Gavin Power, LLC

Gavin Residual Waste Landfill

2019 Annual Groundwater Monitoring and Corrective Action Report

Gavin Power Plant
Cheshire, Ohio

31 January 2020

Project No.: 0505619

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31 January 2020

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2019 Annual Groundwater Monitoring and Corrective Action Report

Gavin Power Plant
Cheshire, Ohio

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Acronyms and Abbreviations

Name	Description
ASD	Alternate Source Demonstration
CCR	Coal Combustion Residual
CFR	Code of Federal Regulations
ERM	ERM Consulting and Engineering, Inc.
Gavin	Gavin Power, LLC
Plant	General James M. Gavin Power Plant
RWL	Residual Waste Landfill
SSI	Statistically significant increase

EXECUTIVE SUMMARY

On behalf of Gavin Power, LLC (Gavin), ERM Consulting and Engineering, Inc. (ERM) has prepared this 2019 Annual Groundwater Monitoring and Corrective Action Report summarizing groundwater sampling activities at the Residual Waste Landfill (RWL) at the General James M. Gavin Power Plant (Plant) located in Cheshire, Ohio. The RWL is one of three regulated coal combustion residual (CCR) management units at the Plant that are subject to regulation under Title 40, Code of Federal Regulations, Part 257, Subpart D (40 CFR § 257.50 *et seq.*), also known as the CCR Rule.

This report documents the status of the groundwater monitoring program for the RWL, which includes the following as required by 40 CFR § 257.90(e):

- A summary of key actions completed;
- A description of problems encountered and actions taken to resolve the problems; and
- Identification of key activities for the coming year.

The RWL CCR unit groundwater monitoring program began 2019 in “detection monitoring” program status as defined by 40 CFR § 257.94 and remains in detection monitoring at the end of the 2019 reporting period. Groundwater monitoring in 2019 consisted of two semi-annual monitoring events completed in March and September 2019, which included groundwater level measurements and subsequent groundwater sampling. Groundwater level measurements were used to construct updated groundwater potentiometric surface maps for each of the geologic units monitored.

Groundwater samples were collected for laboratory analysis of CCR Rule Appendix III constituents and the results were compared to previously calculated upgradient well prediction limits to identify statistically significant increases (SSIs) for downgradient wells. The following locations and analytes had observed SSIs in 2019:

Well	Date Sampled	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids (TDS)
2016-20	Mar-2019	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ
	Sep-2019	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ
2016-21	Mar-2019	ϕ	ϕ	ϕ	ϕ	X	ϕ	ϕ
	Sep-2019	ϕ	ϕ	ϕ	ϕ	X	ϕ	ϕ
93108	Mar-2019	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ
	Sep-2019	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ
94136	Mar-2019	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ
	Sep-2019	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ

Notes: ϕ = No SSI; X = SSI; SSI = statistically significant increase

Each identified SSI was evaluated in corresponding attached Alternate Source Demonstration (ASD) Report. The ASD reports identify cement-bentonite grout from well installation as the source of these SSIs for pH; therefore, the RWL remains in detection monitoring at the conclusion of 2019. Accordingly, no remedial actions were selected, initiated, or performed in 2019.

1. INTRODUCTION

The General James M. Gavin Power Plant (Plant) is a coal-fired generating station located in Gallia County in Cheshire, Ohio, along the Ohio River. The Plant consists of three regulated coal combustion residual management units that are subject to regulation under Title 40, Code of Federal Regulations, Part 257, Subpart D (40 CFR § 257.50 *et seq.*), also known as the CCR Rule: the Residual Waste Landfill, the Fly Ash Reservoir, and the Bottom Ash Pond. The RWL is located approximately 1.25 miles northwest of the Plant (Figure 1-1). The RWL is permitted by the Ohio Environmental Protection Agency to accept and dispose of CCR material as a Class 3 Landfill. Gavin received approval from the Ohio Environmental Protection Agency in January 2019 to construct the Phase I expansion of the RWL. This project includes a lateral expansion to the west of the existing RWL.

This report was produced by ERM Consulting and Engineering, Inc. (ERM) on behalf of Gavin Power, LLC and documents the status of the groundwater monitoring program for the RWL, including the following as required by 40 CFR § 257.90(e):

- A summary of key actions completed;
- A description of problems encountered and actions taken to resolve the problems; and
- Identification of key activities for the coming year.

Consistent with the notification requirements of the CCR Rule, this annual groundwater monitoring report will be posted to the Plant operating record no later than 31 January 2020 (40 CFR § 257.105(h)(1)). Within 30 days of placing the report in the operating record, notification will be made to the Ohio Environmental Protection Agency and the report will be placed on the Plant publicly accessible internet site (40 CFR §§ 257.106(h)(1), 257.107(h)(1)). Table 1-1 cross-references the reporting requirements under the CCR Rule with the contents of this report.

Table 1-1: Regulatory Requirement Cross-Reference Table

Regulatory Citation in 40 CFR Part 257, Subpart D	Requirement (paraphrased)	Where Addressed in this Report
§ 257.90(e)	Status of the groundwater monitoring program.	Section 2
§ 257.90(e)	Summarize key actions completed.	Section 2.3, 2.4, and 3.1
§ 257.90(e)	Describe any problems encountered and actions taken to resolve problems.	Section 2.3
§ 257.90(e)	Key activities for upcoming year.	Section 4.0
§ 257.90(e)(1)	Map, aerial image, or diagram of coal combustion residual (CCR) Unit and monitoring wells.	Figure 2-1
§ 257.90(e)(2)	Identification of new monitoring wells installed or abandoned during the preceding year and narrative description.	Section 2.4
§ 257.90(e)(3)	Summary of groundwater data, wells sampled, date sampled, and whether sample was required under detection or assessment monitoring.	Section 2.3, 3.2, Appendix C
§ 257.90(e)(4)	Narrative discussion of any transition between monitoring programs.	Section 4.0
§ 257.94(e)(2) (via § 257.90(e)(5))	Any alternate source demonstration reports and related certifications.	Appendices A–B

2. PROGRAM STATUS § 257.90(E)

2.1 Monitoring Well Network

Hydrogeology within the RWL is characterized by a shallow zone of saturation that overlies an upper aquifer system that consists of sandstone and interbedded clay and shale units. The uppermost aquifer system, which includes the Morgantown sandstone and the Cow Run sandstone, is overlain by the Clarksburg Red Beds, which act as a confining layer.

Figure 2-1 provides the Morgantown and Cow Run monitoring well locations on the site location map. Three monitoring wells previously in the federal sampling program (94125, 94126, and 94128) were decommissioned in November 2019 following well sampling as part of the RWL expansion activities. Installation of replacement wells along the western boundary of the RWL will occur in 2020.

2.2 Previous Groundwater Monitoring Activities

The RWL monitoring wells were sampled eight times between August 2016 and July 2017 to establish upgradient well baseline data. Prediction limits were developed using the baseline data and compared to the July 2017 downgradient well results, consistent with the CCR Rule and the Statistical Analysis Plan developed for Gavin (ERM 2017). This comparison resulted in the identification of statistically significant increases (SSI) for Appendix III analytes in downgradient RWL wells, which were reported in the 2017 Annual Groundwater Monitoring and Corrective Action Report (ERM 2018a). As a result, ERM prepared an Alternate Source Demonstration (ASD) Report (ERM 2018b) to address the identified SSIs. Downgradient results from the spring and fall 2018 sampling were reported in the 2018 Annual Groundwater Monitoring and Corrective Action Report (ERM 2019a) and SSIs associated with the 2018 results were addressed in additional ASD reports (ERM 2018c and ERM 2019b). Each ASD report concluded that SSIs resulted from alternate sources, and thus the CCR unit remained in detection monitoring. Table 2-1 and Table 2-2 below summarize identified SSIs to date in 2017 and in 2018.

Table 2-1: Previous SSIs for Morgantown Downgradient Wells

Well	Date sampled	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
2016-21	May-2017	ϕ	ϕ	ϕ	ϕ	X	ϕ	ϕ
	Apr-2018	ϕ	ϕ	ϕ	ϕ	X	ϕ	ϕ
	Sep-2018	ϕ	ϕ	ϕ	ϕ	X	ϕ	ϕ
93108	May-2017	ϕ	ϕ	ϕ	X	ϕ	ϕ	ϕ
	Mar-2018	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ
	Sep-2018	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ

Notes: ϕ = No SSI, X = SSI, NA = Not Applicable.

Table 2-2: Previous SSIs for Cow Run Downgradient Wells

Well	Date sampled	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	TDS
2016-20	May-2017	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ
	May-2018	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ
	Sep-2018	*	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ
94136	May-2017	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ
	May-2018	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ
	Sep-2018	**	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ

Notes: ϕ = No SSI, X = SSI
** Insufficient sample volume to perform analysis.*
*** Not reported by laboratory due to analytical quality control not meeting acceptance criteria.*

2.3 2019 Sampling Summary

Groundwater samples were collected in 2019 as part of the detection monitoring program under 40 CFR § 257.94 and analyzed for the constituents listed in Appendix III to 40 CFR Part 257, Subpart D. Tables 2-3 and 2-4 provide a summary of the 2019 sample dates and the well gradient designation (upgradient or downgradient of the CCR unit) for the RWL monitoring network.

Some monitoring wells could not be sampled due to insufficient water, significant depths to groundwater and/or pump malfunctions in 2019. In an effort to resolve these and other sampling challenges that resulted in the inability to collect samples in 2019, Gavin pilot-tested no-purge sampling in 2019.

Table 2-3: Sampling Dates for RWL Morgantown Well Network

Sample Date	Upgradient Wells						Downgradient Wells		Alluvium
	2000	2003	9806	94125	94128	94139	93108	2016-21	94137
7 Mar-2019					X				
11 Mar 2019						X			X
12 Mar 2019	X								
14 Mar 2019		NS	X	*Dry*				X	
17 Sep 2019					X		*Dry*		X
21 Sep 2019		X						X	
23 Sep 2019						X			
22 Sep 2019				*Dry*					
24 Sep 2019	X								
26 Sep 2019			X						

Notes: Notes: Notes: RWL = Fly Ash Reservoir; NS = not sampled
Sampling of certain Morgantown wells was limited in 2019 by the following factors:

(1) Wells with sampling events marked with "dry" had an insufficient volume of water to allow collection of samples.
(2) Well 2003 not sampled ("NS") during March 2019 sampling event due to a pump malfunction.
(3) Wells 93107, 93108 and 94122 consistently contained an insufficient volume of water for the past several years and thus were not sampled.
(4) Well 94137 is part of the certified monitoring well network (Geosyntec 2016) and was sampled in 2019, but is not discussed further in this report because it is not screened in the relevant aquifer.

Table 2-4: Sampling Dates for RWL Cow Run Well Network

Sample Date	Upgradient Wells				Downgradient Wells		Alluvium
	2002	9801	93100	94126	94136	2016-20	9802
7 Mar 2019				X	X		
11 Mar 2019			X				
12 Mar 2019		X					X
14 Mar 2019	NS						
15 Mar 2019						*Dry*	
17 Sep 2019				X	X		
21 Sep 2019						*Dry*	
23 Sep 2019			X				
24 Sep 2019		X					X

Notes: Notes: RWL = Fly Ash Reservoir; NS = not sampled
Sampling of certain Cow Run wells was limited in 2019 by the following factors:
- *(1) Wells with sampling events marked with "dry" had an insufficient volume of water to allow collection of samples.*
- *(2) Well 2002 was not sampled in March or September due to pump malfunction.*
- *(3) Well 9802 is part of the certified monitoring well network (Geosyntec 2016) and was sampled in 2019, but is not discussed further in this report because it is not screened in the relevant aquifer.*

2.4 Monitoring Well Installation

Installation of replacement monitoring wells for the three recently decommissioned wells (94125, 94126, and 94128) is underway and will continue in 2020. Gavin anticipates surveying the horizontal coordinates and reference elevations and formally incorporating the new wells into the RWL monitoring well network in 2020.

2.5 Data Quality

ERM reviewed field and laboratory documentation to assess the validity, reliability, and usability of the analytical results. Samples collected in 2019 were analyzed by TestAmerica of North Canton, Ohio. Data quality information reviewed for these results included field sampling forms, chain-of-custody documentation, holding times, laboratory methods, cooler temperatures, laboratory method blanks, laboratory control sample recoveries, field duplicate samples, matrix spikes/matrix spike duplicates, quantitation limits, and equipment blanks. Data qualifiers were appended to results in the project database, as appropriate, based on laboratory quality measurements (e.g., control sample recoveries) and field quality measurements (e.g., agreement between normal and field duplicate samples). ERM's data quality review found the laboratory analytical results to be valid, reliable, and usable for decision-making purposes with the listed qualifiers. No analytical results were rejected.

3. 2019 RESULTS

3.1 2019 Groundwater Flow Direction and Velocity

Depth to groundwater measurements were collected in March and September 2019 at each monitoring well prior to each sampling event. Groundwater elevations, calculated by subtracting the depth to groundwater from the surveyed reference elevation for each well, were reviewed for each sampling event. Groundwater elevations, interpreted potentiometric surface maps, and interpreted groundwater flow directions for wells screened in the Morgantown Sandstone and Cow Run Sandstone are presented on Figures 3-1 through 3-4.

The principal direction of groundwater flow in the uppermost aquifer system under the RWL (both in the Morgantown Sandstone and in Cow Run Sandstone) is from the north and northwest to the south and southeast, towards the Ohio River. Groundwater velocity estimates are presented in the next sections.

3.1.1 Morgantown Sandstone Groundwater Velocity

A horizontal hydraulic gradient of 0.010 was calculated for the Morgantown Sandstone using groundwater elevations calculated at Wells 96154R and 2016-21. Based on the measured horizontal hydraulic gradient, a hydraulic conductivity of 7.18×10^{-5} centimeters per second (Geosyntec 2012), and an effective porosity value of 0.01 for fractured bedrock, the velocity of groundwater through the Morgantown sandstone is estimated to be about 80 feet/year.

3.1.2 Cow Run Sandstone Groundwater Velocity

A horizontal hydraulic gradient of 0.015 was calculated for the Cow Run Sandstone using groundwater elevations calculated at Wells 2016-09 and 90631 (fall 2019 only). Based on the measured horizontal hydraulic gradient, a hydraulic conductivity of 2.92×10^{-5} centimeters per second (Geosyntec 2012), and an effective porosity value of 0.01 for fractured bedrock, the velocity of groundwater through the Cow Run sandstone is estimated to be about 46 feet/year.

3.2 Comparison of Results to Prediction Limits

Consistent with the CCR Rule and with Gavin's Statistical Analysis Plan (ERM 2017), a prediction limit approach was used to identify potential impacts to groundwater. Upper prediction limits were developed for the Appendix III parameters; in the case of pH, a lower prediction limit was also developed. Documentation of the development of the upper prediction limits and lower prediction limit for the RWL is provided in the 2018 Alternate Source Demonstration (ERM 2018b).

3.2.1 March 2019 Sampling Event Results

Tables 3-1 and 3-2 summarize SSIs observed in the Morgantown and Cow Run downgradient wells for the first semiannual sampling event of 2019. The event took place between 8 March and 13 April 2019.

Table 3-1: SSIs from March 2019 Sampling Event—Morgantown

Analyte	Monitoring Well	
	2016-21	**93108**
Boron	ϕ	*
Calcium	ϕ	*
Chloride	ϕ	*
Fluoride	ϕ	*
pH	X	*
Sulfate	ϕ	*
Total Dissolved Solids	ϕ	*

Notes: ϕ = No SSI, X = SSI
Results are for the downgradient wells sampled in March 2019.
** Insufficient sample volume due to low recharge.*

Table 3-2: SSIs from March 2019 Sampling Event—Cow Run

Analyte	Monitoring Well	
	2016-20	**94136**
Boron	*	ϕ
Calcium	*	ϕ
Chloride	*	ϕ
Fluoride	*	ϕ
pH	ϕ	ϕ
Sulfate	*	ϕ
Total Dissolved Solids	*	ϕ

Notes: ϕ = No SSI, X = SSI
Results are for the downgradient wells sampled in March 2019.
** Insufficient sample volume due to low recharge.*

The only SSI detected for the RWL for March 2019 was pH for Well 2016-21. An alternate source was identified for this SSI and is documented in the First Gavin RWL Semiannual Sampling Event of 2019 ASD Report (ERM 2019c). This ASD Report identified cement-bentonite grout from well construction as the source of the pH SSI detected at Well 2016-21. A copy of the First Gavin RWL Semiannual Sampling Event of 2019 ASD Report is included in Appendix A.

3.2.2 September 2019 Sampling Event Results

A comparison of the September 2019 sampling event results to the prediction limits identified SSIs for the following analytes in the downgradient wells, summarized in Tables 3-3 and 3-4.

Table 3-3: SSIs from September 2019 Sampling Event—Morgantown

Analyte	2016-21	93108
Boron	ϕ	*
Calcium	ϕ	*
Chloride	ϕ	*
Fluoride	ϕ	*
pH	X	*
Sulfate	ϕ	*
Total Dissolved Solids	ϕ	*

Notes: ϕ = No SSI, X = SSI
Results are for the downgradient wells sampled in September 2019.
** Insufficient sample volume due to low recharge.*

Table 3-4: SSIs from September 2019 Sampling Event—Cow Run

Analyte	2016-20	94136
Boron	*	ϕ
Calcium	*	ϕ
Chloride	*	ϕ
Fluoride	*	ϕ
pH	*	ϕ
Sulfate	*	ϕ
Total Dissolved Solids	*	ϕ

Notes: ϕ = No SSI, X = SSI
Results are for the downgradient wells sampled in September 2019.
** Insufficient sample volume due to low recharge.*

The only SSI detected for the RWL for September 2019 was pH for Well 2016-21. An alternate source was identified for this SSI and is documented in the Gavin RWL Second Semiannual Sampling Event of 2019 ASD (ERM 2020), included as Appendix B. This ASD Report identified cement-bentonite grout from well construction as the source of the pH SSI detected at Well 2016-21.

The RWL Second Semiannual Sampling Event of 2018 ASD Report (ERM 2019b) was submitted as Appendix C of the 2018 annual sampling report in January 2019 (ERM 2019a).

A summary of all analytical results obtained from the RWL groundwater monitoring is provided in Appendix C.

4. KEY FUTURE ACTIVITIES

The five ASD Reports prepared to date concluded that sources other than the RWL were responsible for the identified SSIs. As required by 40 CFR § 257.94(e)(2), the demonstrations were completed within 90 days of detecting the SSIs and were certified by a qualified professional engineer. Because it met these requirements, the RWL remains in detection monitoring at the end of the 2019 reporting period. Two rounds of groundwater sampling events will be performed in 2020 at the RWL and the results will be compared to the prediction limits.

The Plant intends to continue expanding the RWL to the west/northwest in 2020 into areas containing existing monitoring wells. Installation of replacement wells will occur in 2020.

5. REFERENCES

ERM. 2017. *Groundwater Monitoring Plan. Bottom Ash Complex, Fly Ash Reservoir, and Residual Waste Landfill*, *Gavin Plant, Cheshire Ohio*.

ERM. 2018a. *2017 Annual Groundwater Monitoring and Corrective Action Report. Residual Waste Landfill, Gavin Plant, Cheshire Ohio,* dated 1-31-2018.

ERM. 2018b. *Gavin Residual Waste Landfill Alternate Source Demonstration Report,* dated 7-3-2018.

ERM. 2018c. *Gavin Residual Waste Landfill First Semi-Annual Sampling Event of 2018 Alternate Source Demonstration Report,* dated 10-12-2018.

ERM. 2019a. *2018 Annual Groundwater Monitoring and Corrective Action Report. Residual Waste Landfill, Gavin Plant, Cheshire Ohio,* dated 1-31-2019.

ERM. 2019b. *Gavin Residual Waste Landfill Second Semiannual Sampling Event of 2018 Alternate Source Demonstration Report,* dated 1-31-2019.

ERM. 2019c. *Gavin Residual Waste Landfill First Semiannual Sampling Event of 2019 Alternate Source Demonstration Report,* dated 1-31-2019.

ERM. 2020. *Gavin Residual Waste Landfill Second Semiannual Sampling Event of 2019 Alternate Source Demonstration Report,* dated 1-31-2020.

Geosyntec. 2012. "Final Permit-To-Install Application. Expansion of the Gavin Plant Residual Waste Landfill*." Hydrogeologic Study Report. OAC 3745-30-05(C)(4).*

Geosyntec. 2016. *Groundwater Monitoring Network Evaluation, Gavin Site—Residual Waste Landfill, Cheshire, Ohio*.

