were not analyzed as part of the Appendix IV ASD.
8g	Has there been a recent flood, recharge event, or dry period that caused groundwater elevation to rise or fall to elevations higher or lower than observed during the background monitoring period?	No	No Alternate Source	Supporting	Unit	Groundwater conditions have generally remained consistent with changes not being attributable to flooding or drought conditions.
8h	Does the aquifer contain saline water at depth?	No	No Alternate Source	Supporting	Unit	Saline conditions are not observed in groundwater.
8i	Was the direction of groundwater flow prior to or during the sample event different than observed during the background prior?	No	No Alternate Source	Supporting	Monitoring Point	Groundwater flow has consistently been to the north and east for both aquifers monitored.

	Line of Evidence (LOE)	Determination[1] (Yes, No, ND, N/A)	Indication	LOE Type[2]	Applies to[3]	Weight of Evidence Determination / Basis
Off-Site Anthropogenic						
9a	Are there former coal mines, mine spoil, or conveyers near the CCR unit or background from the facility (also consider under "On-site")?	Yes	Potential Alternate Source	Supporting	Unit	Refer to LOE 7b.
9b	Does a significant amount of road salting occur off-site?	N/A	N/A	Supporting	Unit	The site, including the uppermost aquifer, is situated in elevation above all surrounding off-site roadways on which road salting may occur.
9c	Does the surrounding land use include agriculture (crops)?	Yes	No Alternate Source	Supporting	Unit	The neighboring properties appear to have agricultural uses (crops) which are determined to present little to no impacts to groundwater as it relates to the CCR unit.
9d	Does the surrounding land use include agriculture (animal)?	Yes	No Alternate Source	Supporting	Unit	The neighboring properties appear to have agricultural uses (animal) which are determined to present little to no impacts to groundwater as it relates to the CCR unit.
9e	Are there current or former underground or aboveground storage tanks that have had a release? (Consider gas stations and surrounding industrial activities.)	No	No Alternate Source	Supporting	Unit	There are no known uses of underground or above ground storage tanks near the CCR unit.
9f	Are there, or were there, oil and gas production wells in the vicinity of the site?	ND	ND	Supporting	Unit	Due to the nature of the SSIs and SSLs, nearby oil and gas production was not assessed as part of this Appendix IV ASD.
9g	Are there existing or historical commercial and/or industrial sources of impacts, such as metal manufacturing, mining, landfills, Superfund or brownfield sites, wood treatment, etc.?	No	No Alternate Source	Supporting	Unit	There are no known off-site industrial or commercial sources that could potentially impact the uppermost aquifer being monitored for the CCR unit.
9h	Could any potential anthropogenic sources be causing changes to groundwater chemistry that would result in release of the constituent of concern through changes to pH, redox, etc.?	Yes	Potential Alternate Source	Supporting	Unit	Historical surface mining and filling operations could have introduced minerals to infiltrating groundwater and oxygen allowing constituents of concern to become mobile in groundwater.

	Line of Evidence (LOE)	Determination[1] (Yes, No, ND, N/A)	Indication	LOE Type[2]	Applies to[3]	Weight of Evidence Determination / Basis
Time-of-Travel Analysis						
10	Has groundwater flowing beneath potential sources had enough time to migrate to the affected monitoring well location?	Yes	Potential Alternate Source	Supporting	Monitoring Point	Given the age of the CCR unit and history of disposal activities dating back to the 1970s, there has been enough time for potentially affected groundwater to flow to the affected monitoring wells.

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 4 - Nature and Extent of Release Sampling
Cobalt and Lithium Data

Monitoring Well ID	Cobalt (mg/L)		Lithium (mg/L)	
	N&E Event 1	N&E Event 2	N&E Event 1	N&E Event 2
MW-202B	0.009096	0.007678	0.135213	0.143547
MW-203B	0.00076	0.000619	0.025202	0.026791
MW-204B	0.001178	0.000978	0.107249	0.120743
MW-210A	0.005487	0.005528	0.193175	0.19922
MW-210B	<MDL	<MDL	0.063195	0.066396
MW-212A	<MDL	<MDL	0.056653	0.064589
MW-213A	<MDL	<MDL	0.027986	0.030394
MW-214A	0.001414	0.001204	0.138755	0.157622
MW-214B	<MDL	<MDL	0.093685	0.107054
MW-215A	0.000723	0.000864	0.132562	0.12345
MW-215B	<MDL	<MDL	0.082568	0.075974
MW-216A	0.425518	0.440698	0.127852	0.13459
MW-217A	0.001188	0.001933	0.192143	0.196715
MW-218A	0.001265	0.001541	0.322076	0.322557
MW-220A	0.136059	0.13415	0.079581	0.091538
MW-222A	0.168859	0.192676	0.031083	0.031518
MW-223A	0.29123	0.268367	0.070328	0.076467
MW-224A	0.025906	0.019371	0.013596	0.016032
PZ-2	0.394111	0.415425	0.02059	0.021313
PZ-5	0.02212	0.030202	0.051276	0.073825

Notes:
1. N&E Sampling Event 1 performed in June 2019.
2. N&E Sampling Event 2 performed in July 2019.