FIGURES

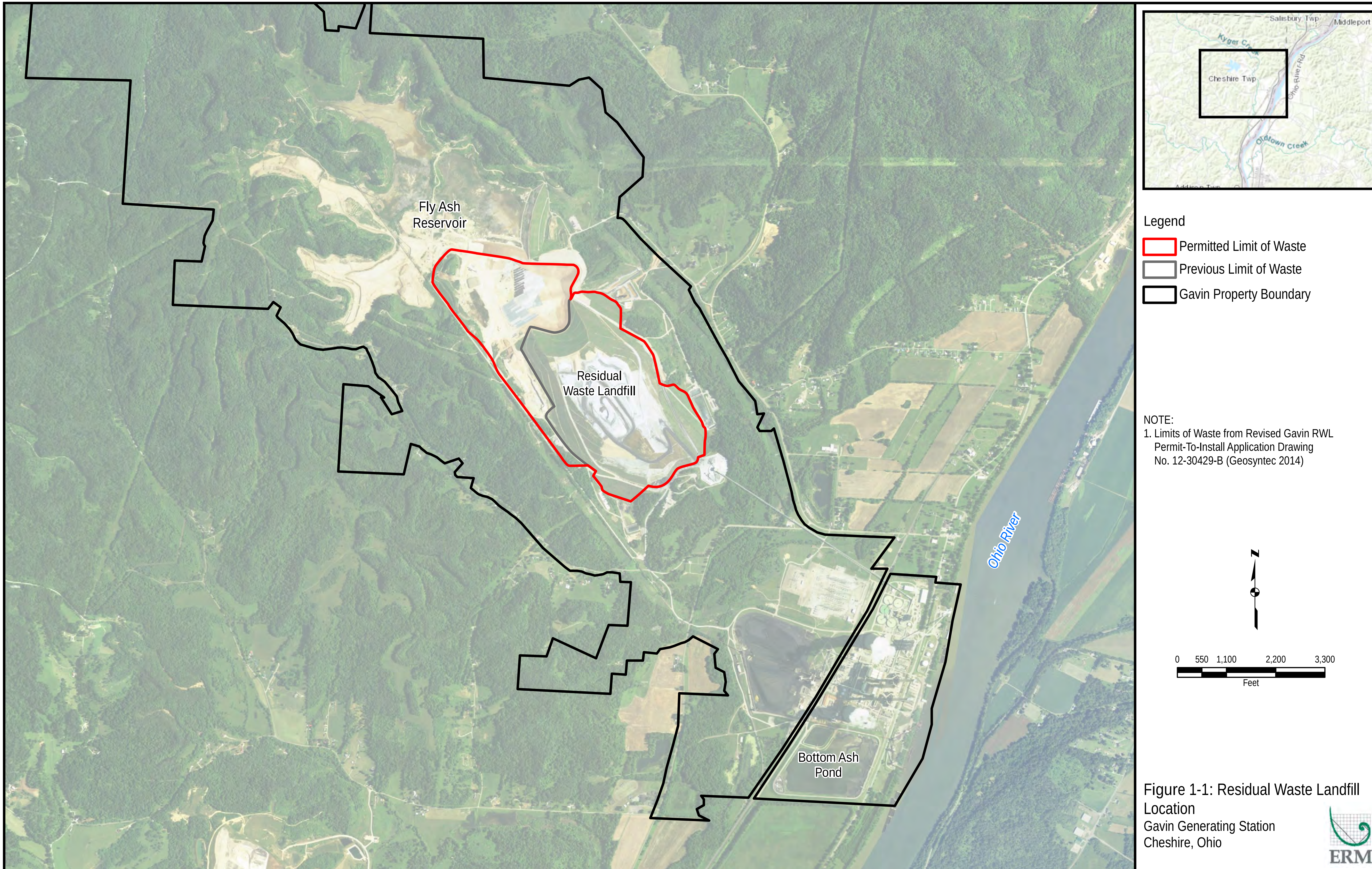


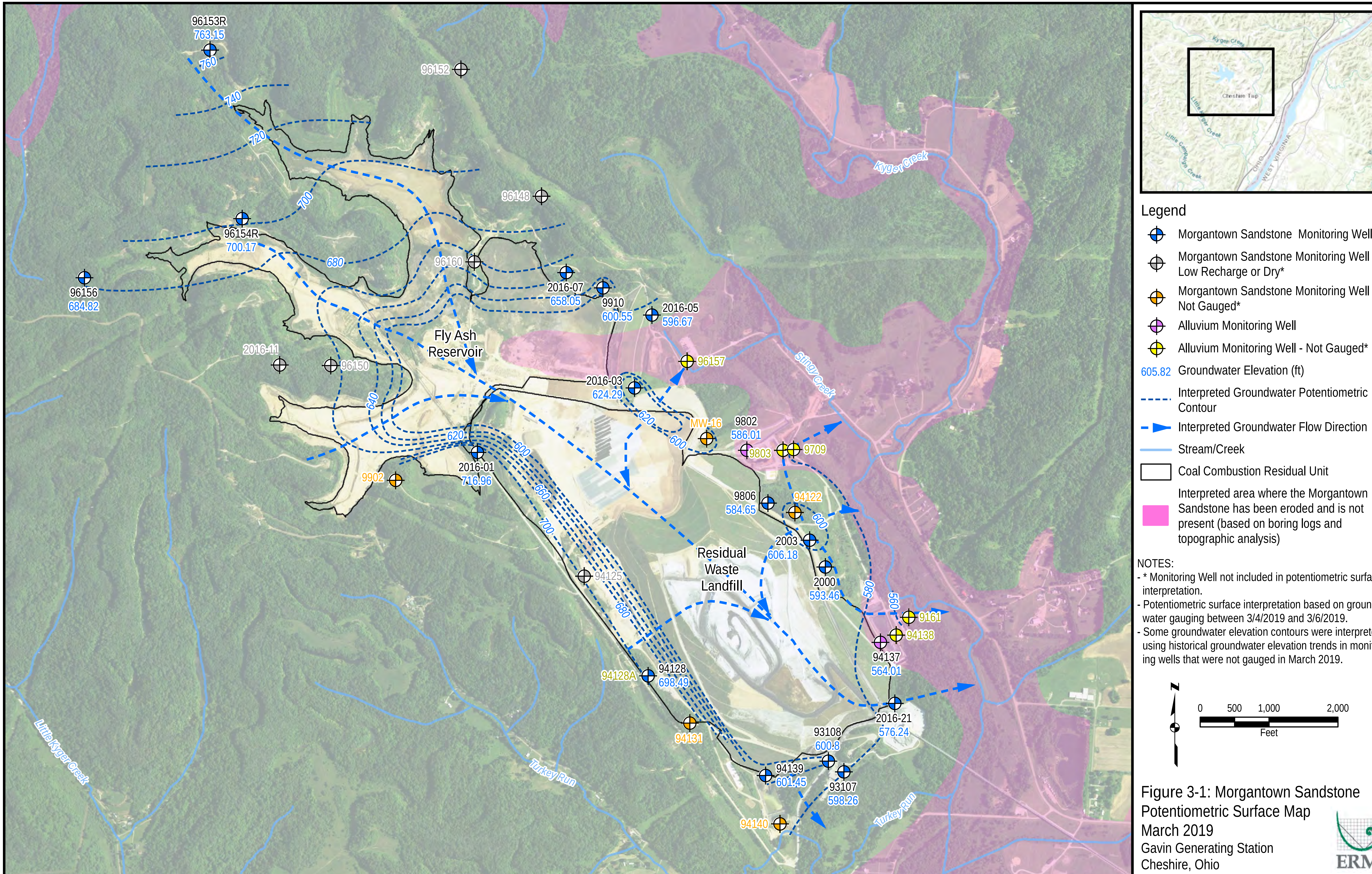
Figure 1-1: Residual Waste Landfill Location
Gavin Generating Station
Cheshire, Ohio

Legend

- Federal Sampling Program Monitoring Well (Morgantown Sandstone)
- Federal Sampling Program Monitoring Well (Cow Run sandstone)
- Monitoring Well (Alluvium)
- Permitted Limit of Waste
- Previous Limit of Waste

NOTES:
1. Locations are approximate
2. Aerial Imagery: USA NAIP 2015
3. Limits of Waste from Revised Gavin RWL Permit-To-Install Application Drawing No. 12-30429-B (Geosyntec 2014)

Figure 2-1: Monitoring Well Network Map
Residual Waste Landfill
Gavin Power Plant
Cheshire, Ohio



Legend

- Morgantown Sandstone Monitoring Well
- Morgantown Sandstone Monitoring Well - Low Recharge or Dry*
- Morgantown Sandstone Monitoring Well - Not Gauged*
- Alluvium Monitoring Well
- Alluvium Monitoring Well - Not Gauged*
- 605.82 Groundwater Elevation (ft)
- Interpreted Groundwater Potentiometric Contour
- Interpreted Groundwater Flow Direction
- Stream/Creek
- Coal Combustion Residual Unit
- Interpreted area where the Morgantown Sandstone has been eroded and is not present (based on boring logs and topographic analysis)

NOTES:

- * Monitoring Well not included in potentiometric surface interpretation.
- Potentiometric surface interpretation based on groundwater gauging between 3/4/2019 and 3/6/2019.
- Some groundwater elevation contours were interpreted using historical groundwater elevation trends in monitoring wells that were not gauged in March 2019.

N

0 500 1,000 2,000

Feet

Figure 3-1: Morgantown Sandstone Potentiometric Surface Map March 2019

Gavin Generating Station

Cheshire, Ohio

ERM

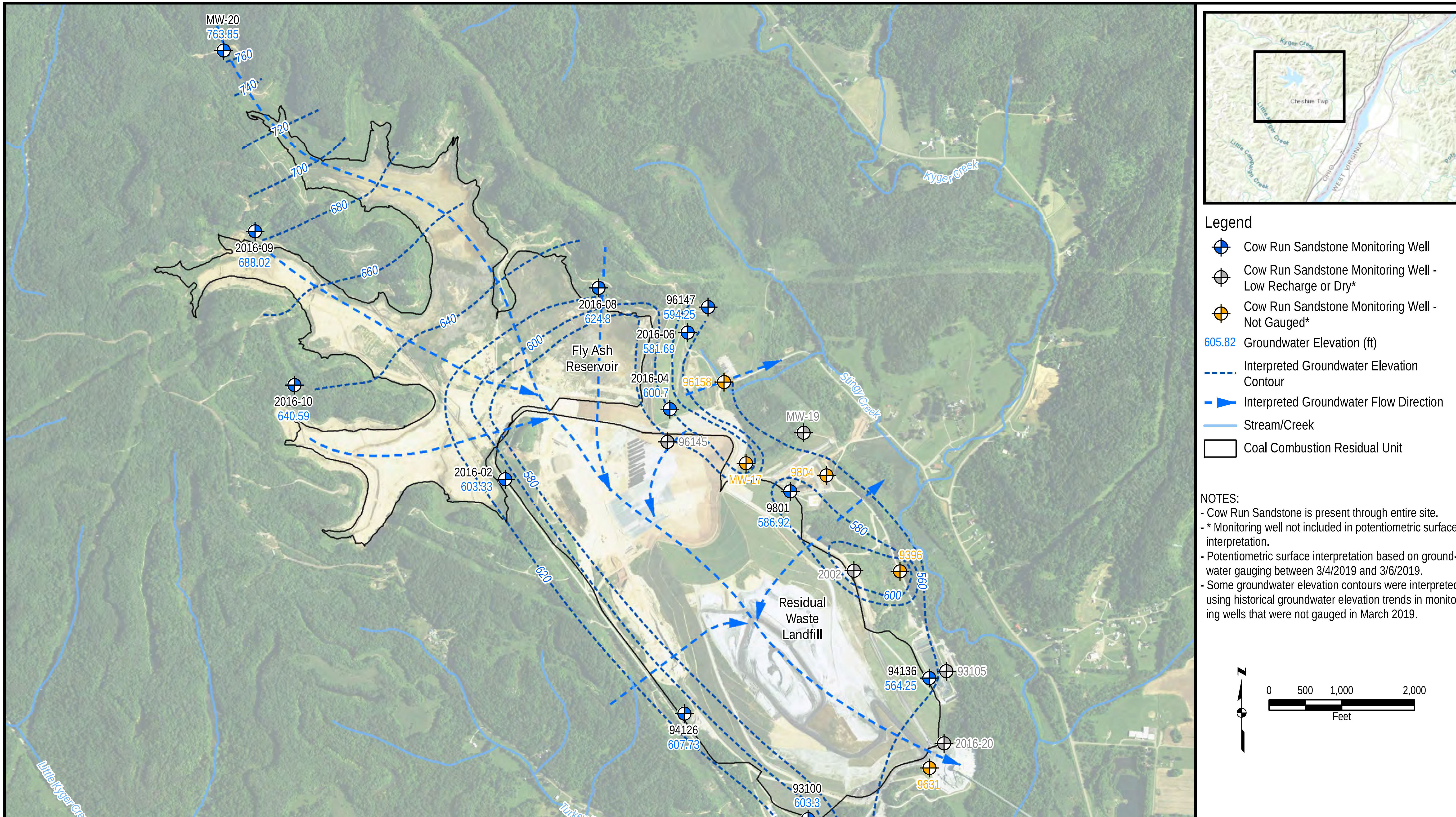
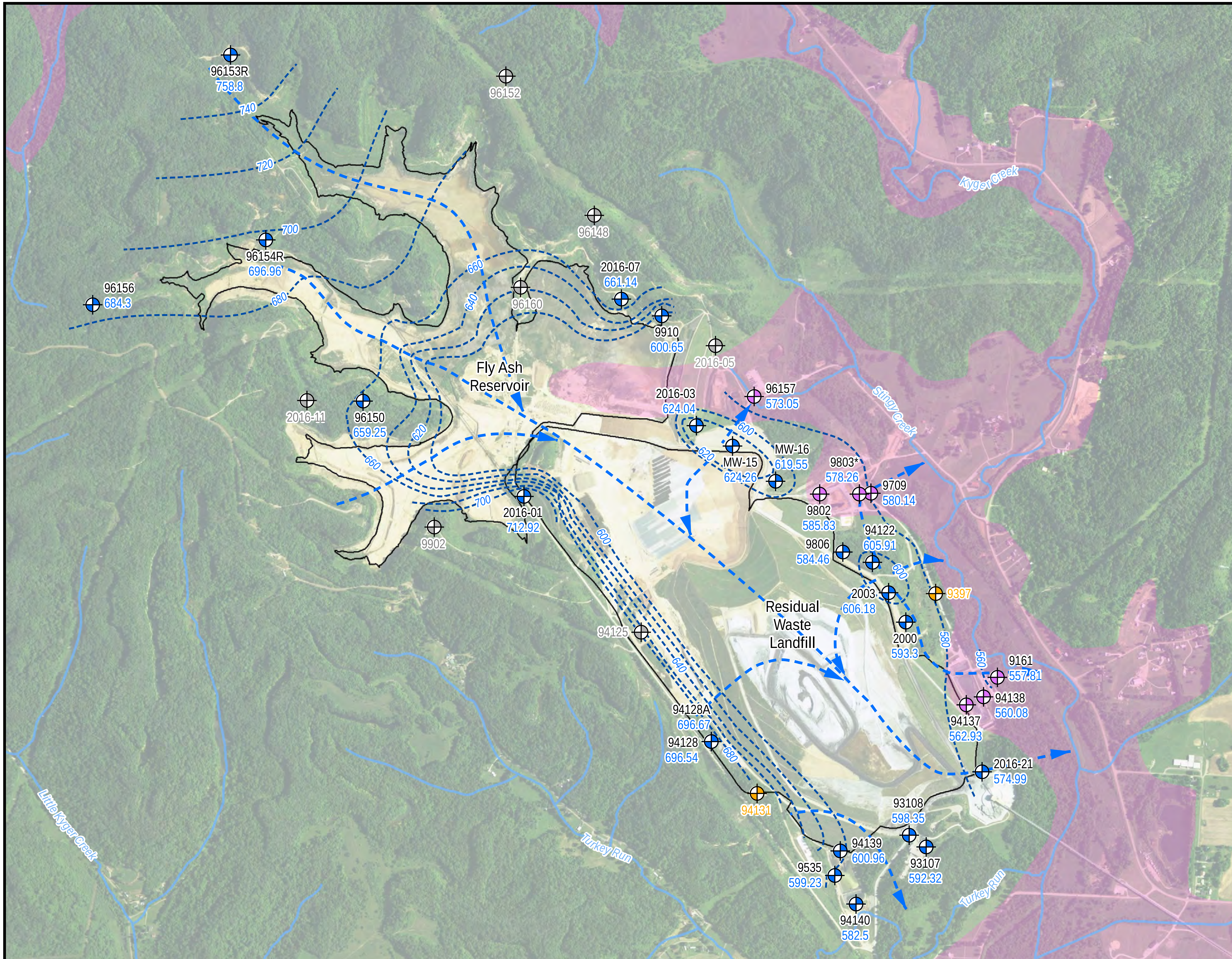
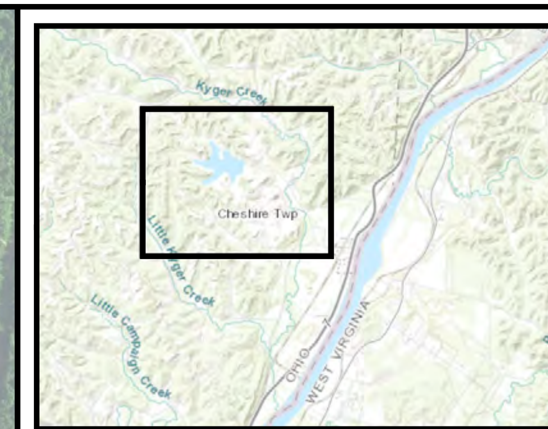


Figure 3-2: Cow Run Sandstone Potentiometric Surface Map
March 2019
Gavin Generating Station
Cheshire, Ohio





Legend

- Morgantown Sandstone Monitoring Well
- Morgantown Sandstone Monitoring Well - Low Recharge or Dry*
- Morgantown Sandstone Monitoring Well - Not Gauged*
- Alluvium Monitoring Well
- 605.82 Groundwater Elevation (ft)
- Interpreted Groundwater Potentiometric Contour
- Interpreted Groundwater Flow Direction
- Stream/Creek
- Coal Combustion Residual Unit
- Interpreted area where the Morgantown Sandstone has been eroded and is not present (based on borehole logs and topographic analysis)

NOTES:

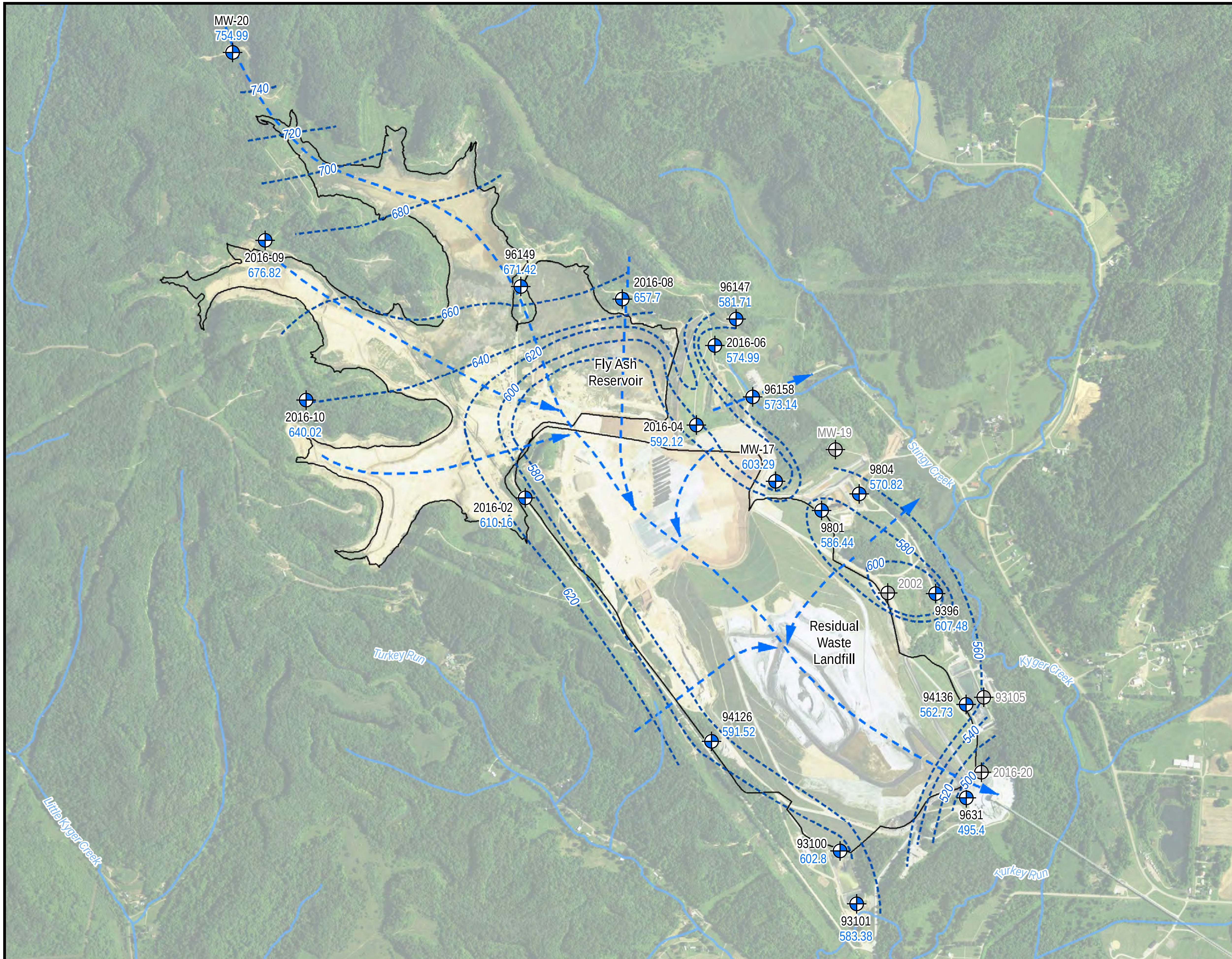
- * Monitoring well not included in potentiometric surface interpretation.
- Potentiometric surface interpretation based on ground-water gauging on conducted 9/5/2019.
- Some groundwater elevation contours were interpreted using historical groundwater elevation trends in monitoring wells that were not gauged in September 2019.
- In areas where the Morgantown Sandstone is absent, on the east side of the landfill, the contours represent the potentiometric surface in the alluvial aquifer because these two aquifers are hydraulically connected.

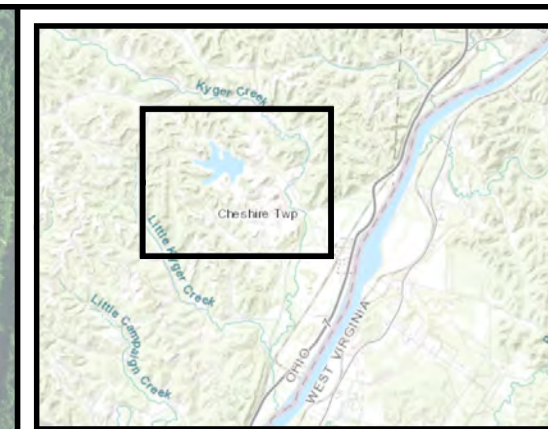
0 500 1,000 2,000
Feet

Figure 3-3: Morgantown Sandstone Potentiometric Surface Map September 2019

Gavin Generating Station
Cheshire, Ohio

ERM





Legend

- Cow Run Sandstone Monitoring Well
- Cow Run Sandstone Monitoring Well - Low Recharge or Dry*
- 605.82 Groundwater Elevation (ft)
- Interpreted Groundwater Potentiometric Contour
- Interpreted Groundwater Flow Direction
- Stream/Creek
- Coal Combustion Residual Unit

NOTES:
- Cow Run Sandstone is present through entire site.
- * Monitoring well not included in potentiometric surface interpretation.
- Potentiometric surface interpretation based on groundwater gauging on conducted 9/5/2019.
- Some groundwater elevation contours were interpreted using historical groundwater elevation trends in monitoring wells that were not gauged in September 2019.