Table 5 - Leachate Data Summary

	Leachate Concentrations (mg/L)					GW Concentrations (mg/L) Mine Spoil / Weathered Bedrock							
Parameters	DP1WD	DP2WD	LCSC1	LCSC2	LCSC Avg.	UG UPL (MW-212A)	MW-216A	MW-220A	DG Avg.	LCSC Avg. > UG UPL?	DG Avg. > UG UPL?	MW-216A < LCSC Avg.?	MW-220A < LCSC Avg.?
Cobalt	Not Relevant for Mine Spoil Aquifer Monitoring Wells		0.004152	0.008796	0.007248	0.00849	0.440698	0.13415	0.28742	No	Yes	No	No
Lithium			3.06713	1.282585	2.174858	0.08305	0.13459	0.091538	0.11306	Yes	Yes	Yes	Yes

	Leachate Concentrations (mg/L)					GW Concentrations (mg/L) Uniontown Sandstone									
Parameters	DP1WD	DP2WD	LCSC1	LCSC2	DPWD/ LCSC Avg.	UG UPL (MW-215B)	MW-202B	MW-203B	MW-204B	DG Avg.	DPWD/ LCSC Avg. > UG UPL?	DG Avg. > UG UPL?	MW-202B < DPWD/ LCSC Avg.?	MW-203B < DPWD/ LCSC Avg.?	MW-204B < DPWD/ LCSC Avg.?
Lithium	0.2298245	0.9280485	3.06713	1.282585	1.376897	0.07311	0.143547	0.026791	0.120743	0.09703	Yes	Yes	Yes	Yes	Yes

Notes: DG -Downgradient; GW - Groundwater; UG - Upgradient; UPL - Upper Prediction Limit
Leachate Concentrations are averages of sampling performed in June and July 2019.
GW Concentrations of Cobalt and Lithium from sampling and analysis completed in July 2019.
UG UPL's based on 8 baseline sampling events.

DP1WD - Phase 1 Blanket Underdrain
DP2WD - Phase 2 Blanket Underdrain
LCSC1 - Phase 3, Step 1 and 3-1 LCS
LCSC2 - Phase 3, Step 2 and 3-1 LCS

FIGURES

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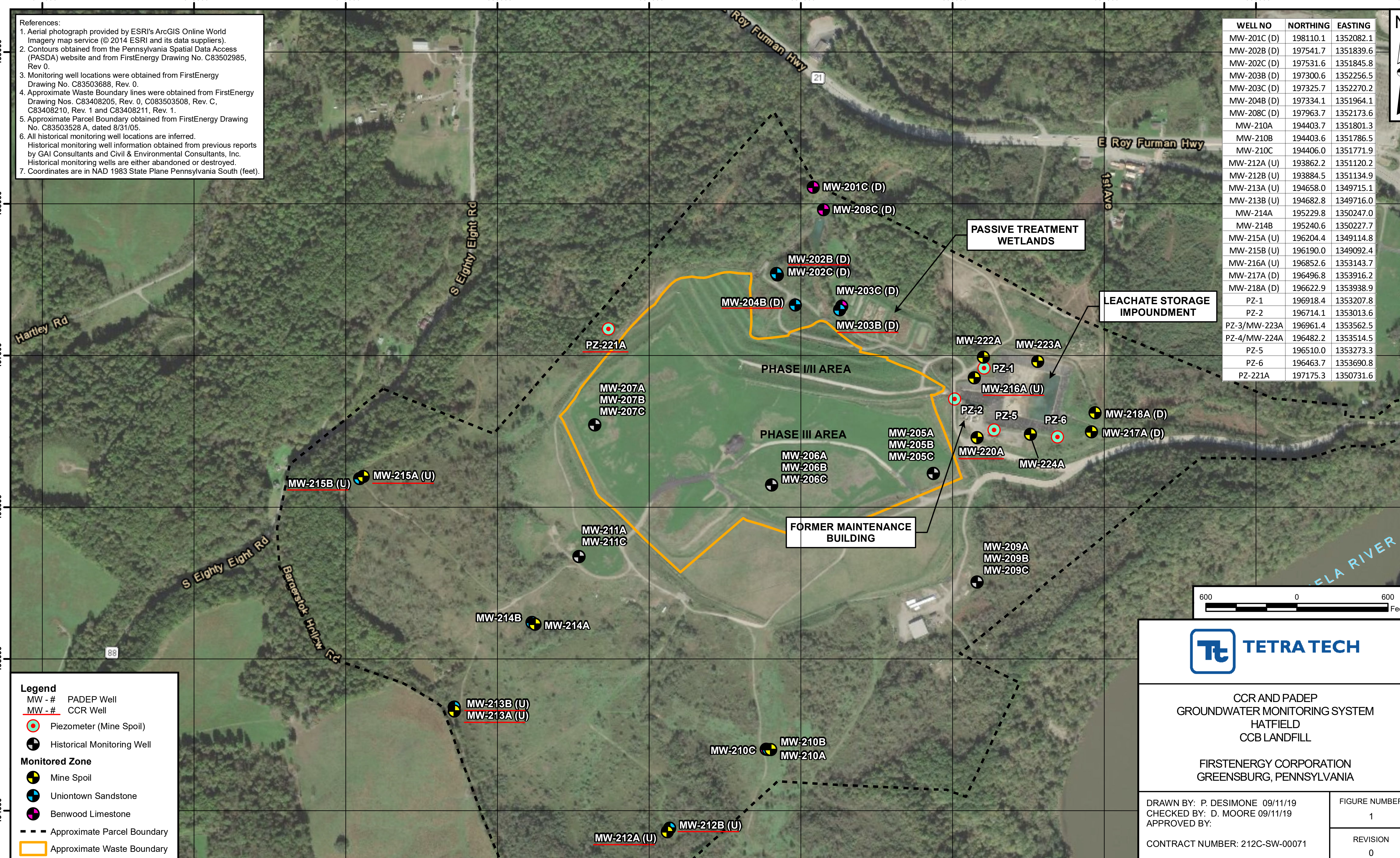