N

0 500 1,000 2,000
Feet

Figure 3-4: Cow Run Sandstone Potentiometric Surface Map September 2019
Gavin Generating Station
Cheshire, Ohio

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APPENDIX A GAVIN RESIDUAL WASTE LANDFILL FIRST SEMIANNUAL SAMPLING EVENT OF 2019 ALTERNATE SOURCE DEMONSTRATION REPORT

Gavin Residual Waste Landfill

Gavin Power, LLC

First Semiannual Sampling Event of 2019
Alternate Source Demonstration Report

Gavin Power Plant
Cheshire, Ohio

04 November 2019

Project No.: 0505619

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Acronyms and Abbreviations

ASD	Alternate Source Demonstration
CCR	Coal Combustion Residuals
CCR Rule	Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments
CCR Unit	Coal Combustion Residual unit
CFR	Code of Federal Regulations
FAR	Fly Ash Reservoir
Gavin	Gavin Power, LLC
mg/L	milligrams per liter
MSWLF	Municipal Solid Waste Landfill
Plant	General James M. Gavin Power Plant
RWL	Residual Waste Landfill
SSI	statistically significant increase
USEPA	United States Environmental Protection Agency
USEPA Guidance	Solid Waste Disposal Facility Criteria Technical Manual, USEPA 530-R-93-017, Subpart E (Nov. 1993)

1. INTRODUCTION

1.1 Regulatory and Legal Framework

In accordance with 40 Code of Federal Regulations (CFR) Part 257 Subpart D—Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments (“CCR Rule”), Gavin Power, LLC (“Gavin”) has been implementing the groundwater monitoring requirements of 40 CFR § 257.90 *et seq.* for its Residual Waste Landfill (RWL, or the “CCR Unit”) at the General James M. Gavin Power Plant (the “Plant”). Gavin calculated background levels and conducted statistical analyses for Appendix III constituents in accordance with 40 CFR § 257.93(h). Currently, Gavin is performing detection monitoring in accordance with 40 CFR § 257.94. A statistically significant increase (SSI) over the background concentration was detected in a downgradient monitoring well for an Appendix III constituent for the first semiannual groundwater sampling event of 2019 and is explained in this Report.

An SSI for one or more Appendix III constituents is a potential indication of a release of constituents from the CCR unit to groundwater. In the event of an SSI, the CCR Rule provides that “the owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality” (40 CFR § 257.94(e)(2)). If it can be demonstrated that the SSI is due to a source other than the CCR unit, then the CCR unit may remain in the Detection Monitoring Program instead of transitioning to an Assessment Monitoring Program. An Alternate Source Demonstration (ASD) must be made in writing, and the accuracy of the information must be verified through certification by a qualified Professional Engineer (40 CFR § 257.94(e)(2)).

The guidance document, “Solid Waste Disposal Facility Criteria Technical Manual, USEPA 530-R-93-017, Subpart E” (Nov. 1993) (“USEPA Guidance”), lays out the six lines of evidence that should be addressed to determine whether an SSI resulted from a source other than the regulated disposal unit:

1. An alternative source exists.
2. Hydraulic connection exists between the alternative source and the well with the significant increase.
3. Constituent(s) (or precursor constituents) are present at the alternative source or along the flow path from the alternative source prior to possible release from the unit.
4. The relative concentration and distribution of constituents in the zone of contamination are more strongly linked to the alternative source than to the unit when the fate and transport characteristics of the constituents are considered.
5. The concentration observed in ground water could not have resulted from the unit given the waste constituents and concentrations in the unit leachate and wastes, and site hydrogeologic conditions.
6. The data supporting conclusions regarding the alternative source are historically consistent with the hydrogeologic conditions and findings of the monitoring program.

This ASD Report addresses each of these lines of evidence for the SSI detected in the groundwater beneath the RWL.

1.2 Background

The Plant is a coal-fired generating station located in Gallia County in Cheshire, Ohio, along the Ohio River (Figure 1-1). The RWL is one of three CCR units at the Plant that are subject to regulation under the CCR Rule. The RWL is located about 1.25 miles northwest of the Plant (Figure 1-2) and is permitted by the Ohio Environmental Protection Agency to accept and dispose of CCR material as a Class 3 Landfill. Approximately 98 percent of this material is Flue Gas Desulfurization by-product (consisting of scrubber cake, fly ash, and lime) and 2 percent is other approved materials (bottom ash, fly ash, lime ball mill rejects, coal pulverizer rejects, and bottom ash pond sediments).

A Groundwater Monitoring Network Evaluation was performed to provide an assessment of the compliance of the groundwater monitoring network with 40 CFR § 257.91. This evaluation identified an uppermost aquifer composed of sandstone and interbedded clayshale units, specifically the Morgantown Sandstone and Cow Run Sandstone, and indicated groundwater flows to the south and east (Geosyntec 2016). Consistent with the CCR Rule and the Groundwater Monitoring Plan developed for Gavin (ERM 2017), a prediction limit approach was used to identify potential impacts to groundwater. Upper prediction limits and lower prediction limits were established based on the upgradient groundwater data. The 2017 Annual Groundwater Monitoring and Corrective Action Report (ERM 2018a) identified SSIs in the downgradient monitoring wells for the period from August 2016 to August 2017. Also, the following reports were previously prepared and posted to Gavin’s public website to identify an alternate source for the following:

- SSIs associated with the August 2016 to August 2017 period were addressed in the *Gavin RWL ASD Report* (ERM 2018b).
- SSIs associated with the May 2018 sampling event were addressed in the *Gavin RWL First Semiannual Sampling Event of 2018 ASD Report* (ERM 2018c)
- SSIs associated with the September 2018 sampling event were addressed in the *Gavin RWL Second Semiannual Sampling Event of 2018 ASD Report* (ERM 2018d)

Tables 1-1 and 1-2 summarize the groundwater results from the Cow Run and Morgantown monitoring wells, respectively, that were sampled in March 2019 (Figure 1-2).

Table 1-1: SSIs in RWL Morgantown Monitoring Wells

Analyte	2016-21	93108
Boron	ϕ	*
Calcium	ϕ	*
Chloride	ϕ	*
Fluoride	ϕ	*
pH	X	*
Sulfate	ϕ	*
Total Dissolved Solids	ϕ	*

Notes: ϕ = No SSI, X = SSI
Results are for the downgradient wells sampled in March 2019.
* *Insufficient sample volume due to low recharge.*

Table 1-2: SSIs in RWL Cow Run Monitoring Wells

Analyte	2016-20	94136
Boron	*	ϕ
Calcium	*	ϕ
Chloride	*	ϕ
Fluoride	*	ϕ
pH	ϕ	ϕ
Sulfate	*	ϕ
Total Dissolved Solids	*	ϕ

Notes: ϕ = No SSI, X = SSI
Results are for the downgradient wells sampled in March 2019.
* *Insufficient sample volume due to low recharge.*

Based on the comparisons shown in Tables 1-1 and 1-2, the only SSI detected for the RWL is pH for Well 2016-21. This ASD Report identifies cement from improper well construction as the source of the pH SSI detected at Well 2016-21. The wells that were not sampled as noted in Table 1-1 and 1-2 did not detect any SSIs during the previous sampling in October 2018. Supporting information and discussion of each of the lines of evidence discussed in Section 1.1 are presented in subsequent sections of this Report.

2. HYDROGEOLOGIC INTERPRETATION

A detailed interpretation of hydrogeological conditions can be found in the Gavin RWL ASD Report (ERM 2018b). Key conclusions from this analysis include the following:

- A region of lower hydraulic pressure than the surrounding areas exists within the portion of the aquifer under the southeastern portion of the Fly Ash Reservoir (FAR), and extends southeastward under the RWL, as shown on Figure 2-1 and Figure 2-2. This area of lower hydraulic pressure is located under portions of the FAR and RWL that have received CCR materials and act to reduce infiltration due to their lower permeability. The forested and pastured areas surrounding the FAR and RWL are more permeable and have higher infiltration than the fine compacted material in the FAR and RWL. Groundwater flows from the areas of higher pressure surrounding the FAR and RWL to areas of lower pressure within the FAR and RWL.
- On the western side of the RWL, groundwater flows from west to east, toward the groundwater trough, and then turns to the southeast and flows toward the Ohio River.
- On the northeastern boundary of the RWL, groundwater flows from a potentiometric high in the northeast to the southwest, and then turns to the southeast and flows toward the Ohio River.

3. DESCRIPTION OF THE ALTERNATE SOURCE

An SSI in pH for RWL Morgantown monitoring well 2016-21 was previously identified in the 2017 Gavin Annual Groundwater Monitoring and Corrective Action Report (ERM 2018a). As discussed in Section 7 of this document, neither the regional hydrogeologic conditions nor the leachate from the RWL was a likely source of elevated pH in the groundwater. Based on a review of the boring log and well construction diagram prepared for Well 2016-21, ERM has determined that the likely source for elevated groundwater pH was improper well construction (ERM 2018b). This improper well construction enabled contact between the screened interval and the cement-bentonite grout used during well construction.

Impacts on groundwater quality caused by cement-based grout are typically associated with groundwater pH values above 10, and, in low-permeability formations, the impacts of grout materials may persist for longer than 18 months due to the slower rate of flushing of the installation by moving groundwater (Pohlmann and Alduino 1992; Barcelona et al. 1988). Based on the elevated pH values observed at this well from August 2016 to present, incorrect well construction methods have affected groundwater quality, and thus the alternate source of the elevated pH continues to be cement used during well construction. Additional details on the cement as an alternate source are provided in the Gavin RWL ASD Report (ERM 2018b).

4. HYDRAULIC CONNECTIONS TO THE ALTERNATE SOURCE

As discussed in Section 3, the source of the elevated pH of groundwater appears to be cement used during well construction. Given that the cement was injected into the borehole during construction, concrete may have penetrated the sand pack or fractures within the aquifer immediately surrounding the well screen, and groundwater migrating through these fractures and the sand pack could have been exposed to the cement. Thus, the alternate source (cement) is hydraulically connected with groundwater entering Well 2016-21.

5. CONSTITUENTS ARE PRESENT AT THE ALTERNATE SOURCE OR ALONG FLOW PATH

Cement mixtures are strongly basic and can have a pH between 12 and 13 (Portland Cement Association 2018). Groundwater that entered the well screen of Well 2016-21 likely contacted uncured cement. The elevated pH has persisted after well installation due to the naturally low groundwater velocity of the Morgantown formation, and the limited flushing of the well screen interval. Thus, the alternate source (cement) is along the flow path of groundwater entering Well 2016-21.

6. LINKAGES OF CONSTITUENT CONCENTRATIONS AND DISTRIBUTIONS BETWEEN ALTERNATE SOURCE AND DOWNGRADIENT WELLS

As discussed in Section 5, the pH of the groundwater detected at Well 2016-21 is consistent with the typical pH of cement used for well construction.

7. A RELEASE FROM THE RWL IS NOT SUPPORTED AS THE SOURCE

A piper diagram is a tool used to identify geochemical fingerprints based on the relative proportions of cations (calcium, sodium, potassium, and magnesium) and anions (chloride, sulfate, carbonate, and bicarbonate) in water samples. The RWL was constructed with a leachate collection system, and leachate is collected and treated in several ponds located around the landfill. Analytical results are available from 1996 to 2018 for samples collected from ponds associated with Phase A, Phase B, and Phase C of the landfill. These results represent the geochemical fingerprint of water in direct contact with CCR leachate from the RWL. As seen in the piper diagram on Figure 7-1, the leachate results plot in the upper portion of the piper diagram, which represents a high calcium and chloride fingerprint. If water in contact with CCR leachate were to be released from the RWL and mix with groundwater, the elevated calcium and chloride concentrations would cause the groundwater signature to become more like the leachate signature (i.e., plot higher in the diamond portion of the piper diagram). In contrast, groundwater from monitoring well 2016-21 plots on the right hand side of the diamond portion of the piper diagram due to differences in both the cationic and anionic ratios. Based on the data presented on Figure 7-1, the chemical fingerprint of groundwater in the Morgantown Sandstone in 2019 is consistent with historical data and has not mixed with RWL leachate because they plot in distinct regions on the piper diagram, and thus the RWL could not be the source of elevated pH in monitoring well 2016-21.

8. ALTERNATE SOURCE DATA ARE HISTORICALLY CONSISTENT WITH HYDROGEOLOGIC CONDITIONS

As previously mentioned, the elevated pH that has been observed at Well 2016-21 since it was constructed in March 2016 is consistent with the typical pH of cement used for well construction. In addition, the persistence of the elevated pH is consistent with the groundwater velocities of the Morgantown Sandstone and the expected low rate of flushing of the monitoring well screen interval. Thus, the alternate source data for pH is historically consistent with hydrogeologic conditions.

9. CONCLUSIONS

The SSI for pH associated with the sample collected from Well 2016-21 was detected in March 2019. The data were reviewed for quality assurance, and reported to Gavin on 07 August 2019. In response to the SSI, this ASD Report was prepared within the required 90-day period in accordance with 40 CFR § 257.94(e)(2). The SSI was determined to result from an alternate source: cement from well construction. Table 9-1 summarizes the six lines of evidence of an ASD for this SSI.

Table 9-1: RWL ASD Summary

Line of Evidence	pH
Alternate source	Elevated pH is due to improper well construction
Hydraulic connection	Cement from well construction is in contact with groundwater
Constituent present at source or along flow path	Cement is located near the well screen
Constituent distribution more strongly linked to alternate source	The observed pH levels are consistent with the expected pH of groundwater in contact with cement
Constituent could not have resulted from the RWL	Piper diagrams show different chemical fingerprints between RWL leachate and groundwater
Data are historically consistent with hydrogeologic conditions	Elevated pH has been observed consistently since the monitoring well was constructed

In conclusion, the RWL was not the source of the pH SSI identified in the first semiannual groundwater sampling event of 2019 and thus the Plant will continue detection monitoring at the RWL in accordance with 40 CFR § 257.94(e)(2). The second RWL semiannual sampling event for 2019 is planned to be performed before 31 December 2019.

PROFESSIONAL ENGINEER CERTIFICATION

I hereby certify that I or an agent under my review has prepared this Alternate Source Demonstration Report for the Residual Waste Landfill and it meets the requirements of 40 CFR § 257.94(e)(2). To the best of my knowledge, the information contained in this Report is true, complete, and accurate.

REFERENCES

Barcelona, M.J., J.A. Helfrich, and E.E. Garske. 1988. *Verification of Sampling Methods and Selection of Materials for Groundwater Contamination Studies*. In: Ground-Water Contamination: Field Methods, Special Technical Publication 963, A. I. Johnson, ed., American Society for Testing Materials.

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FIGURES

Figure 1-1: Gavin Plant Location
Residual Waste Landfill First Semi-Annual Sampling Event of 2019 Alternate Source Demonstration
Gavin Generating Station
Cheshire, Ohio

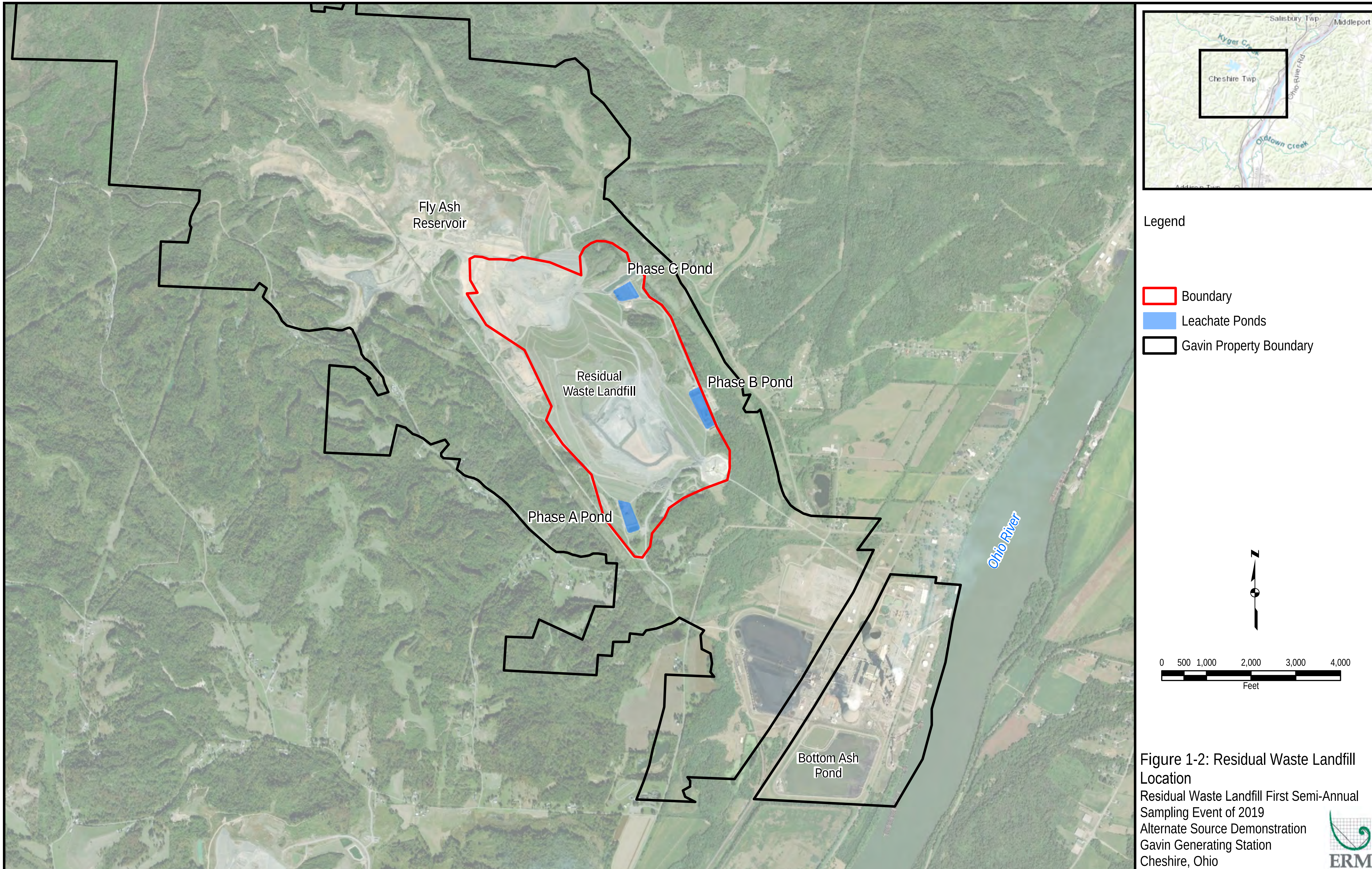


Figure 1-2: Residual Waste Landfill Location
Residual Waste Landfill First Semi-Annual Sampling Event of 2019
Alternate Source Demonstration
Gavin Generating Station
Cheshire, Ohio

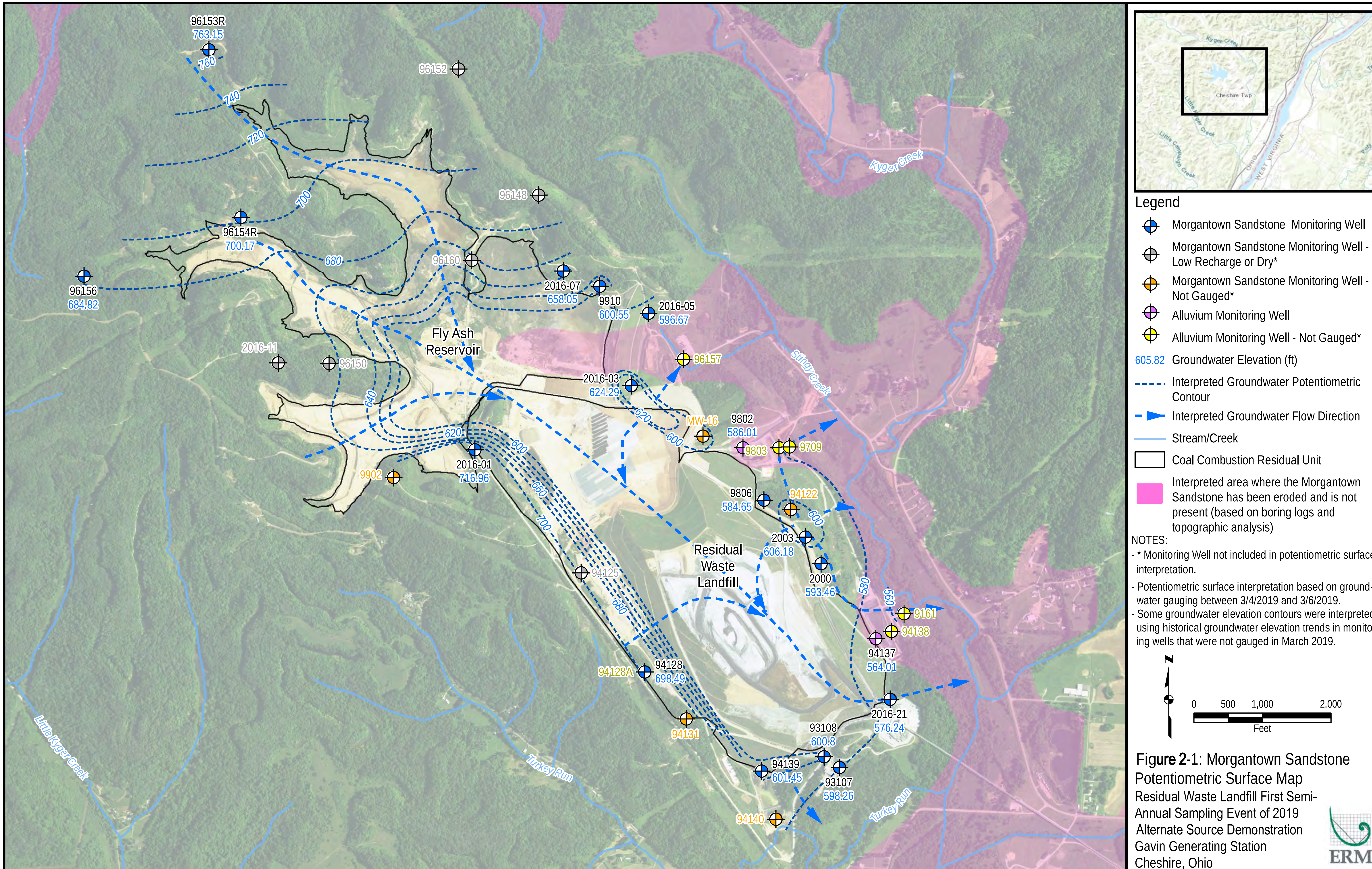
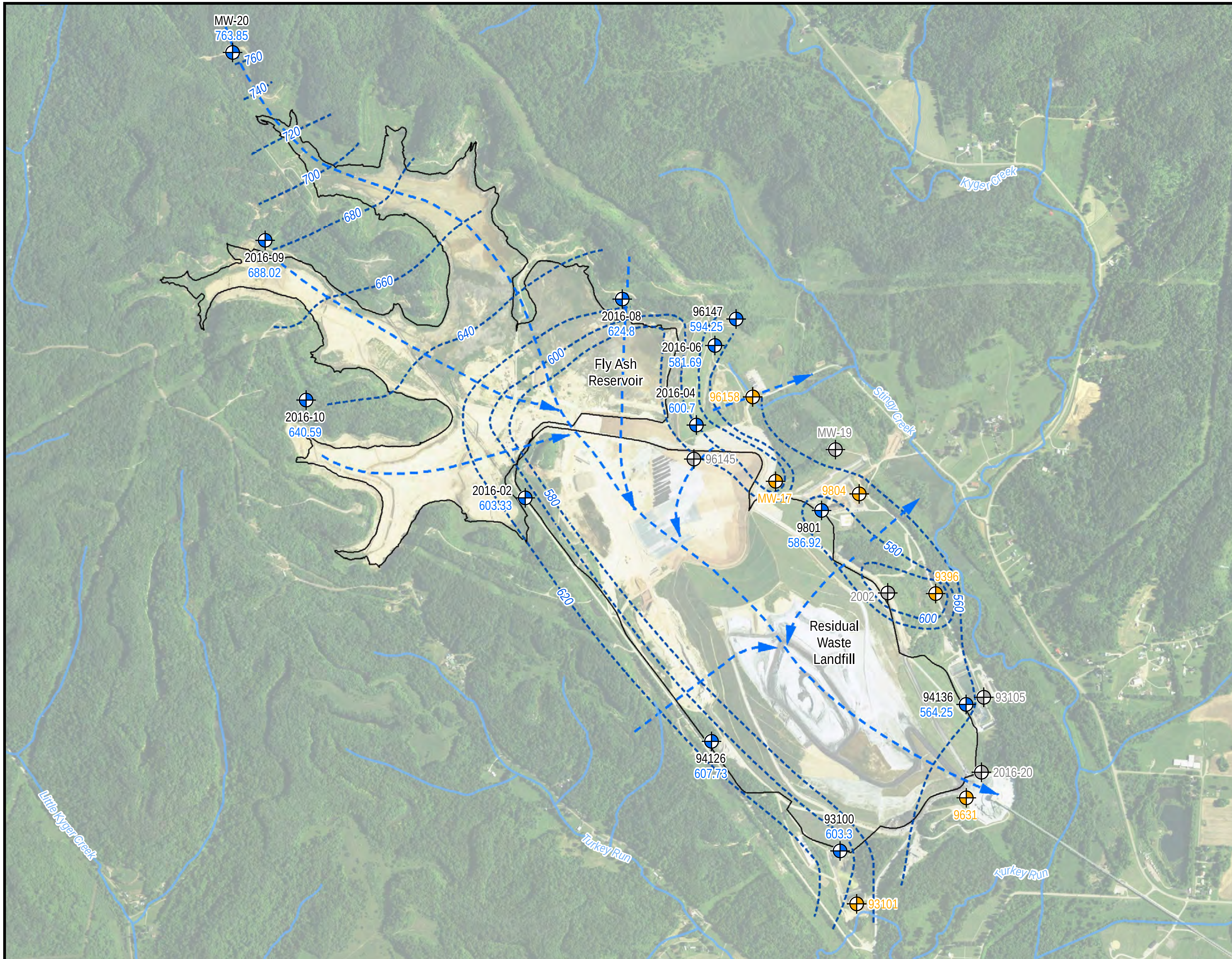
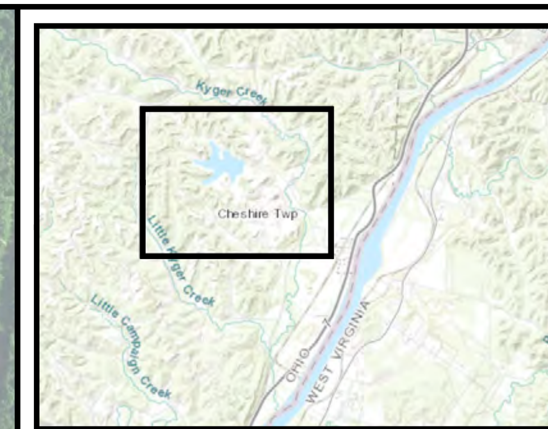


Figure 2-1: Morgantown Sandstone Potentiometric Surface Map
Residual Waste Landfill First Semi-Annual Sampling Event of 2019
Alternate Source Demonstration
Gavin Generating Station
Cheshire, Ohio





Legend

- Cow Run Sandstone Monitoring Well
- Cow Run Sandstone Monitoring Well - Low Recharge or Dry*
- Cow Run Sandstone Monitoring Well - Not Gauged*
- 605.82 Groundwater Elevation (ft)
- Interpreted Groundwater Elevation Contour
- Interpreted Groundwater Flow Direction
- Stream/Creek
- Coal Combustion Residual Unit

NOTES:
- Cow Run Sandstone is present through entire site.
- * Monitoring well not included in potentiometric surface interpretation.
- Potentiometric surface interpretation based on groundwater gauging between 3/4/2019 and 3/6/2019.
- Some groundwater elevation contours were interpreted using historical groundwater elevation trends in monitoring wells that were not gauged in March 2019.

N

0 500 1,000 2,000
Feet

Figure 2-2: Cow Run Sandstone Potentiometric Surface Map

Residual Waste Landfill First Semi-Annual Sampling Event of 2019
Alternate Source Demonstration
Gavin Generating Station
Cheshire, Ohio

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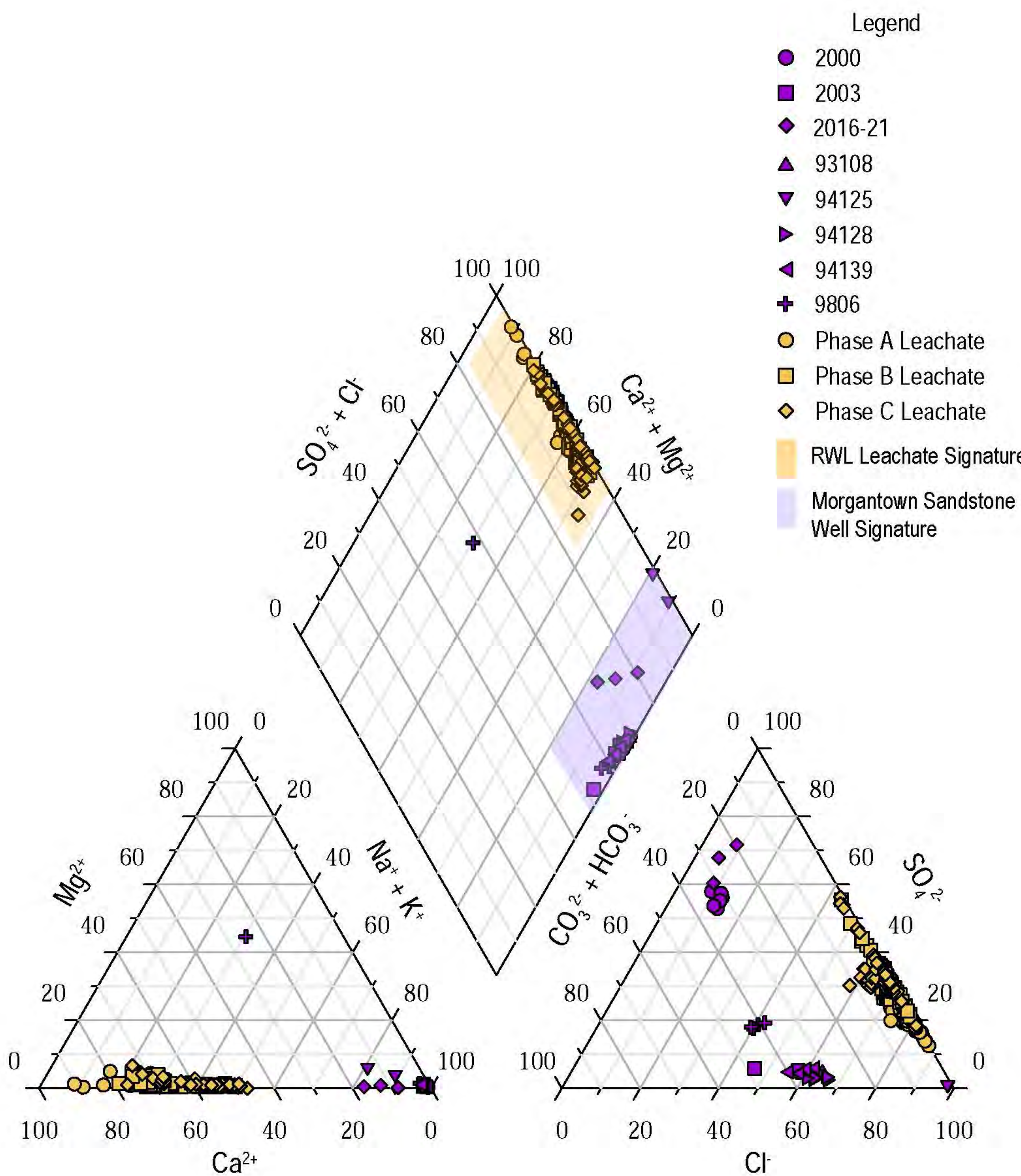

NOTES:
1. Data Range: November 1996 to March 2019
2. Only wells with complete data including all 8 piper diagram analytes are presented

Figure **7-1**: RWL Piper Diagram for the Morgantown Sandstone

Residual Waste Landfill First Semi-Annual Sampling Event of 2019
Alternate Source Demonstration
Gavin Generating Station
Cheshire, Ohio

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APPENDIX B GAVIN RESIDUAL WASTE LANDFILL SECOND SEMIANNUAL SAMPLING EVENT OF 2019 ALTERNATE SOURCE DEMONSTRATION REPORT

Gavin Residual Waste Landfill

Gavin Power, LLC

Second Semiannual Sampling Event of 2019 Alternate Source Demonstration Report

Gavin Power Plant
Cheshire, Ohio

31 January 2020

Project No.: 0505619

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Signature Page

31 January 2020

Gavin Residual Waste Landfill

Second Semiannual Sampling Event of 2019 Alternate Source Demonstration Report

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Acronyms and Abbreviations

Name	Description
ASD	Alternate Source Demonstration
CCR	Coal Combustion Residuals
CCR Unit	Coal Combustion Residual unit
CFR	Code of Federal Regulations
FAR	Fly Ash Reservoir
Gavin	Gavin Power, LLC
Plant	General James M. Gavin Power Plant
RWL	Residual Waste Landfill
SSI	Statistically significant increase

1. INTRODUCTION

1.1 Regulatory and Legal Framework

In accordance with 40 Code of Federal Regulations (CFR) Part 257 Subpart D—Standards for the Disposal of Coal Combustion Residuals (CCR) in Landfills and Surface Impoundments (CCR Rule), Gavin Power, LLC (Gavin) has been implementing the groundwater monitoring requirements for its Residual Waste Landfill (RWL, or the CCR Unit) at the General James M. Gavin Power Plant (Plant). Gavin conducted statistical analyses and calculated background levels for Appendix III constituents in accordance with 40 CFR § 257.93(h) and is performing detection monitoring in accordance with 40 CFR § 257.94. A statistically significant increase (SSI) over the background concentration was detected in a downgradient monitoring well for an Appendix III constituent for the second semiannual groundwater sampling event of 2019 and is explained in this report.

An SSI for one or more Appendix III constituents is a potential indication of a release of constituents from the CCR unit to groundwater. In the event of an SSI, the CCR Rule provides that “the owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality” (40 CFR § 257.94(e)(2)). If it can be demonstrated that the SSI is due to a source other than the CCR unit, then the CCR unit may remain in the Detection Monitoring Program instead of transitioning to an Assessment Monitoring Program. An Alternate Source Demonstration (ASD) must be made in writing and the accuracy of the information must be verified through certification by a qualified Professional Engineer (40 CFR § 257.94(e)(2)).

The United States Environmental Protection Agency guidance document, “Solid Waste Disposal Facility Criteria Technical Manual, USEPA 530-R-93-017, Subpart E” (USEPA 1993), lays out the six lines of evidence that should be addressed to determine whether an SSI resulted from a source other than the regulated disposal unit:

1. An alternative source exists.
2. Hydraulic connection exists between the alternative source and the well with the significant increase.
3. Constituent(s) (or precursor constituents) are present at the alternative source or along the flow path from the alternative source prior to possible release from the unit.
4. The relative concentration and distribution of constituents in the zone of contamination are more strongly linked to the alternative source than to the unit when the fate and transport characteristics of the constituents are considered.
5. The concentration observed in groundwater could not have resulted from the unit given the waste constituents and concentrations in the unit leachate and wastes, and site hydrogeologic conditions.
6. The data supporting conclusions regarding the alternative source are historically consistent with the hydrogeologic conditions and findings of the monitoring program.

This ASD Report addresses each of these lines of evidence for the SSI detected in groundwater beneath the RWL.

1.2 Background

The Plant is a coal-fired generating station located along the Ohio River in Gallia County in Cheshire, Ohio (Figure 1-1). The RWL is one of three CCR units at the Plant that are subject to regulation under the

CCR Rule. The RWL is located about 1.25 miles northwest of the Plant (Figure 1-2) and is permitted by the Ohio Environmental Protection Agency to accept and dispose of CCR material as a Class 3 Landfill. Approximately 98 percent of this material is Flue Gas Desulfurization by-product (consisting of scrubber cake, fly ash, and lime) and 2 percent is other approved materials (bottom ash, fly ash, lime ball mill rejects, coal pulverizer rejects, and Bottom Ash Pond sediments).

A Groundwater Monitoring Network Evaluation was performed to provide an assessment of the compliance of the groundwater monitoring network with 40 CFR § 257.91. This evaluation identified an uppermost aquifer composed of sandstone and interbedded clay shale units—specifically the Morgantown Sandstone and Cow Run Sandstone—and indicated groundwater flows to the south and east (Geosyntec 2016). Consistent with the CCR Rule and the Groundwater Monitoring Plan developed for Gavin (ERM 2017), a prediction limit approach was used to identify potential impacts to groundwater. Upper prediction limits and lower prediction limits were established based on the upgradient groundwater data. The 2017 Annual Groundwater Monitoring and Corrective Action Report (ERM 2018a) identified SSIs in the downgradient monitoring wells for the period from August 2016 to August 2017. Additionally, the following reports were previously prepared and posted to identify an alternate source for the following:

- SSIs associated with the August 2016 to August 2017 period were addressed in the *Gavin RWL ASD Report* (ERM 2018b).
- SSIs associated with the May 2018 sampling event were addressed in the *Gavin RWL First Semiannual Sampling Event of 2018 ASD Report* (ERM 2018c).
- SSIs associated with the September 2018 sampling event were addressed in the *Gavin RWL Second Semiannual Sampling Event of 2018 ASD Report* (ERM 2019a).
- SSIs associated with the March 2019 sampling event were addressed in the *Gavin RWL First Semiannual Sampling Event of 2019 Report* (ERM 2019b).

Tables 1-1 and 1-2 summarize the groundwater statistical results from the downgradient Cow Run and Morgantown monitoring wells, respectively, that were sampled in September 2019 (Figure 1-2).

Table 1-1: SSIs in Downgradient RWL Morgantown Monitoring Wells

Analyte	2016-21	93108
Boron	ϕ	*
Calcium	ϕ	*
Chloride	ϕ	*
Fluoride	ϕ	*
pH	X	*
Sulfate	ϕ	*
Total Dissolved Solids	ϕ	*

Notes: ϕ = No SSI, X = SSI
** Insufficient sample volume due to low recharge.*

Table 1-2: SSIs in Downgradient RWL Cow Run Monitoring Wells

Analyte	2016-20	94136
Boron	*	ϕ
Calcium	*	ϕ
Chloride	*	ϕ
Fluoride	*	ϕ
pH	*	ϕ
Sulfate	*	ϕ
Total Dissolved Solids	*	ϕ

Notes: ϕ = No SSI, X = SSI
** Insufficient sample volume due to low recharge.*

Based on the comparisons shown in Tables 1-1 and 1-2, the only SSI detected for the RWL in the fall of 2019 was at well 2016-21 for pH. This ASD Report identifies cement from well construction as the source of the pH SSI detected at Well 2016-21. The wells that were not sampled as a result of insufficient sample volume, as noted in Table 1-1 and 1-2, did not exhibit SSIs in October 2018, when they were most recently sampled. Supporting information and discussion of each of the lines of evidence discussed in Section 1.1 are presented in subsequent sections of this report.

2. HYDROGEOLOGIC INTERPRETATION

A detailed interpretation of hydrogeological conditions can be found in the Gavin RWL ASD Report (ERM 2018b). Key conclusions from this analysis include the following:

- A region of lower hydraulic head (i.e. pressure) compared to the surrounding areas exists within the portion of the aquifer under the southeastern portion of the Fly Ash Reservoir (FAR) and extends southeastward under the RWL, as depicted on Figure 2-1 for the Morgantown Sandstone and Figure 2-2 for the Cow Run Sandstone. This area of lower hydraulic pressure is located under portions of the FAR and RWL that have received CCR materials that act to reduce infiltration due to their lower permeability, and where an engineered geosynthetic liner system has been installed beneath the RWL. The forested and pastured areas surrounding the FAR and RWL are more permeable and exhibit higher infiltration than the FAR and RWL. Groundwater flows from areas of higher pressure surrounding the FAR and RWL to areas of lower pressure below the FAR and RWL.
- On the western side of the RWL, groundwater flows from west to east toward the groundwater trough and then turns to the southeast and flows toward the Ohio River.
- Along the northeastern boundary of the RWL is a potentiometric ridge that divides groundwater flow. Water northeast of this ridge flows to the northeast and water southwest of this ridge flows to the southwest to the area of lower hydraulic pressure, and then turns to the southeast and flows toward the Ohio River.

3. DESCRIPTION OF THE ALTERNATE SOURCE

An SSI in pH for RWL Morgantown monitoring well 2016-21 was previously identified in the 2017 Gavin Annual Groundwater Monitoring and Corrective Action Report (ERM 2018a). The pH at this location has consistently been above the upper prediction limit of 11.3 standard units, indicating an SSI. As will be further discussed in Section 7 of this document, neither the regional hydrogeologic conditions nor the leachate from the RWL are likely sources of elevated pH in the groundwater. Based on the boring log and well construction diagram prepared for well 2016-21, well construction may have enabled contact between the screened interval and cement bentonite grout, likely causing elevations in groundwater pH (ERM 2018b).

Impacts on groundwater quality caused by cement-based grout are typically associated with groundwater pH values above 10 and, in low-permeability formations, the impacts of grout materials may persist for significant periods of time due to the slower rate of flushing of the installation by moving groundwater (Pohlmann and Alduino 1992; Barcelona et al. 1988). The use of cement-bentonite grout may have increased pH value at well 2016-21; thus, the alternate source of the elevated pH continues to be cement used during well construction. Additional details on cement as an alternate source are provided in the prior Gavin RWL ASD Report (ERM 2018b).

4. HYDRAULIC CONNECTIONS TO THE ALTERNATE SOURCE

Given that the cement was pumped into the borehole during construction, cement may have penetrated the sand pack or fractures within the aquifer immediately surrounding the well screen. As a result, groundwater migrating through these fractures and the sand pack could have been exposed to the cement. Thus, cement is hydraulically connected with groundwater entering well 2016-21.

5. CONSTITUENTS ARE PRESENT AT THE ALTERNATE SOURCE OR ALONG FLOW PATH

Cement mixtures are strongly basic and can have a pH between 12 and 13 (Portland Cement Association 2018). Groundwater that entered the well screen of well 2016-21 likely contacted cement. The elevated pH has persisted after well installation due to the naturally low groundwater velocity of the Morgantown formation and the limited flushing of the well screen interval. Thus, the alternate source (cement) is along the flow path of groundwater entering well 2016-21.

6. LINKAGES OF CONSTITUENT CONCENTRATIONS AND DISTRIBUTIONS BETWEEN ALTERNATE SOURCE AND DOWNGRADIENT WELLS

As discussed in Section 5, the pH of the groundwater detected at well 2016-21 is consistent with the typical pH of cement used for well construction.

7. A RELEASE FROM THE RWL IS NOT SUPPORTED AS THE SOURCE

A Piper Diagram is a tool used to identify geochemical fingerprints based on the relative proportions of cations (calcium, sodium, potassium, and magnesium) and anions (chloride, sulfate, carbonate, and bicarbonate) in water samples.

The RWL was constructed with a leachate collection system. Leachate is collected and treated in several ponds located around the landfill. Analytical results are available from 1996 to 2019 for samples collected from ponds associated with Phase A, Phase B, and Phase C of the landfill. These results represent the geochemical fingerprint of water in direct contact with CCR leachate from the RWL. As indicated in the piper diagram on Figure 7-1, the leachate results plot in the upper portion of the piper diagram, which represents a high calcium and chloride fingerprint. If water in contact with CCR leachate were to be released from the RWL and mix with groundwater, the elevated calcium and chloride concentrations would cause the groundwater signature to become more similar to the leachate signature (i.e., plot higher in the diamond portion of the piper diagram). In contrast, groundwater from monitoring well 2016-21 plots on the lower right hand side of the diamond portion of the piper diagram due to differences in both the cationic and anionic ratios. Based on the data presented on Figure 7-1, the chemical fingerprint of groundwater in Morgantown Sandstone well 2016-21 (and other Morgantown Sandstone monitoring wells) in 2019 is consistent with historical data and has not mixed with RWL leachate because they plot in distinct regions on the piper diagram; thus, the RWL is not the source of elevated pH in monitoring well 2016-21.

8. ALTERNATE SOURCE DATA ARE HISTORICALLY CONSISTENT WITH HYDROGEOLOGIC CONDITIONS

As previously mentioned, the elevated pH that has been observed at well 2016-21 since it was constructed in March 2016 is consistent with the typical pH of cement used for well construction. In addition, the persistence of the elevated pH is consistent with the groundwater velocities of the Morgantown Sandstone and the expected low rate of flushing of the monitoring well screen interval. Thus, the alternate source data for pH is historically consistent with hydrogeologic conditions.