References:
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6. All historical monitoring well locations are inferred. Historical monitoring well information obtained from previous reports by GAI Consultants and Civil & Environmental Consultants, Inc. Historical monitoring wells are either abandoned or destroyed.
7. Coordinates are in NAD 1983 State Plane Pennsylvania South (feet).

WELL NO	NORTHING	EASTING
MW-201C (D)	198110.1	1352082.1
MW-202B (D)	197541.7	1351839.6
MW-202C (D)	197531.6	1351845.8
MW-203B (D)	197300.6	1352256.5
MW-203C (D)	197325.7	1352270.2
MW-204B (D)	197334.1	1351964.1
MW-208C (D)	197963.7	1352173.6
MW-210A	194403.7	1351801.3
MW-210B	194403.6	1351786.5
MW-210C	194406.0	1351771.9
MW-212A (U)	193862.2	1351120.2
MW-212B (U)	193884.5	1351134.9
MW-213A (U)	194658.0	1349715.1
MW-213B (U)	194682.8	1349716.0
MW-214A	195229.8	1350247.0
MW-214B	195240.6	1350227.7
MW-215A (U)	196204.4	1349114.8
MW-215B (U)	196190.0	1349092.4
MW-216A (U)	196852.6	1353143.7
MW-217A (D)	196496.8	1353916.2
MW-218A (D)	196622.9	1353938.9
PZ-1	196918.4	1353207.8
PZ-2	196714.1	1353013.6
PZ-3/MW-223A	196961.4	1353562.5
PZ-4/MW-224A	196482.2	1353514.5
PZ-5	196510.0	1353273.3
PZ-6	196463.7	1353690.8
PZ-221A	197175.3	1350731.6

TETRA TECH

CCR AND PADEP
GROUNDWATER MONITORING SYSTEM
HATFIELD
CCB LANDFILL

FIRSTENERGY CORPORATION
GREENSBURG, PENNSYLVANIA

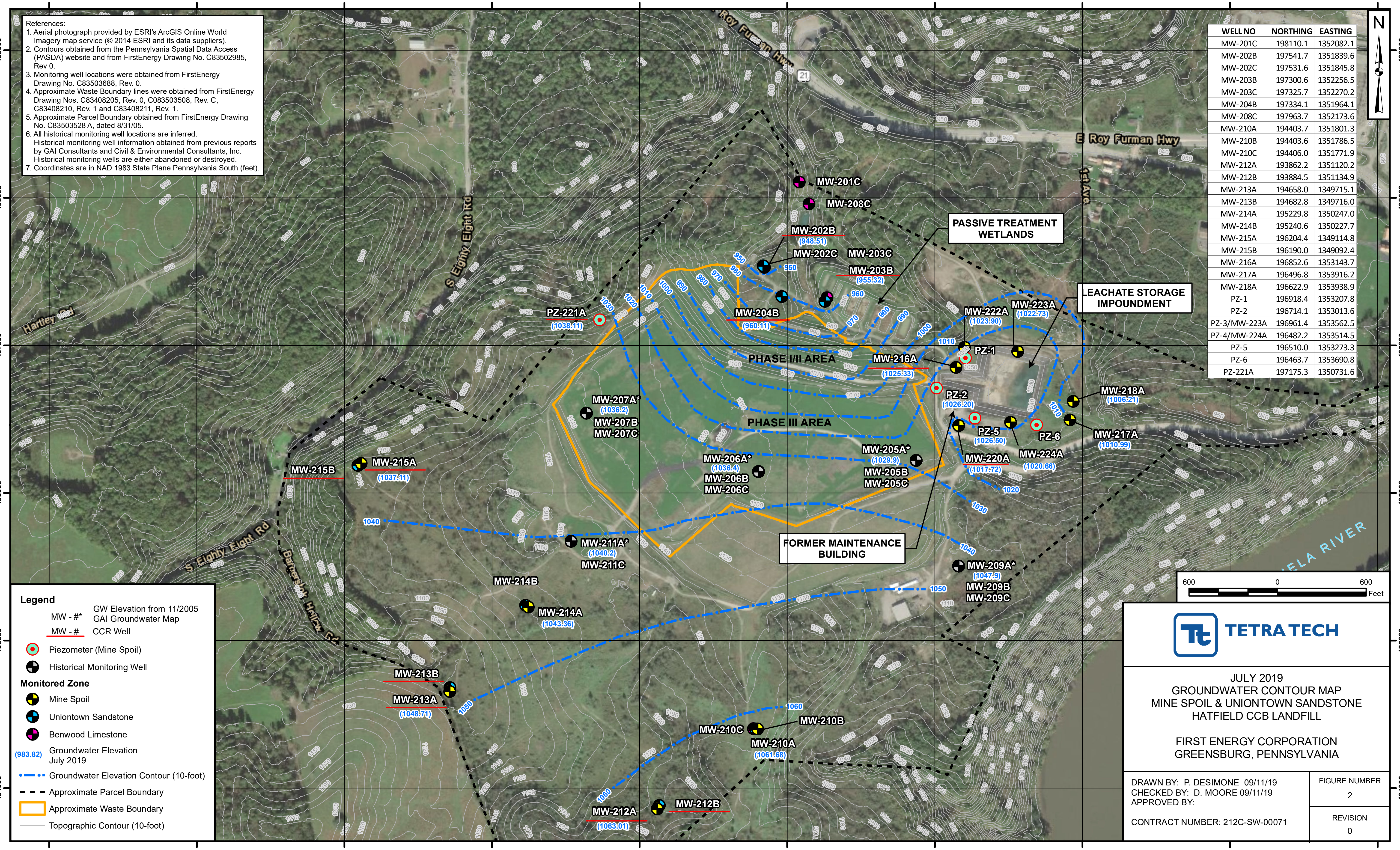
DRAWN BY: P. DESIMONE 09/11/19
CHECKED BY: D. MOORE 09/11/19
APPROVED BY:

CONTRACT NUMBER: 212C-SW-00071

FIGURE NUMBER 1

REVISION 0

PGH P:\GIS\FIRST_ENERGY\MAPDOCS\HATFIELDSFERRY_GROUNDWATERCONTOUR_MINESPOIL_UNIONTOWNSS_JULY2019.MXD 09/11/19 PD



WELL NO	NORTHING	EASTING
MW-201C	198110.1	1352082.1
MW-202B	197541.7	1351839.6
MW-202C	197531.6	1351845.8
MW-203B	197300.6	1352256.5
MW-203C	197325.7	1352270.2
MW-204B	197334.1	1351964.1
MW-208C	197963.7	1352173.6
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PZ-4/MW-224A	196482.2	1353514.5
PZ-5	196510.0	1353273.3
PZ-6	196463.7	1353690.8
PZ-221A	197175.3	1350731.6

TETRA TECH

JULY 2019
GROUNDWATER CONTOUR MAP
MINE SPOIL & UNIONTOWN SANDSTONE
HATFIELD CCB LANDFILL

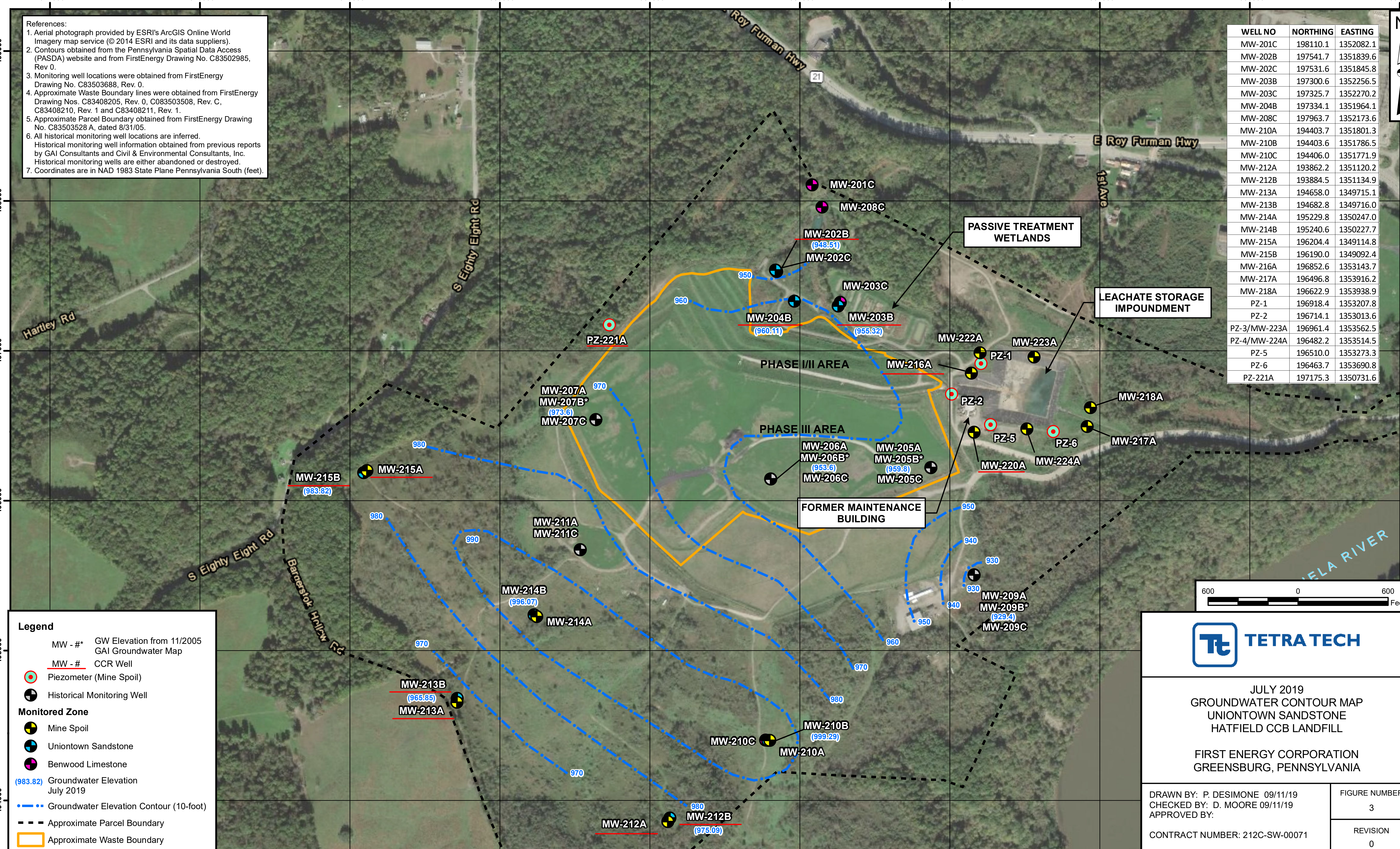
FIRST ENERGY CORPORATION
GREENSBURG, PENNSYLVANIA