9. CONCLUSIONS

The SSI for pH associated with the sample collected from well 2016-21 was detected in September 2019. The data were reviewed for quality assurance, statistically analyzed, and reported to Gavin on 18 December 2019. In response to the SSI, this ASD Report was prepared within the required 90-day period in accordance with 40 CFR § 257.94(e)(2). The SSI was determined to result from an alternate source: cement from well construction. Table 9-1 summarizes the six lines of evidence of an ASD for this SSI.

Table 9-1: RWL ASD Summary

Line of Evidence	pH
Alternate source	Elevated pH is due to the use of cement during well construction.
Hydraulic connection	Cement from well construction is in contact with groundwater.
Constituent present at source or along flow path	Cement is located near the well screen.
Constituent distribution more strongly linked to alternate source	The observed pH levels are consistent with the expected pH of groundwater in contact with cement.
Constituent could not have resulted from the RWL	Piper diagrams show different chemical fingerprints between RWL leachate and groundwater.
Data are historically consistent with hydrogeologic conditions	Elevated pH has been observed consistently since the monitoring well was constructed.

In conclusion, the RWL was not the source of the pH SSI identified in the second semiannual groundwater sampling event of 2019. The Plant will continue detection monitoring at the RWL in accordance with 40 CFR § 257.94(e)(2). The first RWL semiannual sampling event for 2020 is planned to be performed before 30 June 2020.

PROFESSIONAL ENGINEER CERTIFICATION

I hereby certify that I, or an agent under my review, have prepared this Alternate Source Demonstration Report for the Residual Waste Landfill and it meets the requirements of 40 CFR § 257.94(e)(2). To the best of my knowledge, the information contained in this report is true, complete, and accurate.

____

James A. Hemme, P.E.
State of Ohio License No.: 72851

Date: 1/30/2020

10. REFERENCES

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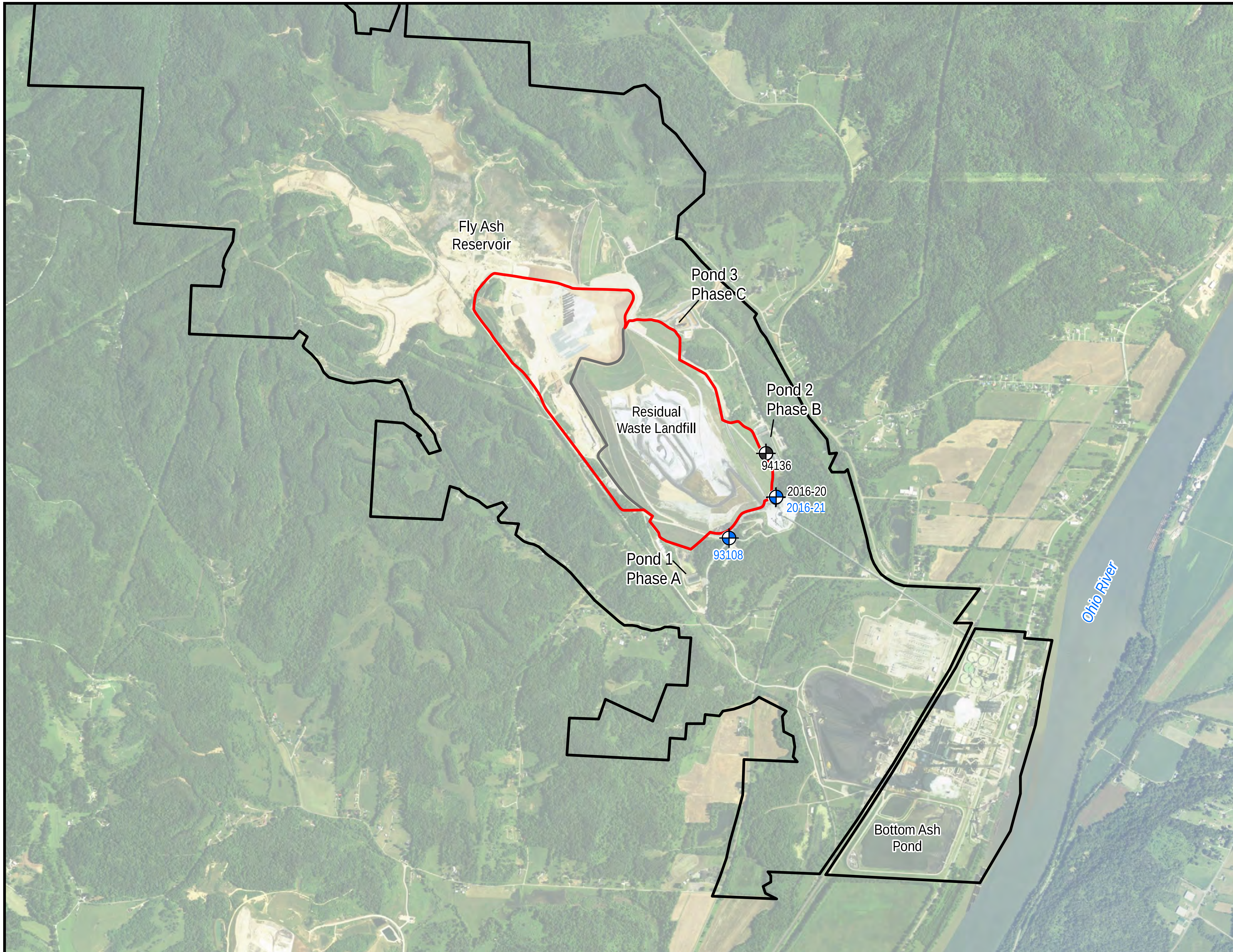
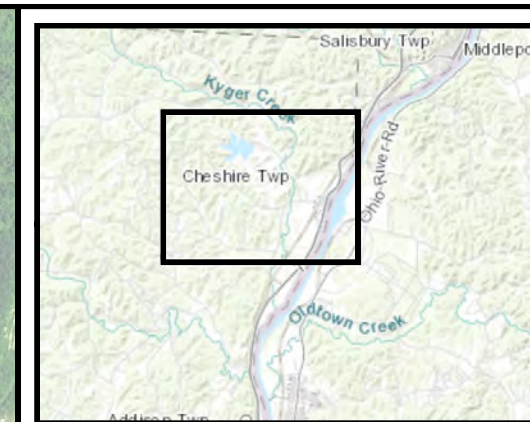
FIGURES

Figure 1-1: Gavin Plant Location
Gavin Generating Station
Cheshire, Ohio





Legend

- Morgantown Downgradient Monitoring Well
- Cow Run Downgradient Monitoring Well
- Permitted Limit of Waste
- Previous Limit of Waste
- Gavin Property Boundary

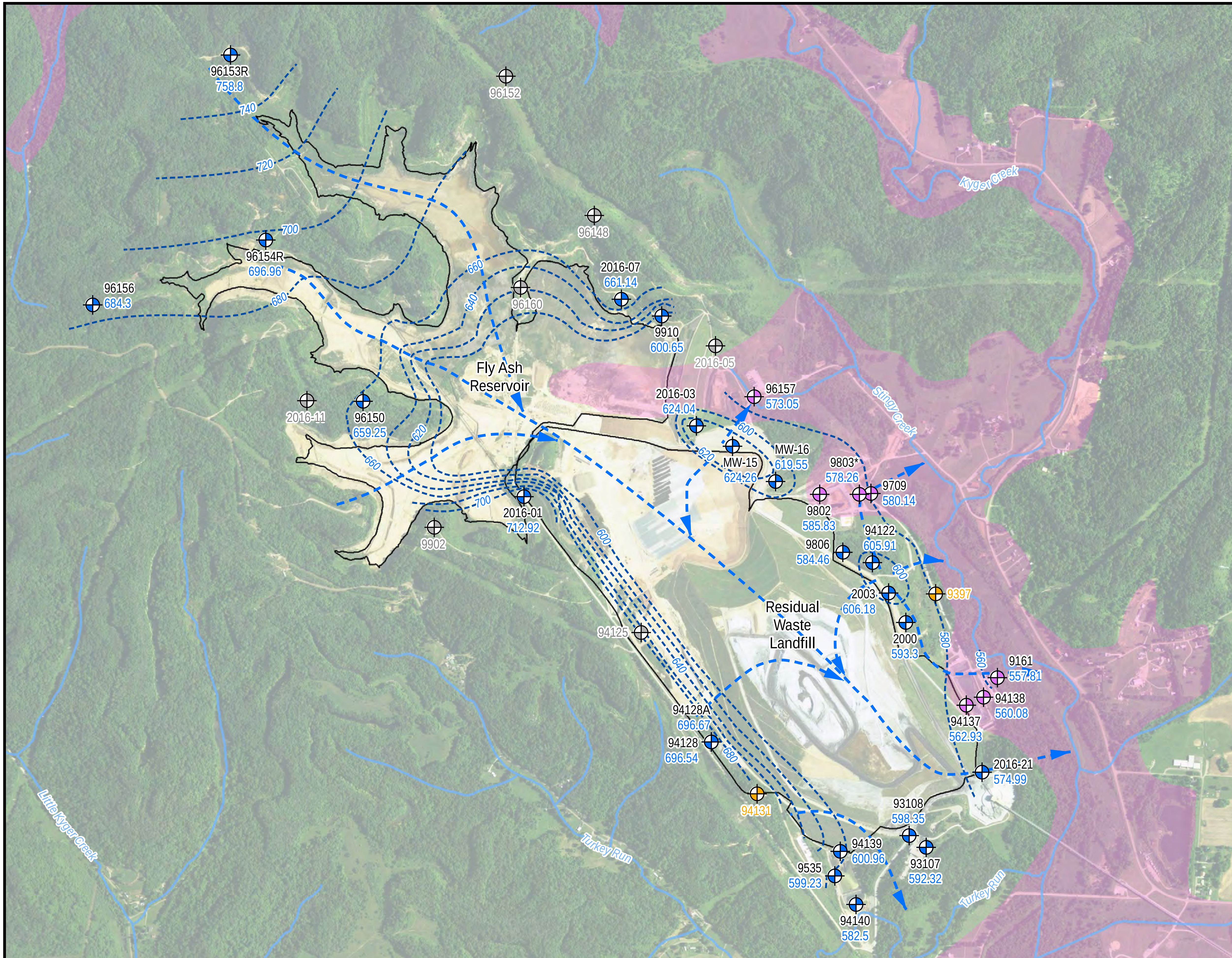
NOTE:
1. Limits of Waste from Revised Gavin RWL Permit-To-Install Application Drawing No. 12-30429-B (Geosyntec 2014)

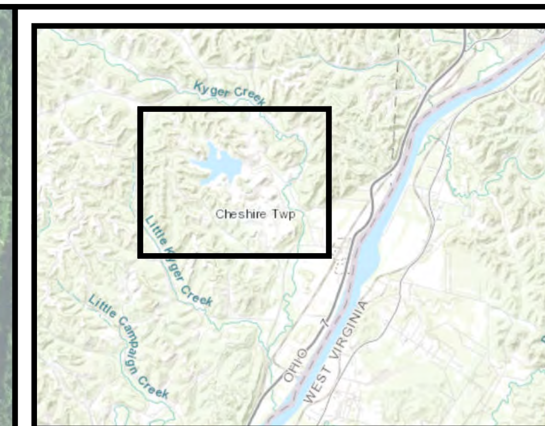
N

0 500 1,000 2,000 3,000 4,000
Feet

Figure 1-2: Residual Waste Landfill
Gavin Generating Station
Cheshire, Ohio

ERM





Legend

- Morgantown Sandstone Monitoring Well
- Morgantown Sandstone Monitoring Well - Low Recharge or Dry*
- Morgantown Sandstone Monitoring Well - Not Gauged*
- Alluvium Monitoring Well
- 605.82 Groundwater Elevation (ft)
- Interpreted Groundwater Potentiometric Contour
- Interpreted Groundwater Flow Direction
- Stream/Creek
- Coal Combustion Residual Unit
- Interpreted area where the Morgantown Sandstone has been eroded and is not present (based on borehole logs and topographic analysis)

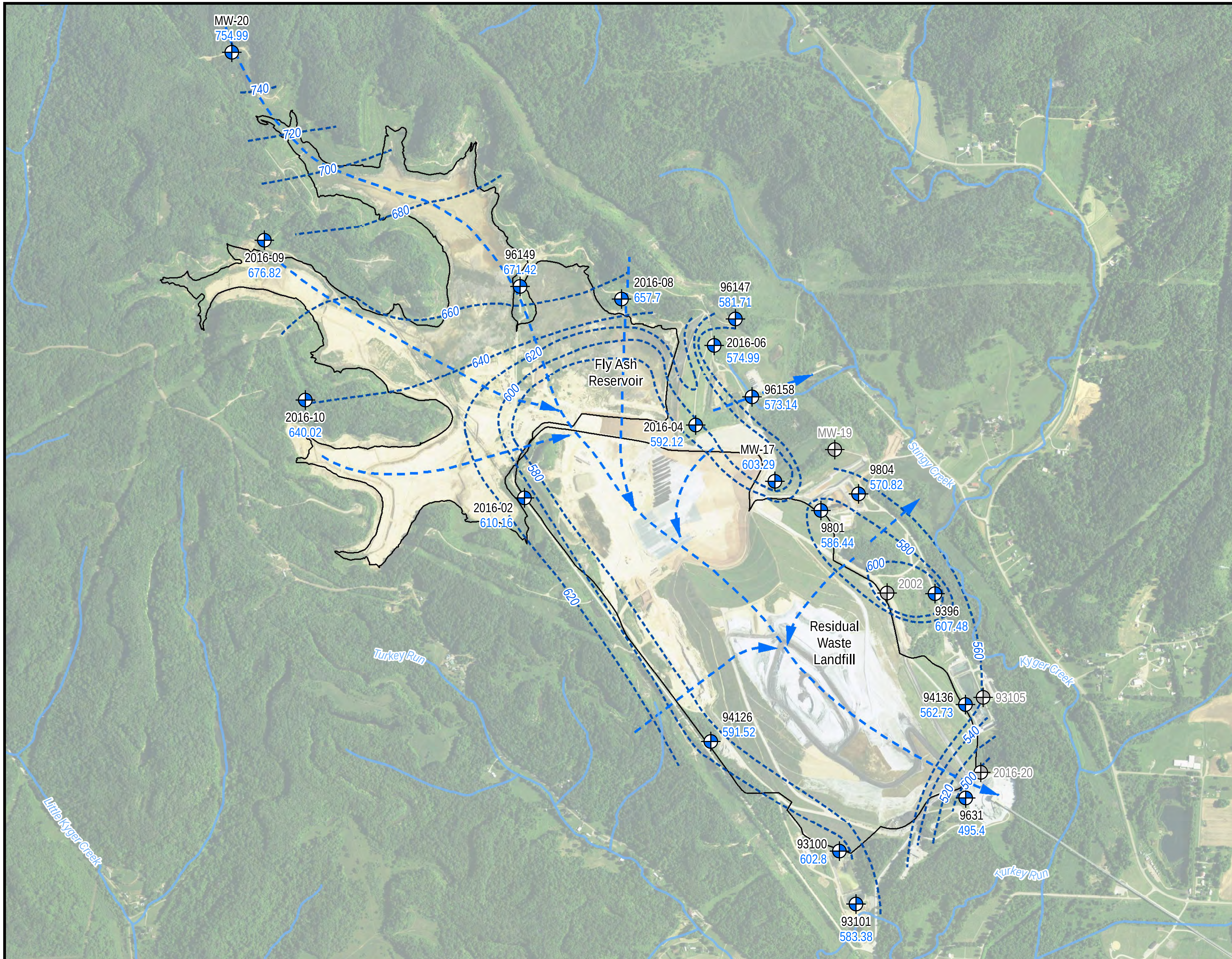
NOTES:
- * Monitoring well not included in potentiometric surface interpretation.
- Potentiometric surface interpretation based on ground-water gauging on conducted 9/5/2019.
- Some groundwater elevation contours were interpreted using historical groundwater elevation trends in monitoring wells that were not gauged in September 2019.
- In areas where the Morgantown Sandstone is absent, on the east side of the landfill, the contours represent the potentiometric surface in the alluvial aquifer because these two aquifers are hydraulically connected.

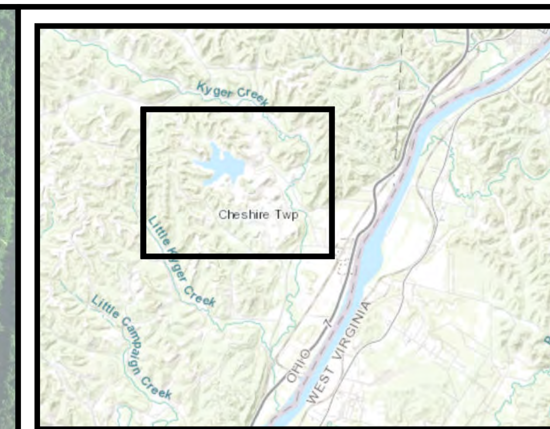
N

0 500 1,000 2,000
Feet

Figure 2-1: Morgantown Sandstone Potentiometric Surface Map September 2019
Gavin Generating Station
Cheshire, Ohio

ERM





Legend

- Cow Run Sandstone Monitoring Well
- Cow Run Sandstone Monitoring Well - Low Recharge or Dry*
- 605.82 Groundwater Elevation (ft)
- Interpreted Groundwater Potentiometric Contour
- Interpreted Groundwater Flow Direction
- Stream/Creek
- Coal Combustion Residual

NOTES:
- Cow Run Sandstone is present through entire site.
- * Monitoring well not included in potentiometric surface interpretation.
- Potentiometric surface interpretation based on ground-water gauging on conducted 9/5/2019.
- Some groundwater elevation contours were interpreted using historical groundwater elevation trends in monitor-ing wells that were not gauged in September 2019.

N

0 500 1,000 2,000

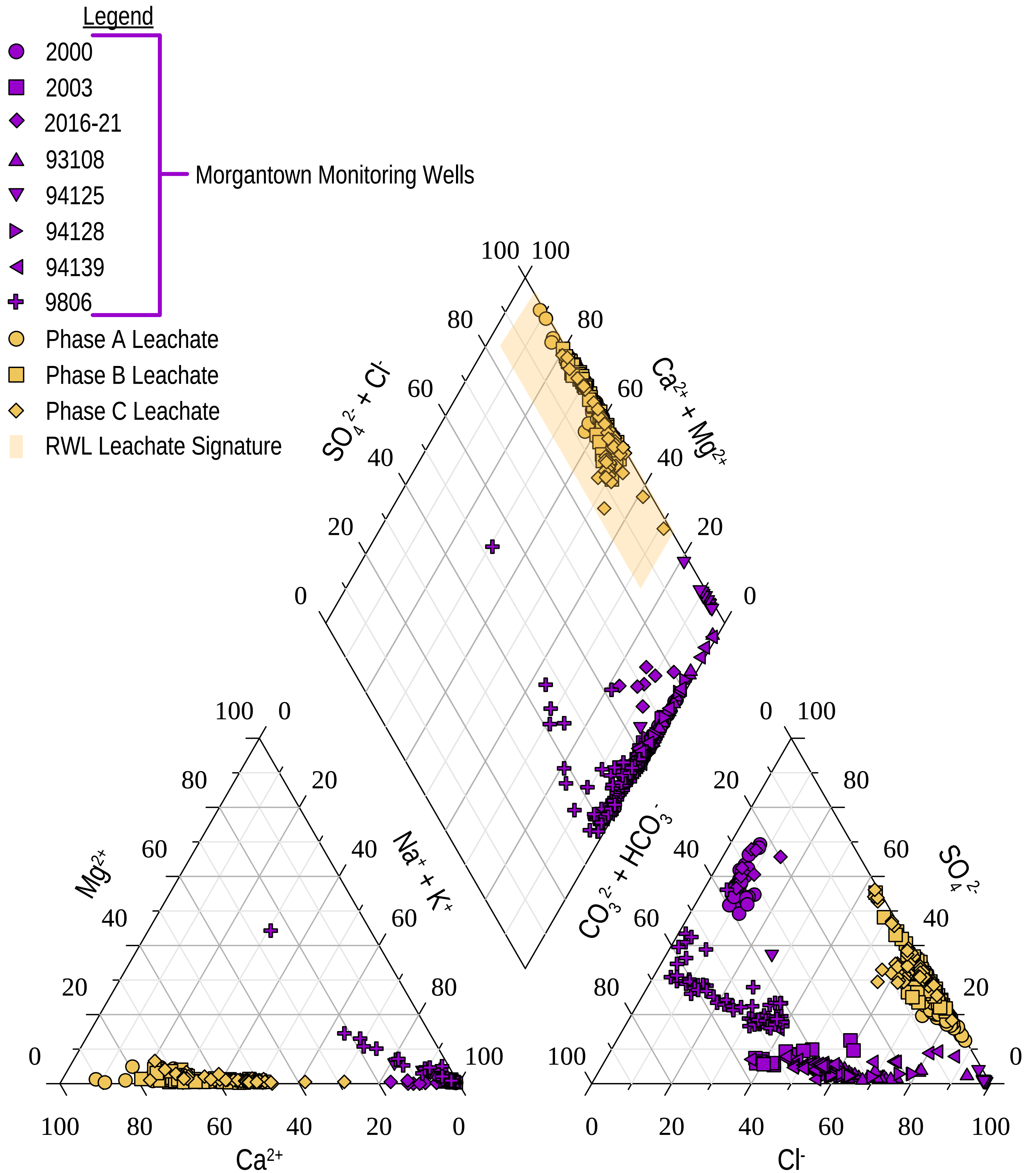
Feet

Figure 2-2: Cow Run Sandstone Potentiometric Surface Map September 2019

Gavin Generating Station

Cheshire, Ohio

ERM



NOTES:
1. Date Range: November 1996 to November 2019
2. Only wells with complete data including all 8 piper diagram analytes are presented
3. 4/22/03 data point for 9806 removed due to anomalous sulfate value

Figure 7-1: RWL Piper Diagram for the Morgantown Sandstone
November 2019
Gavin Generating Station
Cheshire, Ohio

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APPENDIX C ANALYTICAL DATA SUMMARY

Appendix C
Analytical Data Summary
Residual Water Landfill
Gavin Power Plant

	Location ID Date	FEDERAL 2000 2016-08-24 N	FEDERAL 2000 2016-10-06 N	FEDERAL 2000 2016-12-01 N	FEDERAL 2000 2017-02-02 N	FEDERAL 2000 2017-03-23 N	FEDERAL 2000 2017-05-01 N	FEDERAL 2000 2017-06-12 N	FEDERAL 2000 2017-07-17 N	FEDERAL 2000 2018-03-15 N	FEDERAL 2000 2018-09-13 N	FEDERAL 2000 2019-03-12 N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L			417	424					380	370	380
Aluminum	mg/L					7.8 J	0.18	1.4 B	0.32			
Antimony	mg/L	2E-05	1E-05	3E-05	0.0001	0.002 U	0.002 U	0.002 U	0.002 U			
Arsenic	mg/L	0.0018	0.00177	0.00153	0.00192	0.0042 J	0.0017 J	0.0024 J	0.0017 J			
Barium	mg/L	0.0244	0.0233	0.019	0.0245	0.078 B	0.022	0.036	0.024			
Beryllium	mg/L	2E-05	5E-06	5E-06	2E-05	0.00042 J	0.001 U	0.001 U	0.001 U			
Bicarbonate Alkalinity as CaCO3	mg/L									350	330	
Bicarbonate Alkalinity as HCO3	mg/L											350
Boron	mg/L	0.289	0.278	0.296	0.283	0.33	0.33	0.34	0.35 JB	0.32		0.34
Bromide	mg/L			0.412	0.334	0.41 J	5 U	2.5 U	2.5 U			
Cadmium	mg/L	2E-05	5E-06	1E-05	5E-05	0.001 U	0.001 U	0.001 U	0.001 U			
Calcium	mg/L	2.7	2.78	2.64	2.57	3.9 B	2.5	3.2	2.6	2.6	2.8	2.6
Carbonate Alkalinity as CaCO3	mg/L									34	34	34
Chloride	mg/L	83.9	92	96.9	96.3	96	60	79	62	86	96	93
Chromium	mg/L	0.0018	0.0033	0.0007	0.00263	0.06	0.0019 J	0.0081	0.0019 J			
Cobalt	mg/L	0.00011	0.000202	4.6E-05	0.000151	0.0052	0.00026 J	0.0011	0.00042 J			
Conductivity, Field	uS/cm	2068	2149	2094	2158							
Copper	mg/L					0.01 B	0.002 U	0.0048 B	0.002 U			
Dissolved Oxygen, Field	mg/L	0.88	3.16	1.59	1.86					0.2		
Dissolved Solids, Total	mg/L	1220	1300	1290	1290	1300 J	1200 J	1300	1300 J	1300		1300
Fluoride	mg/L	1.86	2	2.26	2.13	2.6	2.2	2.4	2.2	2.2	2.3	2.2
Iron	mg/L					8.3 JB	0.19	1.5	0.39			
Lead	mg/L	3.9E-05	9.6E-05	4.9E-05	0.000237	0.0052 J	0.00056 J	0.0011	0.00058 J			
Lithium	mg/L	0.02	0.023	0.017	0.014	0.021	0.016	0.018	0.016			
Magnesium	mg/L			0.724	0.723	2.4 B	0.75 J	1.1	0.8 J	0.66	0.69	0.76
Manganese	mg/L					0.084	0.01	0.026	0.014			
Mercury	mg/L	5E-06	5E-06	2E-06	5E-06	0.0002 U	0.0002 U	0.0002 U	0.0002 U			
Mercury	ug/L											
Molybdenum	mg/L	0.0389	0.0349	0.0331	0.0345	0.037	0.033	0.033	0.032			
Nickel	mg/L					0.039	0.002 U	0.0056	0.0018 J			
pH, Field	pH units	7.28	8.89	8.6	8.59	8.69	8.58	8.55	8.61	8.71	8.6	8.85
Potassium	mg/L			1.05	1.49	2.6 B	0.92 J	1.2	0.91 J	0.84	1	0.93
Radium 226	pCi/L	0.356	0.547	0.32	0.257	0.303	0.116	0.147	0.171			
Radium-226/228	pCi/L	1.348	1.827	0.595	0.701	0.497	0.339	0.539	0.53			
Radium-228	pCi/L	0.992	1.28	0.275	0.444	0.194 U	0.224 U	0.393	0.359			
Redox Potential, Field	mV	167.6	70.5	-68	88.2							
Selenium	mg/L	7E-05	4E-05	5E-05	0.0001	0.00073 J	0.005 U	0.005 U	0.005 U			
Silver	mg/L					0.0005 J	0.001 U	0.001 U	0.001 U			
Sodium	mg/L			414	405	440 JB	480 B	460 B	440 JB	440	460	470
Specific Conductivity, Field	uS/cm									2079		
Strontium	mg/L			0.199	0.19	0.22 B	0.19 B	0.2 B	0.19			
Sulfate	mg/L	493	516	567	521	560 J	570	560	560	560	570	570
Temperature, Field	deg C	15.16	18.6	15.2	12.4					13.1		
Thallium	mg/L	2E-05	4E-05	1E-05	5.2E-05	0.001 U	0.001 U	0.001 U	0.001 U			
Turbidity, Field	NTU	3.3	5.1	6.7	1.9	61.2	28.9	31.1	5.7	1.2	1.96	
Vanadium	mg/L					0.013			0.005 U			
Zinc	mg/L					0.026	0.02 U	0.02 U	0.02 U			

Notes:
FD = Field duplicate sample
N = Normal environmental sample
deg C = Degree Celcius
mg/L = Milligrams per liter
mV = Milivolts
NTU = Nephelometric Turbidity Unit
uS/cm = Microsiemens per centimeter
pCi/L = Picocuries per liter
B: Compound was found in the blank and sample.
J: Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.
U: Indicates the analyte was analyzed for but not detected.
Empty cells = Not analyzed

Appendix C
Analytical Data Summary
Residual Water Landfill
Gavin Power Plant

	Location ID	FEDERAL 2000	FEDERAL 2002	FEDERAL 2003	FEDERAL 2003	FEDERAL 2003	FEDERAL 2003	FEDERAL 2003	FEDERAL 2003	FEDERAL 2003	FEDERAL 2016-20	FEDERAL 2016-20
	Date	2019-09-24	2018-10-22	2016-12-01	2017-02-08	2017-03-27	2017-05-01	2017-06-12	2018-10-29	2019-09-21	2016-08-26	2016-10-05
		N	N	N	N	N	N	N	N	N	N	N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L	380	240	709	680				730	740		
Aluminum	mg/L					61 J	34	27	28			
Antimony	mg/L			0.00029	0.0002	0.0014 JB	0.00087 J	0.00074 J	0.00058		0.00039	0.00039
Arsenic	mg/L			0.00826	0.0074	0.03	0.019	0.02	0.021		0.0264	0.008
Barium	mg/L			0.175	0.145	0.41 B	0.39	0.29	0.2		0.12	0.213
Beryllium	mg/L			0.000166	0.000162	0.0031	0.0022	0.0016	0.0011		0.00281	0.000343
Bicarbonate Alkalinity as CaCO3	mg/L	340	240						710	710		
Bicarbonate Alkalinity as HCO3	mg/L											
Boron	mg/L		0.48	0.461	0.462	0.46	0.48	0.51	0.48		0.326	0.344
Bromide	mg/L			2.7	2.25	2.6 J	2.4 J	2 J				
Cadmium	mg/L			8E-05	6E-05	0.001 U	0.001 U	0.001 U	0.001		0.00201	0.00027
Calcium	mg/L		760	8.98	8.37	12 B	15	12	7.5		138	34.1
Carbonate Alkalinity as CaCO3	mg/L	38	5						27	21		
Chloride	mg/L	100	17000	643	700	650	690	560	430	390	574	1570
Chromium	mg/L			0.0011	0.0839	0.11 B	0.058	0.055	0.037		0.0287	0.0079
Cobalt	mg/L			0.00251	0.00382	0.023	0.014	0.013	0.0075		0.0398	0.00486
Conductivity, Field	uS/cm			3638	3676						3670	4990
Copper	mg/L					0.023 B	0.018 B	0.019 B	0.0076			
Dissolved Oxygen, Field	mg/L			1.03	1.28						11.98	10.16
Dissolved Solids, Total	mg/L	1300	4700	1950	1960	2100 J	2400 J	2100	1800	1600	1970	3540
Fluoride	mg/L	2.5	2.5	2.7	2.36	2.9	2.8	2.7	3.2	3.6	1.29	0.95
Iron	mg/L					67 JB	38	36	19			
Lead	mg/L			0.00144	0.00165	0.031 J	0.019	0.018	0.0097		0.0678	0.00995
Lithium	mg/L			0.024	0.019	0.084	0.05	0.051	0.051		0.088	0.051
Magnesium	mg/L		320	2.26	2.65	9.6 B	7.3	5.9	4			
Manganese	mg/L					0.21 B	0.17	0.13	0.062			
Mercury	mg/L			1.7E-05	5E-06	0.0002 U	0.0002 U	0.0002 U	0.0002		0.000423	2.4E-05
Mercury	ug/L											
Molybdenum	mg/L			0.105	0.125	0.12	0.1	0.12 J	0.16		0.00943	0.11
Nickel	mg/L					0.074 B	0.039	0.04	0.025			
pH, Field	pH units	8.83	6.82	8.02	7.84	7.94	7.87	7.83	8.06	8.19	9.29	9.02
Potassium	mg/L		29	2.61	3.22	11 B	7.2	6	5.9			
Radium 226	pCi/L			0.555	0.193	0.937	0.45	1.48	0.909		4.03	0.0323
Radium-226/228	pCi/L			0.975	1.483	2.93	0.95	2.05	1.71		4.656	1.7223
Radium-228	pCi/L			0.42	1.29	2	0.5 U	0.57 U	0.797		0.626	1.69
Redox Potential, Field	mV			4	-122.2						172.2	139.2
Selenium	mg/L			0.0013	0.0011	0.0068	0.0034 J	0.0046 J	0.0017		0.0104	0.002
Silver	mg/L					0.00074 J	0.00023 J	0.00061 J	0.0005			
Sodium	mg/L		8400	605	628	730 JB	740 B	730	630			
Specific Conductivity, Field	uS/cm											
Strontium	mg/L			0.593	0.567	0.84 B	0.94 B	0.69 B	0.52			
Sulfate	mg/L	540	50	77.8	65.3	84 J	84	86	73	74	459	460
Temperature, Field	deg C			12.5	13.1						24.8	18.4
Thallium	mg/L			4E-05	3E-05	0.00031 J	0.001 U	0.001 U	0.0002		0.000318	0.000115
Turbidity, Field	NTU	3	882	123.9	265.2	530.1	336.7	236.9	1000	60	1270	668.2
Vanadium	mg/L											
Zinc	mg/L					0.11	0.07	0.059	0.041			

Notes:
FD = Field duplicate sample
N = Normal environmental sample
deg C = Degree Celcius
mg/L = Milligrams per liter
mV = Milivolts
NTU = Nephelometric Turbidity Unit
uS/cm = Microsiemens per centimeter
pCi/L = Picocuries per liter
B: Compound was found in the blank and sample.
J: Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.
U: Indicates the analyte was analyzed for but not detected.
Empty cells = Not analyzed

Appendix C
Analytical Data Summary
Residual Water Landfill
Gavin Power Plant

	Location ID	FEDERAL 2016-20	FEDERAL 2016-20	FEDERAL 2016-20	FEDERAL 2016-21	FEDERAL 2016-21	FEDERAL 2016-21	FEDERAL 2016-21	FEDERAL 2016-21	FEDERAL 2016-21	FEDERAL 2016-21	FEDERAL 93100
	Date	2017-05-17	2018-10-29	2019-03-15	2016-08-25	2016-10-06	2017-08-10	2018-04-13	2018-09-24	2019-03-14	2019-09-21	2016-08-23
		N	N	N	N	N	N	N	N	N	N	N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L							340	300	240	170	
Aluminum	mg/L	1.6 B					0.46					
Antimony	mg/L	0.00099 J			0.00047	0.001	0.0036 B					4E-05
Arsenic	mg/L	0.0055			0.0245	0.0373	0.037					0.00164
Barium	mg/L	0.48			0.0618	0.113	0.035					0.602
Beryllium	mg/L	0.001 U			0.000591	0.000923	0.001 U					1E-05
Bicarbonate Alkalinity as CaCO3	mg/L							5	5	5	5 U	
Bicarbonate Alkalinity as HCO3	mg/L											
Boron	mg/L	0.41			0.504	0.429	0.34	0.24	0.24	0.22		0.432
Bromide	mg/L	15					0.71					
Cadmium	mg/L	0.001 U			0.00011	0.00016	0.001 U					4E-05
Calcium	mg/L	49			22.8	24.4	24	54	26	41		20.3
Carbonate Alkalinity as CaCO3	mg/L							90	90	58	73	
Chloride	mg/L	3200	5400		62.2	65.2	110	54	48	40	88	2180
Chromium	mg/L	0.004			0.0075	0.0112	0.0035					0.0022
Cobalt	mg/L	0.0014			0.00396	0.00519	0.00088 J					0.00062
Conductivity, Field	uS/cm				2714	2184						6544
Copper	mg/L	0.0067 B					0.02 B					
Dissolved Oxygen, Field	mg/L				2.91	4.78		3.34				1.22
Dissolved Solids, Total	mg/L	6300 J	8800		1310	1510	1000	1100	1100	1100	1100	3630
Fluoride	mg/L	1.2	0.88		2.7	2.72	2.1	1.4	1.5	1.1	1.6	2.17
Iron	mg/L	1.2					0.12					
Lead	mg/L	0.001			0.00238	0.00351	0.001 U					0.000244
Lithium	mg/L	0.06			0.044	0.048	0.076					0.048
Magnesium	mg/L	15					1 U	1	0.37	1.8		
Manganese	mg/L	0.18					0.005 U					
Mercury	mg/L	0.0002 U			3.2E-05	5.2E-05	0.0002 U					5E-06
Mercury	ug/L											
Molybdenum	mg/L	0.14			0.0545	0.057	0.1 B					0.087
Nickel	mg/L	0.025					0.016					
pH, Field	pH units	8.16	7.44	7.31	11.76	11.42		11.99	11.71	11.85	11.4	7.97
Potassium	mg/L	7.9					44	42	16	15		
Radium 226	pCi/L				0.733	1.19	1.87					0.637
Radium-226/228	pCi/L				1.356	1.362	6.04					2.587
Radium-228	pCi/L				0.623	0.172	4.16					1.95
Redox Potential, Field	mV				-312.7	31.1						-98.5
Selenium	mg/L	0.0023 J			0.0018	0.0033	0.0027 J					0.0001
Silver	mg/L	0.0014					0.001 U					
Sodium	mg/L	2000					330	280	320	320		
Specific Conductivity, Field	uS/cm							2425				
Strontium	mg/L	4 B					0.48 B					
Sulfate	mg/L	450	330		415	373	360	520	530	600	540	11.4
Temperature, Field	deg C				17.8	15.7		14.9				19.02
Thallium	mg/L	0.001 U			0.000143	0.00011	0.001 U					0.0001
Turbidity, Field	NTU	6382	1000		195.1	847.3		208	37.7		60	7
Vanadium	mg/L											
Zinc	mg/L	0.02 U					0.02 U					

Notes:
FD = Field duplicate sample
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deg C = Degree Celcius
mg/L = Milligrams per liter
mV = Milivolts
NTU = Nephelometric Turbidity Unit
uS/cm = Microsiemens per centimeter
pCi/L = Picocuries per liter
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Appendix C
Analytical Data Summary
Residual Water Landfill
Gavin Power Plant

	Location ID	FEDERAL 93100	FEDERAL 93100	FEDERAL 93100	FEDERAL 93100	FEDERAL 93100	FEDERAL 93100	FEDERAL 93100	FEDERAL 93100	FEDERAL 93100	FEDERAL 93100	FEDERAL 93100
	Date	2016-10-05	2016-12-02	2017-02-02	2017-03-29	2017-04-28	2017-06-12	2017-07-18	2017-07-18	2018-03-15	2018-09-24	2019-03-11
		N	N	N	N	N	N	FD	N	N	N	FD
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L		393	359						360	320	320
Aluminum	mg/L				1.8 J	0.044 J	3.8 B	1.8	1.7			
Antimony	mg/L	6E-05	5E-05	5E-05	0.0012 J	0.002 U	0.002 U	0.002 U	0.002 U			
Arsenic	mg/L	0.00207	0.00174	0.00156	0.002 J	0.0016 J	0.002 J	0.0019 J	0.002 J			
Barium	mg/L	0.69	0.468	0.521	0.64 B	0.65	0.65	0.66	0.66			
Beryllium	mg/L	5.3E-05	1E-05	1E-05	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U			
Bicarbonate Alkalinity as CaCO3	mg/L									360	320	
Bicarbonate Alkalinity as HCO3	mg/L											320
Boron	mg/L	0.429	0.39	0.415	0.45	0.47 B	0.48	0.49 JB	0.5 JB	0.45	0.45	0.48
Bromide	mg/L		7.81	8.8	8.9 J	8.9 J	10	8.7 J	8.8 J			
Cadmium	mg/L	1E-05	4E-05	4E-05	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U			
Calcium	mg/L	22.2	14.1	16.8	17 B	16	20	17	17	14	18	17
Carbonate Alkalinity as CaCO3	mg/L									5	5	5
Chloride	mg/L	2310	1770	199	2200	2200	2100	2200	2200	1800	2200	2100
Chromium	mg/L	0.0049	0.00586	0.00582	0.0098	0.002 U	0.04	0.011	0.011			
Cobalt	mg/L	0.00129	0.00235	0.00195	0.0012	0.00027 J	0.0099	0.0033	0.0031			
Conductivity, Field	uS/cm	7642	5904	7014								
Copper	mg/L				0.0028 B	0.002 U	0.0051 B	0.002 U	0.002 U			
Dissolved Oxygen, Field	mg/L	0.51	0.91	1.18						0.2		
Dissolved Solids, Total	mg/L	3980	3420	3600	3900 J	3700 J	3600	3400 J	3600 J	3300	3100	3100
Fluoride	mg/L	2.05	1.97	2.18	2.4	2.2	2.3	2.3	2.3	2.6	2.7	2.2
Iron	mg/L				1.7 JB	0.082 J	1	0.42	0.41			
Lead	mg/L	0.00093	0.000135	0.000189	0.001 J	0.001 U	0.00046 J	0.001 U	0.001 U			
Lithium	mg/L	0.058	0.046	0.04	0.044	0.047	0.043	0.048	0.048			
Magnesium	mg/L		4.4	5.37	6.2 B	5.6	6.1	6.2	6.2	4.1	5.4	5.9
Manganese	mg/L				0.046	0.032	0.055	0.045	0.044			
Mercury	mg/L	3E-06	5E-06	5E-06	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U			
Mercury	ug/L											
Molybdenum	mg/L	0.0889	0.125	0.106	0.11	0.11	0.11 J	0.097	0.098			
Nickel	mg/L				0.0065	0.002 U	0.038	0.0096	0.0087			
pH, Field	pH units	7.85	7.78	7.87	7.82	7.86	7.77		7.71	7.93	7.89	
Potassium	mg/L		3.87	4.57	3.1 B	2.6	2.7	2.7	2.7	2.1	2.6	2.6
Radium 226	pCi/L	0.909	0.863	0.544	0.538	0.565	0.736	0.691 J	0.758 J			
Radium-226/228	pCi/L	1.969	1.538	1.252	0.869	1.14	1.19	1.32	1.41			
Radium-228	pCi/L	1.06	0.675	0.708	0.332 U	0.58	0.458	0.63	0.648			
Redox Potential, Field	mV	788	35.3	-138.6								
Selenium	mg/L	0.0002	0.0003	0.0002	0.0007 J	0.005 U	0.005 U	0.005 U	0.005 U			
Silver	mg/L				0.001 U	0.001 U	0.00036 J	6.9E-05 J	6.3E-05 J			
Sodium	mg/L		1270	1050	1400 JB	1500	1500	1500 JB	1500 JB	1200	1400	1500
Specific Conductivity, Field	uS/cm									6107		
Strontium	mg/L		1.18	1.4	1.7 B	1.9	1.7 B	1.7	1.7			
Sulfate	mg/L	8.4	12.2	9.9	15 J	13 J	15	14 J	14 J	22	16	17
Temperature, Field	deg C	18.6	14.9	14.1						15.2		
Thallium	mg/L	3E-05	2E-05	4E-05	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U			
Turbidity, Field	NTU	42.7	7.4	15.3	31.1	6.4	2.8		6	4.6	1.18	
Vanadium	mg/L							0.005 U	0.005 U			
Zinc	mg/L				0.02 U	0.02 U	0.02 U	0.02 U	0.02 U			

Notes:
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mg/L = Milligrams per liter
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NTU = Nephelometric Turbidity Unit
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Appendix C
Analytical Data Summary
Residual Water Landfill
Gavin Power Plant