DRAWN BY: P. DESIMONE 09/11/19
CHECKED BY: D. MOORE 09/11/19
APPROVED BY:

CONTRACT NUMBER: 212C-SW-00071

FIGURE NUMBER 2

REVISION 0



WELL NO	NORTHING	EASTING
MW-201C	198110.1	1352082.1
MW-202B	197541.7	1351839.6
MW-202C	197531.6	1351845.8
MW-203B	197300.6	1352256.5
MW-203C	197325.7	1352270.2
MW-204B	197334.1	1351964.1
MW-208C	197963.7	1352173.6
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PZ-3/MW-223A	196961.4	1353562.5
PZ-4/MW-224A	196482.2	1353514.5
PZ-5	196510.0	1353273.3
PZ-6	196463.7	1353690.8
PZ-221A	197175.3	1350731.6

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6. All historical monitoring well locations are inferred. Historical monitoring well information obtained from previous reports by GAI Consultants and Civil & Environmental Consultants, Inc. Historical monitoring wells are either abandoned or destroyed.
7. Coordinates are in NAD 1983 State Plane Pennsylvania South (feet).

Legend

MW - #* GW Elevation from 11/2005 GAI Groundwater Map
MW - # CCR Well
Piezometer (Mine Spoil)
Historical Monitoring Well

Monitored Zone

Mine Spoil
Uniontown Sandstone
Benwood Limestone
(983.82) Groundwater Elevation July 2019
Groundwater Elevation Contour (10-foot)
Approximate Parcel Boundary
Approximate Waste Boundary

TETRA TECH

JULY 2019
GROUNDWATER CONTOUR MAP
UNIONTOWN SANDSTONE
HATFIELD CCB LANDFILL

FIRST ENERGY CORPORATION
GREENSBURG, PENNSYLVANIA

DRAWN BY: P. DESIMONE 09/11/19
CHECKED BY: D. MOORE 09/11/19
APPROVED BY:

CONTRACT NUMBER: 212C-SW-00071

FIGURE NUMBER 3

REVISION 0

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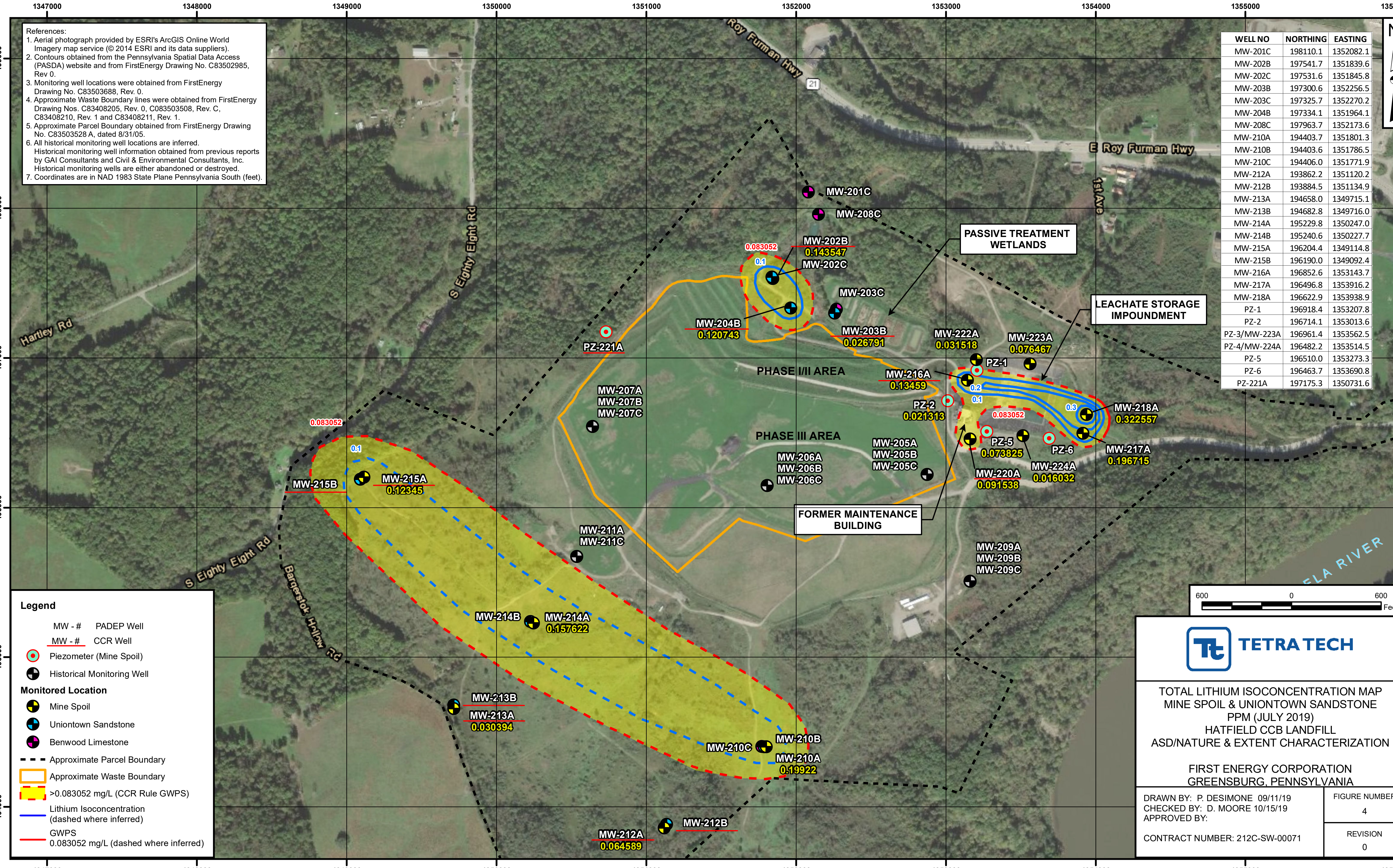

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MW-202B	197541.7	1351839.6
MW-202C	197531.6	1351845.8
MW-203B	197300.6	1352256.5
MW-203C	197325.7	1352270.2
MW-204B	197334.1	1351964.1
MW-208C	197963.7	1352173.6
MW-210A	194403.7	1351801.3
MW-210B	194403.6	1351786.5
MW-210C	194406.0	1351771.9
MW-212A	193862.2	1351120.2
MW-212B	193884.5	1351134.9
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MW-213B	194682.8	1349716.0
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MW-214B	195240.6	1350227.7
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MW-216A	196852.6	1353143.7
MW-217A	196496.8	1353916.2
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PZ-5	196510.0	1353273.3
PZ-6	196463.7	1353690.8
PZ-221A	197175.3	1350731.6

Legend

MW - # PADEP Well
MW - # CCR Well
Piezometer (Mine Spoil)
Historical Monitoring Well

Monitored Location

Mine Spoil
Uniontown Sandstone
Benwood Limestone
Approximate Parcel Boundary
Approximate Waste Boundary
>0.083052 mg/L (CCR Rule GWPS)
Lithium Isoconcentration (dashed where inferred)
GWPS 0.083052 mg/L (dashed where inferred)

TETRA TECH

TOTAL LITHIUM ISOCONCENTRATION MAP
MINE SPOIL & UNIONTOWN SANDSTONE
PPM (JULY 2019)
HATFIELD CCB LANDFILL
ASD/NATURE & EXTENT CHARACTERIZATION

FIRST ENERGY CORPORATION
GREENSBURG, PENNSYLVANIA

DRAWN BY: P. DESIMONE 09/11/19
CHECKED BY: D. MOORE 10/15/19
APPROVED BY:

CONTRACT NUMBER: 212C-SW-00071

FIGURE NUMBER 4

REVISION 0

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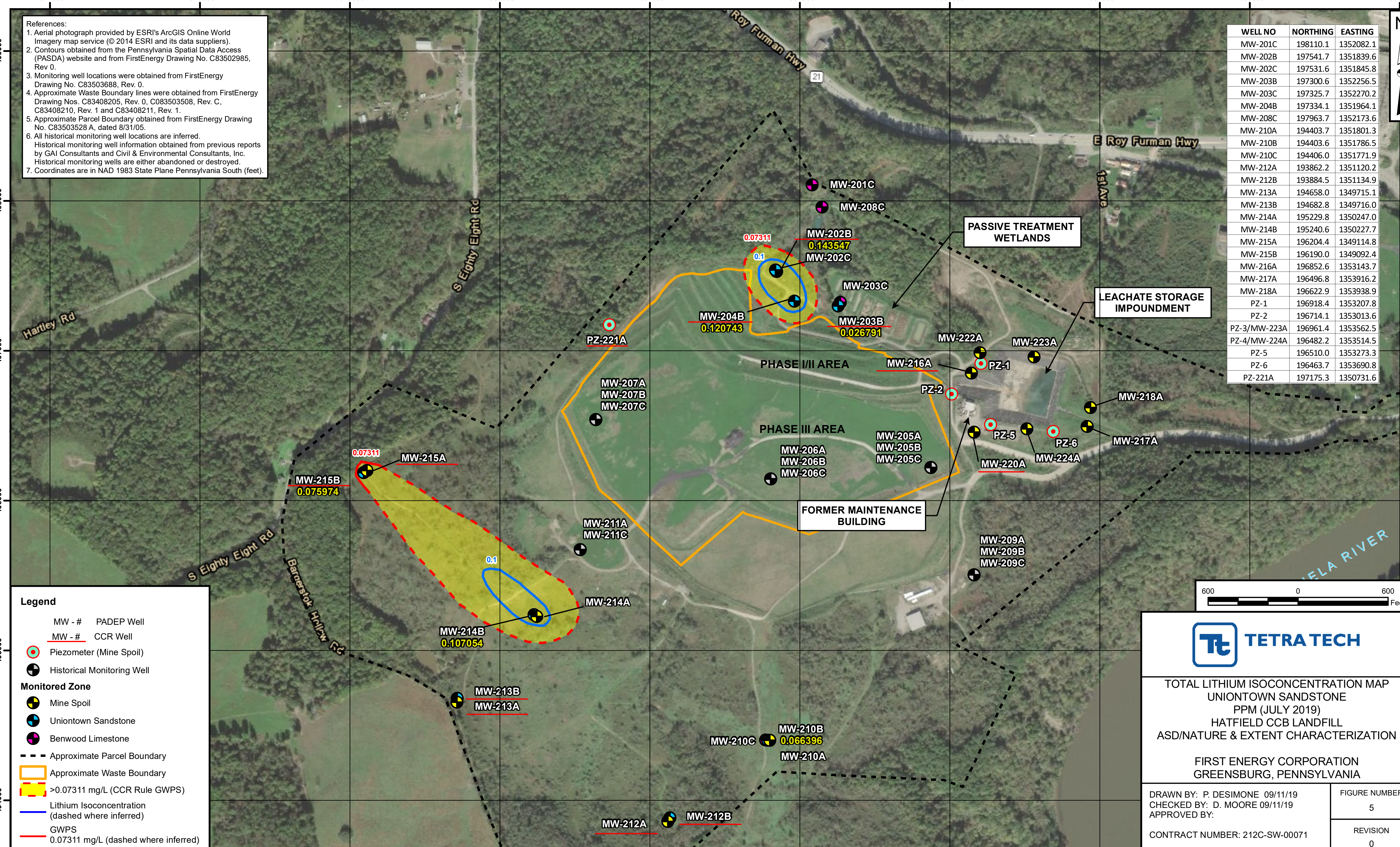

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PZ-221A	197175.3	1350731.6

Legend

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MW - # CCR Well
Piezometer (Mine Spoil)
Historical Monitoring Well

Monitored Zone

Mine Spoil
Uniontown Sandstone
Benwood Limestone
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Approximate Waste Boundary
>0.07311 mg/L (CCR Rule GWPS)
Lithium Isoconcentration (dashed where inferred)
GWPS 0.07311 mg/L (dashed where inferred)

TETRA TECH

TOTAL LITHIUM ISOCONCENTRATION MAP
UNIONTOWN SANDSTONE
PPM (JULY 2019)
HATFIELD CCB LANDFILL
ASD/NATURE & EXTENT CHARACTERIZATION

FIRST ENERGY CORPORATION
GREENSBURG, PENNSYLVANIA

DRAWN BY: P. DESIMONE 09/11/19
CHECKED BY: D. MOORE 09/11/19
APPROVED BY:

CONTRACT NUMBER: 212C-SW-00071

FIGURE NUMBER 5

REVISION 0

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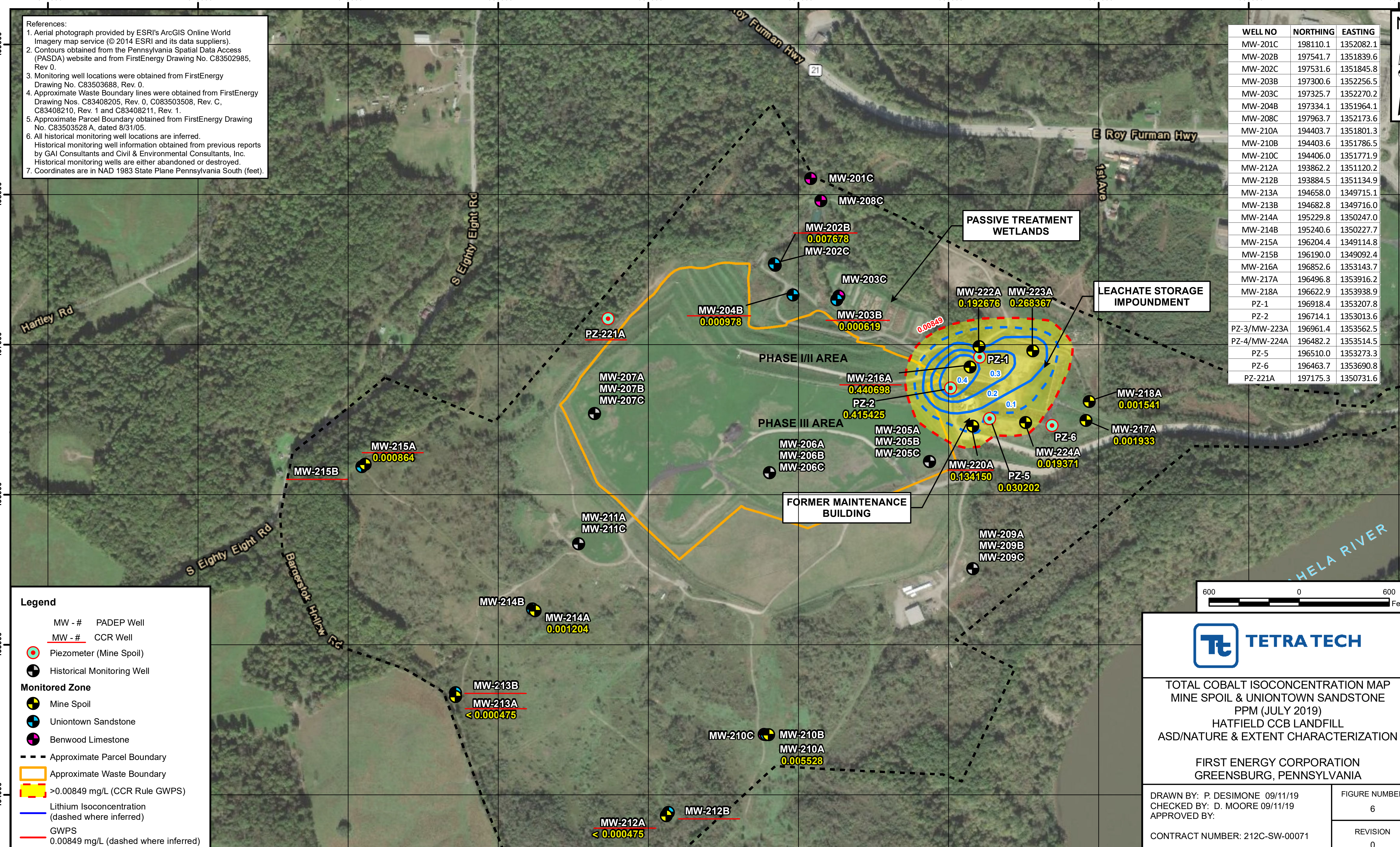

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4. Approximate Waste Boundary lines were obtained from FirstEnergy Drawing Nos. C83408205, Rev. 0, C083503508, Rev. C, C83408210, Rev. 1 and C83408211, Rev. 1.
5. Approximate Parcel Boundary obtained from FirstEnergy Drawing No. C83503528 A, dated 8/31/05.
6. All historical monitoring well locations are inferred. Historical monitoring well information obtained from previous reports by GAI Consultants and Civil & Environmental Consultants, Inc. Historical monitoring wells are either abandoned or destroyed.
7. Coordinates are in NAD 1983 State Plane Pennsylvania South (feet).

WELL NO	NORTHING	EASTING
MW-201C	198110.1	1352082.1
MW-202B	197541.7	1351839.6
MW-202C	197531.6	1351845.8
MW-203B	197300.6	1352256.5
MW-203C	197325.7	1352270.2
MW-204B	197334.1	1351964.1
MW-208C	197963.7	1352173.6
MW-210A	194403.7	1351801.3
MW-210B	194403.6	1351786.5
MW-210C	194406.0	1351771.9
MW-212A	193862.2	1351120.2
MW-212B	193884.5	1351134.9
MW-213A	194658.0	1349715.1
MW-213B	194682.8	1349716.0
MW-214A	195229.8	1350247.0
MW-214B	195240.6	1350227.7
MW-215A	196204.4	1349114.8
MW-215B	196190.0	1349092.4
MW-216A	196852.6	1353143.7
MW-217A	196496.8	1353916.2
MW-218A	196622.9	1353938.9
PZ-1	196918.4	1353207.8
PZ-2	196714.1	1353013.6
PZ-3/MW-223A	196961.4	1353562.5
PZ-4/MW-224A	196482.2	1353514.5
PZ-5	196510.0	1353273.3
PZ-6	196463.7	1353690.8
PZ-221A	197175.3	1350731.6

Legend

- MW - # PADEP Well
- MW - # CCR Well
- Piezometer (Mine Spoil)
- Historical Monitoring Well

Monitored Zone

- Mine Spoil
- Uniontown Sandstone
- Benwood Limestone
- Approximate Parcel Boundary
- Approximate Waste Boundary
- >0.00849 mg/L (CCR Rule GWPS)
- Lithium Isoconcentration (dashed where inferred)
- GWPS 0.00849 mg/L (dashed where inferred)

TETRA TECH

TOTAL COBALT ISOCONCENTRATION MAP
MINE SPOIL & UNIONTOWN SANDSTONE
PPM (JULY 2019)
HATFIELD CCB LANDFILL
ASD/NATURE & EXTENT CHARACTERIZATION

FIRST ENERGY CORPORATION
GREENSBURG, PENNSYLVANIA

DRAWN BY: P. DESIMONE 09/11/19
CHECKED BY: D. MOORE 09/11/19
APPROVED BY:

CONTRACT NUMBER: 212C-SW-00071

FIGURE NUMBER 6

REVISION 0