Location ID / Date		FEDERAL 93100 2019-03-11 N	FEDERAL 93100 2019-09-23 N	FEDERAL 93108 2016-08-24 N	FEDERAL 93108 2016-10-06 N	FEDERAL 93108 2016-12-02 N	FEDERAL 93108 2017-02-02 N	FEDERAL 93108 2017-03-23 N	FEDERAL 93108 2017-05-02 N	FEDERAL 93108 2017-06-12 N	FEDERAL 93108 2017-07-18 N	FEDERAL 93108 2018-03-15 N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L	320	330			720	672					640
Aluminum	mg/L							2.5 J	0.13	0.041 JB	7.1	
Antimony	mg/L			0.0001	3E-05	0.00023	0.00016	0.002 U	0.002 U	0.002 U	0.002 U	
Arsenic	mg/L			0.00196	0.00153	0.0025	0.00166	0.0018 J	0.0013 J	0.0016 J	0.0029 J	
Barium	mg/L			0.174	0.164	0.199	0.157	0.19 B	0.18	0.18	0.22	
Beryllium	mg/L			4.1E-05	1E-05	0.000162	0.000107	0.001 U	0.001 U	0.001 U	0.00047 J	
Bicarbonate Alkalinity as CaCO3	mg/L		330									640
Bicarbonate Alkalinity as HCO3	mg/L	320										
Boron	mg/L	0.49		0.429	0.404	0.391	0.411	0.5	0.48	0.46	0.48 JB	0.45
Bromide	mg/L					2.42	2.16	2.4 J	2.7 J	2.8	2.6 J	
Cadmium	mg/L			7E-05	3E-05	0.0003	0.00019	0.001 U	0.001 U	0.0014	0.00024 J	
Calcium	mg/L	17		6.09	5.87	6.55	5.85	6 B	5.9	5.8	6.4	5.6
Carbonate Alkalinity as CaCO3	mg/L	5	5 U									5
Chloride	mg/L	2100	2000	745	731	681	688	700	820	790	750	770
Chromium	mg/L			0.0086	0.0062	0.0263	0.025	0.02	0.004	0.002 U	0.067	
Cobalt	mg/L			0.00113	0.00039	0.00393	0.00262	0.002	0.00037 J	0.00025 J	0.0059	
Conductivity, Field	uS/cm			3490	3589	3580	3545					
Copper	mg/L							0.008 B	0.002 U	0.002 U	0.021	
Dissolved Oxygen, Field	mg/L			1.67	0.81	1.01	1.42					0.64
Dissolved Solids, Total	mg/L	3100	2900	1940	1900	1950	1900	1800 J	1900 J	2000	1800 J	2100
Fluoride	mg/L	2.2	2.7	4.59	4.46	4.15	4.57	5.4	5.1	5.3	5.5	4.6
Iron	mg/L							2.7 JB	0.25	0.12	8.3	
Lead	mg/L			0.00206	0.000516	0.00639	0.00385	0.0026 J	0.0007 J	0.001 U	0.0074	
Lithium	mg/L			0.027	0.028	0.033	0.024	0.025	0.025	0.029	0.033	
Magnesium	mg/L	6.1				2.33	2.18	2.2 B	2	1.8	2.9	1.7
Manganese	mg/L							0.051	0.027	0.031	0.092	
Mercury	mg/L			5E-06	1.5E-05	1E-05	9E-06	0.0002 U	0.0002 U	0.0002 U	0.0002 U	
Mercury	ug/L											
Molybdenum	mg/L			0.254	0.267	0.237	0.23	0.25	0.24	0.23 J	0.24	
Nickel	mg/L							0.014	0.0033	0.0015 J	0.05	
pH, Field	pH units	8.06	8.04	7.59	7.87	7.96	7.9	8.07	7.99	7.87	7.84	7.97
Potassium	mg/L	2.6				2.59	2.53	1.8 B	1.4	1.3	2.7	1.3
Radium 226	pCi/L			0.74	0.639	1.02	0.322	0.355	0.289	0.351	0.527	
Radium-226/228	pCi/L			2.68	2.059	1.229	0.502	0.471	0.919	0.704	2.09	
Radium-228	pCi/L			1.94	1.42	0.209	0.18	0.116 U	0.63	0.353	1.56	
Redox Potential, Field	mV			-29.9	-145.3	-112.7	-121.3					
Selenium	mg/L			0.0002	6E-05	0.0004	0.0002	0.005 U	0.005 U	0.005 U	0.005 U	
Silver	mg/L							0.001 U	0.001 U	0.001 U	6.2E-05 J	
Sodium	mg/L	1500				827	595	790 JB	790 B	790	760 JB	810
Specific Conductivity, Field	uS/cm											3606
Strontium	mg/L					0.434	0.41	0.46 B	0.5 B	0.45 B	0.46	
Sulfate	mg/L	18	16	73.1	66.1	68.1	72.3	83 J	82	84	90	85
Temperature, Field	deg C			18.33	15	12.9	12.9					14.8
Thallium	mg/L			0.000125	4E-05	0.000159	0.000126	0.001 U	0.001 U	0.001 U	0.00021 J	
Turbidity, Field	NTU		7	28.9	9.7	18.3	15.9	50.1	16.4	8.6	287.1	4.8
Vanadium	mg/L							0.0045 J			0.013	
Zinc	mg/L							0.019 J	0.02 U	0.02 U	0.036	

Notes:
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Appendix C
Analytical Data Summary
Residual Water Landfill
Gavin Power Plant

	Location ID	FEDERAL	FEDERAL	FEDERAL	FEDERAL	FEDERAL	FEDERAL	FEDERAL	FEDERAL	FEDERAL	FEDERAL	FEDERAL
		93108	94125	94125	94126	94126	94126	94126	94126	94126	94126	94126
	Date	2018-09-14	2016-12-02	2017-02-06	2016-08-23	2016-10-05	2016-12-01	2017-02-02	2017-03-23	2017-03-23	2017-05-17	2017-06-08
		N	N	N	N	N	N	N	FD	N	N	N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L	640	279	274			135	123				
Aluminum	mg/L								0.024 J	0.016 J	0.52 B	0.79
Antimony	mg/L		0.0003	0.0003	0.0005	0.0005	0.0001	0.0005	0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L		0.00689	0.00276	0.00422	0.00524	0.0043	0.00442	0.0058	0.0058	0.0025 J	0.0021 J
Barium	mg/L		1.41	1.22	13	12.5	13	10.8	11 B	11 B	11	11
Beryllium	mg/L		0.000598	0.0002	0.0002	0.0002	5E-05	0.0002	0.001 U	0.001 U	0.001 U	0.001 U
Bicarbonate Alkalinity as CaCO3	mg/L	640										
Bicarbonate Alkalinity as HCO3	mg/L											
Boron	mg/L	0.47	0.408	0.494	0.372	0.371	0.372	0.333	0.46	0.44	0.41	0.41
Bromide	mg/L		51.7	49.6			50.9	52.2	49	50	52	49 J
Cadmium	mg/L		0.00116	0.00109	4E-05	0.0002	4E-05	0.0002	0.001 U	0.001 U	0.001 U	0.001 U
Calcium	mg/L	6.4	410	448	325	356	336	323	370 B	370 B	320	320
Carbonate Alkalinity as CaCO3	mg/L	5										
Chloride	mg/L	720	11600	12500	11100	11000	10600	11400	12000	12000	12000	11000
Chromium	mg/L		0.126	0.195	0.0023	0.0027	0.0045	0.00257	0.0046	0.0028	0.022	0.011
Cobalt	mg/L		0.0138	0.0112	0.00363	0.00485	0.00369	0.00371	0.0041	0.0038	0.0023	0.0022
Conductivity, Field	uS/cm		33959	33696	27600	30317	29486	30460				
Copper	mg/L								0.0013 JB	0.0015 JB	0.002 U	0.0028
Dissolved Oxygen, Field	mg/L		152	1.89	2.99	0.71	2	1.19				
Dissolved Solids, Total	mg/L	1700	20000	19500	17900	18200	17300	16900	18000 J	19000 J	18000 J	18000
Fluoride	mg/L	4.9	2	1	0.43	0.5	0.6	0.7	0.82 J	0.69 J	5 U	5 U
Iron	mg/L								2.8 JB	2.6 JB	1.1	1.1
Lead	mg/L		0.0105	0.0044	0.0002	0.0002	0.0001	9E-05	0.001 U	0.001 U	0.001 U	0.00053 J
Lithium	mg/L		0.263	0.237	0.2	0.237	0.249	0.228	0.17	0.16	0.19	0.19
Magnesium	mg/L	1.9	113	112			93.4	97.4	120 B	120 B	100	110
Manganese	mg/L								1.4	1.3	0.63	0.64
Mercury	mg/L		2E-05	7E-06	5E-06	5E-06	1.2E-05	5E-06	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Mercury	ug/L											
Molybdenum	mg/L		0.0642	0.0534	0.00601	0.0338	0.0099	0.0626	0.0059 J	0.0042 J	0.008 J	0.004 J
Nickel	mg/L								0.0067	0.0061	0.027	0.05 U
pH, Field	pH units	7.7	6.74	6.81	7.36	7.21	7.2	7.2		7.35	7.21	7.12
Potassium	mg/L	1.4	21.4	24.7			16.9	22	11 B	10 B	11	10
Radium 226	pCi/L		3.28	10.9	20.1	20.2	22.7	25.2	36.8	37.6	36.8	31.6
Radium-226/228	pCi/L		12.69	20.73	50.95	60.9	52.3	55.57	91.8	83.5	84.7	77.2
Radium-228	pCi/L		9.41	9.83	30.85	40.7	29.6	30.37	55	45.9	47.9	45.7
Redox Potential, Field	mV		149.5	21.7	-77.2	-107.5	-88.5	-113.7				
Selenium	mg/L		0.0022	0.0009	0.001	0.001	0.0005	0.001	0.00087 J	0.00087 J	0.001 J	0.00095 J
Silver	mg/L								4E-05 J	4E-05 J	9E-05 J	8.7E-05 J
Sodium	mg/L	820	5630	3100			1370	626	6400 JB	6200 JB	5900	5800 B
Specific Conductivity, Field	uS/cm											
Strontium	mg/L		34.1	32.5			32.2	29.9	31 B	31 B	30 B	30 B
Sulfate	mg/L	85	83.5	80.8	2.1	10.9	0.5	1	8.3 J	28 J	100 U	100 U
Temperature, Field	deg C		11.8	11.8	17.4	15.4	13	12.9				
Thallium	mg/L		0.0002	0.0003	0.0001	0.00098	0.0001	0.0001	0.001 U	0.001 U	0.001 U	0.001 U
Turbidity, Field	NTU	10.1	2190.4	158.7	1.9	8	4.2	4.7		11.8	5.9	38.2
Vanadium	mg/L								0.005 U	0.005 U		
Zinc	mg/L								0.0068 J	0.007 J	0.02 U	0.02 U

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Residual Water Landfill
Gavin Power Plant

Analyte	Unit	FEDERAL 94126 2017-07-18 N	FEDERAL 94126 2018-03-15 N	FEDERAL 94126 2018-09-14 FD	FEDERAL 94126 2018-09-14 N	FEDERAL 94126 2019-03-07 N	FEDERAL 94126 2019-09-17 N	FEDERAL 94128 2016-06-08 N	FEDERAL 94128 2016-08-23 N	FEDERAL 94128 2016-10-05 N	FEDERAL 94128 2016-12-01 N	FEDERAL 94128 2017-02-02 N
Alkalinity, Total as CaCO3	mg/L		130	120	120	130	120				730	712
Aluminum	mg/L	0.46										
Antimony	mg/L	0.004 U							7E-05	7E-05	6E-05	6E-05
Arsenic	mg/L	0.0017 J							0.0226	0.0236	0.0193	0.0195
Barium	mg/L	11							0.141	0.141	0.134	0.131
Beryllium	mg/L	0.002 U							2E-05	2E-05	5E-06	2E-05
Bicarbonate Alkalinity as CaCO3	mg/L		130	120	120		120					
Bicarbonate Alkalinity as HCO3	mg/L					130						
Boron	mg/L	0.43 JB	0.39	0.35	0.36	0.38			0.439	0.421	0.431	0.411
Bromide	mg/L	53									3.34	2.62
Cadmium	mg/L	0.002 U							2E-05	2E-05	4E-06	2E-05
Calcium	mg/L	310	350	400	380	330			6.72	7.16	6.85	6.38
Carbonate Alkalinity as CaCO3	mg/L		5	5	5	5	5 U					
Chloride	mg/L	12000	11000	14000	13000	11000	11000		765	788	805	770
Chromium	mg/L	0.0066							0.0003	0.0004	0.0022	0.000409
Cobalt	mg/L	0.0028							0.000105	0.000124	0.000142	0.000101
Conductivity, Field	uS/cm								3384	3649	3719	3788
Copper	mg/L	0.004 U										
Dissolved Oxygen, Field	mg/L		0.2						1.6	0.82	1	1.4
Dissolved Solids, Total	mg/L	16000 J	18000	13000	14000	4800	20000		1990	1980	1460	1990
Fluoride	mg/L	5	5	5	5	2.5	2.5 U		2.17	2.11	2.29	2.06
Iron	mg/L	0.99										
Lead	mg/L	0.002 U							3.5E-05	4.9E-05	7.1E-05	2E-05
Lithium	mg/L	0.2							0.029	0.035	0.031	0.023
Magnesium	mg/L	110	100	130	120	110					2.13	2.04
Manganese	mg/L	0.78										
Mercury	mg/L	0.0002 U							5E-06	5E-06	9E-06	5E-06
Mercury	ug/L											
Molybdenum	mg/L	0.0062 J							0.45	0.441	0.444	0.371
Nickel	mg/L	0.034										
pH, Field	pH units	7.11	7.99		7.3	7.36	7.38	7.99	7.92	7.98	7.99	7.96
Potassium	mg/L	11	9.1	11	11	9.8					2.53	2.4
Radium 226	pCi/L	32 J							0.719	0.525	0.321	0.364
Radium-226/228	pCi/L	82.8 J							1.626	1.735	1.046	0.92
Radium-228	pCi/L	50.8 J							0.907	1.21	0.725	0.556
Redox Potential, Field	mV								-39.2	-96.7	-96.1	-60.6
Selenium	mg/L	0.01 U							0.0001	3E-05	3E-05	0.0001
Silver	mg/L	0.002 U										
Sodium	mg/L	5900 JB	6000	6600	6500	6000					551	618
Specific Conductivity, Field	uS/cm		3703									
Strontium	mg/L	33									0.5	0.459
Sulfate	mg/L	100 U	100	100	100	50	50 U		51.4	40.7	52.4	43.4
Temperature, Field	deg C		12.7						17.95	16.1	13.1	12.7
Thallium	mg/L	0.002 U							2E-05	5E-05	1E-05	2E-05
Turbidity, Field	NTU	37.1	1.9		8.41		12	4.3	6.4	3.5	3.9	2
Vanadium	mg/L	0.01 U										
Zinc	mg/L	0.04 U										

Notes:
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deg C = Degree Celcius
mg/L = Milligrams per liter
mV = Milivolts
NTU = Nephelometric Turbidity Unit
uS/cm = Microsiemens per centimeter
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Appendix C
Analytical Data Summary
Residual Water Landfill
Gavin Power Plant

Analyte	Unit	FEDERAL 94128 2017-03-23 N	FEDERAL 94128 2017-05-02 FD	FEDERAL 94128 2017-05-02 N	FEDERAL 94128 2017-06-08 N	FEDERAL 94128 2017-07-18 N	FEDERAL 94128 2018-03-15 N	FEDERAL 94128 2018-09-14 N	FEDERAL 94128 2019-03-07 N	FEDERAL 94128 2019-09-17 N	FEDERAL 94136 2016-08-24 N	FEDERAL 94136 2016-10-06 N
Alkalinity, Total as CaCO3	mg/L						650	630	640	620		
Aluminum	mg/L	0.05 UJ	0.05 U	0.05 U	0.18	0.046 J						
Antimony	mg/L	0.002 UJ	0.002 U	0.002 U	0.002 U	0.002 U					2E-05	3E-05
Arsenic	mg/L	0.018 J	0.017	0.017	0.017	0.019					0.00037	0.00048
Barium	mg/L	0.15 JB	0.15	0.15	0.15	0.15					0.0865	0.0894
Beryllium	mg/L	0.001 UJ	0.001 U	0.001 U	0.001 U	0.001 U					2E-05	1E-05
Bicarbonate Alkalinity as CaCO3	mg/L						650	620		610		
Bicarbonate Alkalinity as HCO3	mg/L								640			
Boron	mg/L	0.49	0.45	0.45	0.46	0.47 JB	0.43	0.43	0.43		0.405	0.395
Bromide	mg/L	2.9 J	3 J	3 J	2.9 J	3.3 J						
Cadmium	mg/L	0.001 UJ	0.001 U	0.001 U	0.00035 J	0.001 U					6E-06	6E-06
Calcium	mg/L	6.6 JB	6.3	6.4	6.7	6	7.5	6.9	6.5		23.2	22
Carbonate Alkalinity as CaCO3	mg/L						5	4.1	2.7	17		
Chloride	mg/L	780	840	850	790	830	830	790	780	800	888	927
Chromium	mg/L	0.002 UJ	0.002 U	0.002 U	0.0028	0.002 U					0.0012	0.002
Cobalt	mg/L	0.001 UJ	0.001 U	0.001 U	0.0002 J	0.001 U					0.000107	0.00029
Conductivity, Field	uS/cm										3541	3581
Copper	mg/L	0.002 UJ	0.002 U	0.002 U	0.002 U	0.002 U						
Dissolved Oxygen, Field	mg/L						0.61				1.08	0.58
Dissolved Solids, Total	mg/L	1500 J	1900 J	1800 J	2100	1900 J	1900	1400	1900	2200	1850	1820
Fluoride	mg/L	2.6	2.8	2.8	2.6	2.8	2.4	2.5	2.5	2.6	0.96	0.94
Iron	mg/L	0.011 JB	0.1 U	0.1 U	0.23	0.058 J						
Lead	mg/L	0.001 UJ	0.001 U	0.001 U	0.001 U	0.001 U					5.3E-05	0.000164
Lithium	mg/L	0.026 J	0.03	0.029	0.032	0.032					0.028	0.033
Magnesium	mg/L	2.1 JB	2.1	2.1	2.1	2	2.1	2.2	2			
Manganese	mg/L	0.034 J	0.032	0.032	0.036	0.033						
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U					5E-06	5E-06
Mercury	ug/L											
Molybdenum	mg/L	0.39 J	0.39	0.39	0.38 J	0.39					0.0135	0.015
Nickel	mg/L	0.002 UJ	0.002 U	0.002 U	0.0018 J	0.002 U						
pH, Field	pH units	8		7.97		7.8	7.22	8.02	8.2	8.2	7.54	7.69
Potassium	mg/L	1.6 JB	1.6	1.7	1.7	1.6	1.7	1.7	1.6			
Radium 226	pCi/L	0.357	0.368	0.361	0.223	0.351					0.312	0.984
Radium-226/228	pCi/L	0.367 U	0.74	0.804	0.639	1.09					2.592	2.264
Radium-228	pCi/L	0.00985 U	0.373	0.443	0.417	0.738					2.28	1.28
Redox Potential, Field	mV										170.7	11.5
Selenium	mg/L	0.005 UJ	0.005 U	0.005 U	0.005 U	0.005 U					4E-05	8E-05
Silver	mg/L	0.001 UJ	0.001 U	0.001 U	0.001 U	0.001 U						
Sodium	mg/L	840 JB	790 B	780 B	760 B	840 JB	840	840	770			
Specific Conductivity, Field	uS/cm						30253					
Strontium	mg/L	0.48 JB	0.5 B	0.49 B	0.52 B	0.49						
Sulfate	mg/L	49 J	51	52	53	57	55	58	51	50	91.6	75.1
Temperature, Field	deg C						12.9				17.44	15.8
Thallium	mg/L	0.001 UJ	0.001 U	0.001 U	0.001 U	0.001 U					1E-05	9.9E-05
Turbidity, Field	NTU	2.6		4.5		4.3	58	1.74		1	4	8.4
Vanadium	mg/L	0.005 UJ				0.005 U						
Zinc	mg/L	0.02 UJ	0.02 U	0.02 U	0.02 U	0.02 U						

Notes:
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Appendix C
Analytical Data Summary
Residual Water Landfill
Gavin Power Plant

	Location ID Date	FEDERAL 94136 2016-12-01 N	FEDERAL 94136 2017-02-01 N	FEDERAL 94136 2017-03-23 N	FEDERAL 94136 2017-04-28 N	FEDERAL 94136 2017-06-09 N	FEDERAL 94136 2017-07-17 FD	FEDERAL 94136 2017-07-17 N	FEDERAL 94136 2018-03-08 FD	FEDERAL 94136 2018-03-08 N	FEDERAL 94136 2018-09-12 N	FEDERAL 94136 2019-03-07 N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L	331	323								310	310
Aluminum	mg/L			0.057	0.037 J	0.69	0.05 U	0.05 U				
Antimony	mg/L	2E-05	1E-05	0.0017 J	0.002 U	0.01 U	0.002 U	0.002 U				
Arsenic	mg/L	0.00042	0.00039	0.0012 J	0.005 U	0.025 U	0.005 U	0.005 U				
Barium	mg/L	0.102	0.0877	0.11 B	0.1	0.099 B	0.11	0.1				
Beryllium	mg/L	1E-05	5E-06	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U				
Bicarbonate Alkalinity as CaCO3	mg/L										310	
Bicarbonate Alkalinity as HCO3	mg/L											310
Boron	mg/L	0.349	0.362	0.46	0.43 B	0.54	0.42 JB	0.44 JB	0.49	0.54		0.33
Bromide	mg/L	4.07	3.25	3.7 J	3.7 J	3.8 J	4.2 J	4.2 J				
Cadmium	mg/L	6E-06	5E-06	0.001 U	0.001 U	0.005 U	0.001 U	0.001 U				
Calcium	mg/L	19.2	17.7	19 B	17	16	17	17	29	34	17	15
Carbonate Alkalinity as CaCO3	mg/L										5	5
Chloride	mg/L	887	882	910	900	940	950	960	940	950	970	900
Chromium	mg/L	0.0013	0.00124	0.0019 J	0.002 U	0.005 J	0.0032	0.001 J				
Cobalt	mg/L	0.00015	0.000122	0.0004 J	0.00079 J	0.0014 J	0.0007 J	0.00065 J				
Conductivity, Field	uS/cm	3578	3558									
Copper	mg/L			0.00085 JB	0.002 U	0.01 U	0.002 U	0.002 U				
Dissolved Oxygen, Field	mg/L	0.77	1.7							4.05		
Dissolved Solids, Total	mg/L	1840	1750	1800 J	2000 J	2000	1800 J	1900 J	1900	1900		1700
Fluoride	mg/L	1.03	0.9	1.2	1.2	1.4	1.1	1.1	1.1	1.1	1.2	1.1
Iron	mg/L			0.067 JB	0.1 U	0.6	0.1 U	0.1 U				
Lead	mg/L	0.000142	7.9E-05	0.00031 J	0.001 U	0.001 U	0.001 U	0.001 U				
Lithium	mg/L	0.035	0.029	0.026	0.028	0.025	0.03	0.029				
Magnesium	mg/L	4.46	4.13	4.5 B	3.9	4.1 J	4.3	4.3	6.5	7.4	3.9	3.8
Manganese	mg/L			0.058	0.03	0.079	0.098	0.089				
Mercury	mg/L	2E-06	5E-06	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U				
Mercury	ug/L											
Molybdenum	mg/L	0.0137	0.0133	0.02	0.015	0.017 J	0.015	0.015				
Nickel	mg/L			0.0015 J	0.004	0.01 U	0.002 U	0.002 U				
pH, Field	pH units	7.72	7.74	7.81	7.76	7.8		7.89		7.74	7.87	8
Potassium	mg/L	2.38	4.27	2.1 B	2	2.1 J	2	2	2.4	2.6	2.1	1.8
Radium 226	pCi/L	0.122	0.304	0.211	0.338	0.191	0.123	0.22				
Radium-226/228	pCi/L	1.642	0.665	0.398	0.584	0.528	0.521	0.765				
Radium-228	pCi/L	1.52	0.361	0.188 U	0.246 U	0.337 U	0.398	0.545				
Redox Potential, Field	mV	-50.1	26.4									
Selenium	mg/L	7E-05	5E-05	0.0012 J	0.005 U	0.025 U	0.005 U	0.005 U				
Silver	mg/L			0.001 U	0.001 U	0.005 U	0.001 U	0.001 U				
Sodium	mg/L	557	496	750 JB	690	750	720 JB	720 JB	790	800	760	710
Specific Conductivity, Field	uS/cm									3896		
Strontium	mg/L	0.686	0.616	0.74 B	0.69	0.65 B	0.73	0.73				
Sulfate	mg/L	63.8	52.7	78 J	83	99	60	61	150	180	75	60
Temperature, Field	deg C	15.3	14							14.7		
Thallium	mg/L	1E-05	5E-05	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U				
Turbidity, Field	NTU	9.2	21.1	6.4	195.4	8.5		5.9		1.1	2.94	
Vanadium	mg/L			0.00054 J			0.005 U	0.005 U				
Zinc	mg/L			0.02 U	0.02 U	0.1 U	0.02 U	0.02 U				

Notes:
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mg/L = Milligrams per liter
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Appendix C
Analytical Data Summary
Residual Water Landfill
Gavin Power Plant

	Location ID	FEDERAL 94136	FEDERAL 94136	FEDERAL 94137	FEDERAL 94137	FEDERAL 94137	FEDERAL 94137	FEDERAL 94137	FEDERAL 94137	FEDERAL 94137	FEDERAL 94137	FEDERAL 94137
	Date	2019-09-17	2019-09-17	2016-08-24	2016-10-06	2016-12-01	2017-02-01	2017-03-23	2017-04-28	2017-06-09	2017-07-17	2018-03-08
		FD	N	N	N	N	N	N	N	N	N	N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L	330	340			341	360					
Aluminum	mg/L							0.039 J	0.05 U	0.27	0.05 U	
Antimony	mg/L			5E-05	3E-05	3E-05	4E-05	0.00038 J	0.002 U	0.002 U	0.002 U	
Arsenic	mg/L			0.00179	0.00244	0.00211	0.00138	0.0026 J	0.0012 J	0.0036 J	0.0028 J	
Barium	mg/L			0.0524	0.0578	0.0553	0.049	0.068 B	0.056	0.065 B	0.059	
Beryllium	mg/L			2E-05	2E-05	5E-06	2E-05	0.001 U	0.001 U	0.001 U	0.001 U	
Bicarbonate Alkalinity as CaCO3	mg/L	330	330									
Bicarbonate Alkalinity as HCO3	mg/L											
Boron	mg/L			0.021	0.017	0.022	0.037	0.04 J	0.028 JB	0.039 J	0.072 JB	0.035
Bromide	mg/L					0.106	0.085	0.11 J	2.5 U	0.11 J	0.09 J	
Cadmium	mg/L			6E-05	2E-05	7E-05	5E-05	0.001 U	0.001 U	0.001 U	0.001 U	
Calcium	mg/L			147	163	154	148	160 B	160	160	160	150
Carbonate Alkalinity as CaCO3	mg/L	5.9	6									
Chloride	mg/L	870	870	27.5	27.7	27.8	27.5	29	29	29	28	28
Chromium	mg/L			0.0035	0.0055	0.0014	0.00169	0.0031	0.002 U	0.0049	0.0038	
Cobalt	mg/L			0.0922	0.495	0.0503	0.056	0.12	0.031	0.097	0.17	
Conductivity, Field	uS/cm			1252	1305	1283	1302					
Copper	mg/L							0.00065 JB	0.002 U	0.0045	0.002 U	
Dissolved Oxygen, Field	mg/L			1.08	0.73	0.83	1.29					1.61
Dissolved Solids, Total	mg/L	2000	1900	958	856	867	883	890 J	920 J	880	920 J	890
Fluoride	mg/L	1.3	1.4	0.11	0.1	0.12	0.11	0.14	0.12 J	0.13 J	0.12	0.12
Iron	mg/L							0.67 JB	0.19	1.6	0.83	
Lead	mg/L			0.0002	0.000152	0.000156	7E-05	0.00019 J	0.001 U	0.00053 J	0.001 U	
Lithium	mg/L			0.011	0.017	0.015	0.007	0.0078 J	0.0096	0.0088	0.0088	
Magnesium	mg/L					47.9	47.4	51 B	47	50	48	51
Manganese	mg/L							0.088	0.06	0.13	0.14	
Mercury	mg/L			8E-06	3E-06	5E-06	2E-06	0.0002 U	0.0002 U	0.0002 U	0.0002 U	
Mercury	ug/L											
Molybdenum	mg/L			0.00275	0.00353	0.00287	0.00633	0.0034 J	0.0027 J	0.0031 J	0.0026 J	
Nickel	mg/L							0.0028	0.0019 J	0.0039	0.003	
pH, Field	pH units		8.02	7.11	6.93	6.98	7.02	7.03	6.96	7.05	6.96	6.98
Potassium	mg/L					1.82	2.18	1.7 B	1.7	1.8	1.7	1.7
Radium 226	pCi/L			0.171	1.71	0.29	0.257	0.239	0.111	0.0957	0.0922	
Radium-226/228	pCi/L			2.681	2.373	1.268	3.127	0.261 U	0.201 U	0.331 U	0.3 U	
Radium-228	pCi/L			2.51	0.663	0.978	2.87	0.0221 U	0.0903 U	0.235 U	0.208 U	
Redox Potential, Field	mV			-32.2	-21.4	-55.4	-74.7					
Selenium	mg/L			5E-05	9E-05	5E-05	0.0001	0.00056 J	0.005 U	0.005 U	0.005 U	
Silver	mg/L							6E-05 J	0.001 U	6.8E-05 J	0.001 U	
Sodium	mg/L					70.7	65	68 JB	64 B	68	68 JB	67
Specific Conductivity, Field	uS/cm											1281
Strontium	mg/L					0.298	0.276	0.32 B	0.29	0.28 B	0.29	
Sulfate	mg/L	81	85	348	330	349	332	360 J	360	360	370	360
Temperature, Field	deg C			19.28	17	15.7	14					14.7
Thallium	mg/L			4E-05	4E-05	4E-05	0.000166	0.001 U	0.001 U	0.001 U	0.001 U	
Turbidity, Field	NTU		12	5.9	9.7	7.8	7.1	8	13.9	4.5	6.7	2.3
Vanadium	mg/L							0.00076 J			0.005 U	
Zinc	mg/L							0.02 U	0.02 U	0.02 U	0.02 U	

Notes:
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mg/L = Milligrams per liter
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NTU = Nephelometric Turbidity Unit
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Appendix C
Analytical Data Summary
Residual Water Landfill
Gavin Power Plant

Analyte	Unit	FEDERAL 94137 2018-09-12 N	FEDERAL 94137 2019-03-11 N	FEDERAL 94137 2019-09-17 N	FEDERAL 94139 2016-08-23 N	FEDERAL 94139 2016-10-05 N	FEDERAL 94139 2016-12-02 N	FEDERAL 94139 2017-02-02 N	FEDERAL 94139 2017-03-29 N	FEDERAL 94139 2017-04-28 N	FEDERAL 94139 2017-06-12 FD	FEDERAL 94139 2017-06-12 N
Alkalinity, Total as CaCO3	mg/L	330	330	340			563	555				
Aluminum	mg/L								1.1 J	0.092	3.8 B	5.1 B
Antimony	mg/L				4E-05	3E-05	6E-05	3E-05	0.0017 J	0.002 U	0.002 U	0.002 U
Arsenic	mg/L				0.00328	0.00322	0.00438	0.00317	0.0031 J	0.0033 J	0.0047 J	0.0051
Barium	mg/L				0.0893	0.0852	0.0969	0.081	0.097 B	0.092	0.11	0.12
Beryllium	mg/L				6.5E-05	2.7E-05	7.1E-05	2E-05	0.001 U	0.001 U	0.001 U	0.00038 J
Bicarbonate Alkalinity as CaCO3	mg/L	330		340								
Bicarbonate Alkalinity as HCO3	mg/L		330									
Boron	mg/L		0.037		0.498	0.507	0.458	0.456	0.52	0.54 B	0.53	0.54
Bromide	mg/L						1.75	1.57	1.9 J	1.8 J	1.8 J	1.8 J
Cadmium	mg/L				1E-05	1E-05	2E-05	6E-06	0.001 U	0.001 U	0.001 U	0.001 U
Calcium	mg/L	160	150		6.7	5.6	7.99	6.66	5.5 B	7.1	9.6	10
Carbonate Alkalinity as CaCO3	mg/L	5	5	5 U								
Chloride	mg/L	28	28	26	487	503	450	500	510	510	480	480
Chromium	mg/L				0.0008	0.0017	0.00236	0.000647	0.0017 J	0.002 U	0.0029	0.0052
Cobalt	mg/L				0.000397	0.00031	0.000507	0.000159	0.00037 J	0.001 U	0.00062 J	0.00082 J
Conductivity, Field	uS/cm				2454	2630	2608	2726				
Copper	mg/L								0.0014 JB	0.002 U	0.007 B	0.0063 B
Dissolved Oxygen, Field	mg/L				1.05	0.41	0.79	1.27				
Dissolved Solids, Total	mg/L		870	890	1420	1460	1390	1360	1500 J	1500 J	1400	1400
Fluoride	mg/L	0.11	0.25	0.11	4.22	4.08	4.05	4.11	4.6	4.7	5	5
Iron	mg/L								0.62 JB	0.048 J	1.7	2.4
Lead	mg/L				0.000963	0.00125	0.000921	0.000319	0.001 J	0.001 U	0.0025	0.004
Lithium	mg/L				0.02	0.026	0.026	0.014	0.019	0.019	0.018	0.019
Magnesium	mg/L	49	51				2.44	2	1.9 B	2.1	3.2	3.4
Manganese	mg/L								0.026	0.017	0.023	0.033
Mercury	mg/L				5E-06	5E-06	1E-05	3E-06	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ
Mercury	ug/L											
Molybdenum	mg/L				0.2	0.231	0.214	0.195	0.22	0.21	0.19 J	0.2 J
Nickel	mg/L								0.00089 J	0.002 U	0.0025	0.0027
pH, Field	pH units	7.01	7.13	7.13	8.19	8.18	8.17	8.13	8.12	8.14		8.01
Potassium	mg/L	1.9	2				2.6	1.97	1.4 B	1.4	1.5	1.6
Radium 226	pCi/L				1.34	0.464	0.936	0.454	0.387	0.547	0.559	0.61
Radium-226/228	pCi/L				16.81	1.634	1.606	1.196	0.797	0.907	1.12	0.971
Radium-228	pCi/L				15.47	1.17	0.67	0.742	0.41 U	0.36 U	0.565	0.361 U
Redox Potential, Field	mV				-51.8	-191.2	-43.3	-102.6				
Selenium	mg/L				0.0002	0.0001	0.0002	3E-05	0.00089 J	0.005 U	0.005 U	0.00091 J
Silver	mg/L								0.001 U	0.001 U	0.001 U	0.001 U
Sodium	mg/L	64	67				425	451	580 JB	570	530	550
Specific Conductivity, Field	uS/cm											
Strontium	mg/L						0.453	0.395	0.4 B	0.46	0.48 B	0.51 B
Sulfate	mg/L	370	370	350	56.1	49	52.8	51	62 J	62	70	69
Temperature, Field	deg C				20.42	17.9	14.8	14.3				
Thallium	mg/L				5E-05	5E-05	2E-05	2E-05	0.001 U	0.001 U	0.001 U	0.001 U
Turbidity, Field	NTU	4.31		3	69.7	8.8	169.8	8.7	5	5.9		90.8
Vanadium	mg/L											
Zinc	mg/L								0.02 U	0.02 U	0.02 U	0.02 U

Notes:
FD = Field duplicate sample
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deg C = Degree Celcius
mg/L = Milligrams per liter
mV = Milivolts
NTU = Nephelometric Turbidity Unit
uS/cm = Microsiemens per centimeter
pCi/L = Picocuries per liter
B: Compound was found in the blank and sample.
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Appendix C
Analytical Data Summary
Residual Water Landfill
Gavin Power Plant

Location ID / Date		FEDERAL 94139 2017-07-18 N	FEDERAL 94139 2018-03-15 N	FEDERAL 94139 2018-09-24 N	FEDERAL 94139 2019-03-11 N	FEDERAL 94139 2019-09-23 N	FEDERAL 9801 2016-08-24 N	FEDERAL 9801 2016-10-06 N	FEDERAL 9801 2016-12-02 N	FEDERAL 9801 2017-02-01 N	FEDERAL 9801 2017-03-29 N	FEDERAL 9801 2017-06-09 FD
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L		510	500	500	490			141	160		
Aluminum	mg/L	32									0.25 U	1.3 U
Antimony	mg/L	0.002 U					0.0005	0.0005	5E-05	0.0005	0.01 U	0.05 U
Arsenic	mg/L	0.008					0.00075	0.00109	0.00072	0.00056	0.025 U	0.13 U
Barium	mg/L	0.29					5.16	4.84	4.63	4.33	5 B	4.7 B
Beryllium	mg/L	0.0015					0.0002	0.0002	2E-05	0.0002	0.005 U	0.001 U
Bicarbonate Alkalinity as CaCO3	mg/L		490	490		470						
Bicarbonate Alkalinity as HCO3	mg/L				480							
Boron	mg/L	0.54 JB	0.51	0.5	0.54		0.378	0.329	0.353	0.404	0.42	0.45
Bromide	mg/L	1.8 J							34.3	36.2	41	36 J
Cadmium	mg/L	0.00034 J					0.0002	0.0002	2E-05	0.0002	0.005 U	0.025 U
Calcium	mg/L	13	7.1	6.8	6.7		202	198	184	180	180 B	170
Carbonate Alkalinity as CaCO3	mg/L		15	13	17	19						
Chloride	mg/L	520	500	560	500	480	7930	7950	7210	7330	8800	8300
Chromium	mg/L	0.014					0.0045	0.0024	0.00216	0.000768	0.0017 J	0.05 U
Cobalt	mg/L	0.0035					0.00173	0.00172	0.000975	0.000957	0.0014 J	0.025 U
Conductivity, Field	uS/cm						2129	23618	23470	22980		
Copper	mg/L	0.019									0.01 U	0.05 U
Dissolved Oxygen, Field	mg/L		1.29				3.03	0.71	2.8	1.53		
Dissolved Solids, Total	mg/L	1400 J	1400	1400	1300	1300	12600	13000	12300	11300	13000 J	14000
Fluoride	mg/L	5.1	4.4	4.6	4.4	4.7	0.87	0.61	0.6	0.91	1 J	5 U
Iron	mg/L	16									0.51 JB	2.5 U
Lead	mg/L	0.029					0.0001	0.0001	0.000354	9E-05	0.005 U	0.005 U
Lithium	mg/L	0.024					0.141	0.142	0.16	0.159	0.12	0.13
Magnesium	mg/L	7.5	2.3	2.1	2.3				54.6	55.2	63 B	58
Manganese	mg/L	0.28									0.57	0.44
Mercury	mg/L	0.0002 U					5E-06	1.6E-05	1.6E-05	1E-05	0.0002 U	0.0002 U
Mercury	ug/L											
Molybdenum	mg/L	0.19					0.00533	0.00723	0.00651	0.0068	0.0042 J	0.05 U
Nickel	mg/L	0.013									0.01 U	0.05 U
pH, Field	pH units	7.92	8.19	8.17	8.37	8.36	6.95	7.16	6.92	7.03	7.2	
Potassium	mg/L	2.4	1.4	1.4	1.4				14.4	18.6	9.6 B	8.3 J
Radium 226	pCi/L	0.886 J					3.39	6.84	3.47	4.19	4.48	4.49
Radium-226/228	pCi/L	2.21					8.15	13.99	7.83	9.95	10.5	10.3
Radium-228	pCi/L	1.32					4.76	7.15	4.36	5.76	5.98	5.8
Redox Potential, Field	mV						124.2	-91.8	85.3	-87.4		
Selenium	mg/L	0.0029 J					0.001	0.001	0.001	0.001	0.025 U	0.13 U
Silver	mg/L	0.00019 J									0.005 U	0.005 U
Sodium	mg/L	560 JB	550	590	560				4310	1650	4400 JB	4200
Specific Conductivity, Field	uS/cm		2550									
Strontium	mg/L	0.75							16.4	15.6	19 B	13 B
Sulfate	mg/L	66	65	74	66	60	3.4	7.2	6.7	3.4	8.6 J	100 U
Temperature, Field	deg C		15.7				19.72	16.5	14.2	13.5		
Thallium	mg/L	0.001 U					0.0002	0.0001	0.000528	0.0005	0.005 U	0.005 U
Turbidity, Field	NTU	69.3	22	10.8		34	4.7	9.7	3	3.9	7.7	
Vanadium	mg/L	0.0079										
Zinc	mg/L	0.081									0.1 U	0.5 U

Notes:
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Appendix C
Analytical Data Summary
Residual Water Landfill
Gavin Power Plant

	Location ID	FEDERAL 9801	FEDERAL 9801	FEDERAL 9801	FEDERAL 9801	FEDERAL 9801	FEDERAL 9801	FEDERAL 9802	FEDERAL 9802	FEDERAL 9802	FEDERAL 9802	FEDERAL 9802
	Date	2017-06-09	2017-07-17	2018-03-16	2018-09-12	2019-03-12	2019-09-24	2016-08-24	2016-10-06	2016-12-02	2017-02-01	2017-03-29
		N	N	N	N	N	N	N	N	N	N	N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L			130	130	140	130			796	645	
Aluminum	mg/L	1.3 U	0.1 U									0.071 J
Antimony	mg/L	0.05 U	0.004 U		0.002			3E-05	4E-05	2E-05	3E-05	0.00034 J
Arsenic	mg/L	0.13 U	0.01 U		0.005			0.00091	0.00072	0.0012	0.00103	0.00094 J
Barium	mg/L	5 B	5.3		4.8			0.0781	0.0711	0.0664	0.069	0.08 B
Beryllium	mg/L	0.001 U	0.002 U		0.001			5E-06	2E-05	7E-06	6E-06	0.001 U
Bicarbonate Alkalinity as CaCO3	mg/L			130	130		130					
Bicarbonate Alkalinity as HCO3	mg/L					140						
Boron	mg/L	0.45	0.52 JB	0.44	0.44	0.44		0.172	0.157	0.178	0.242	0.18
Bromide	mg/L	35 J	39 J							0.499	0.157	2.5 U
Cadmium	mg/L	0.025 U	0.002 U		0.001			2E-05	1E-05	0.0001	5E-05	0.001 U
Calcium	mg/L	190	200	220	200	180		29.3	28.7	24.5	28	29 B
Carbonate Alkalinity as CaCO3	mg/L			5	5	5	5 U					
Chloride	mg/L	8100	9000	8300	8400	150	9300	36.1	35.2	39.1	38	39
Chromium	mg/L	0.05 U	0.0025 J		0.0018			0.0013	0.0028	0.00206	0.000823	0.00081 J
Cobalt	mg/L	0.025 U	0.0011 J		0.0015			0.000954	0.00112	0.000847	0.00108	0.0011
Conductivity, Field	uS/cm							1311	1361	1354	1366	
Copper	mg/L	0.05 U	0.004 U									0.00056 JB
Dissolved Oxygen, Field	mg/L			0.22				1.81	0.73	2.01	1.68	
Dissolved Solids, Total	mg/L	14000	14000 J	13000	14000	11000	14000	766	784	796	810	820 J
Fluoride	mg/L	5 U	5	2.5	1	0.05	1.1	0.88	0.8	0.8	0.84	0.96
Iron	mg/L	2.5 U	0.43									0.18 JB
Lead	mg/L	0.005 U	0.002 U		0.001			4.4E-05	3.1E-05	4.3E-05	6E-05	0.00026 J
Lithium	mg/L	0.12	0.15		0.13			0.015	0.018	0.022	0.012	0.014
Magnesium	mg/L	63	63	61		69				6.8	7.8	8.2 B
Manganese	mg/L	0.47	0.51									0.48
Mercury	mg/L	0.0002 U	0.0002 U		0.0002			5E-06	5E-06	1.1E-05	5E-06	0.0002 U
Mercury	ug/L											
Molybdenum	mg/L	0.05 U	0.004 J		0.0039			0.0064	0.00563	0.00543	0.00525	0.0051 J
Nickel	mg/L	0.05 U	0.0035 J									0.00079 J
pH, Field	pH units	7.21	7.16	7.32	7.34	7.51	7.49	6.94	7.25	7.3	7.19	7.24
Potassium	mg/L	9.3 J	9.5	9.2		9.1				1.66	2.05	1.5 B
Radium 226	pCi/L	3.83	4.35 J		5.31			0.443	0.327	0.603	0.245	0.173
Radium-226/228	pCi/L	11.3	11 J		11.5			2.763	0.638	0.832	0.506	0.31 U
Radium-228	pCi/L	7.43	6.64 J		6.16			2.32	0.311	0.229	0.261	0.136 U
Redox Potential, Field	mV							14.6	-32.9	9	-49.4	
Selenium	mg/L	0.13 U	0.01 U		0.005			5E-05	4E-05	3E-05	5E-05	0.005 U
Silver	mg/L	0.005 U	0.002 U									0.001 U
Sodium	mg/L	4700	4600 JB	4700		4800				253	270	260 JB
Specific Conductivity, Field	uS/cm			22901								
Strontium	mg/L	13 B	20							0.58	0.601	0.62 B
Sulfate	mg/L	100 U	100 U	50	6.3	1	5.2 J	65.8	57.5	60.2	58.9	70 J
Temperature, Field	deg C			14.9				20.37	18.2	14.3	13.6	
Thallium	mg/L	0.005 U	0.002 U		0.001			5.8E-05	8.4E-05	5.8E-05	5E-05	0.001 U
Turbidity, Field	NTU	3.2	3.5	1.5	4.22		6	0.4	2.5	14.4	6.5	6.9
Vanadium	mg/L		0.01 U									
Zinc	mg/L	0.5 U	0.04 U									0.02 U

Notes:
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mg/L = Milligrams per liter
mV = Milivolts
NTU = Nephelometric Turbidity Unit
uS/cm = Microsiemens per centimeter
pCi/L = Picocuries per liter
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Appendix C
Analytical Data Summary
Residual Water Landfill
Gavin Power Plant

	Location ID	FEDERAL 9802	FEDERAL 9802	FEDERAL 9802	FEDERAL 9802	FEDERAL 9802	FEDERAL 9802	FEDERAL 9806	FEDERAL 9806	FEDERAL 9806	FEDERAL 9806	FEDERAL 9806
	Date	2017-06-09	2017-07-17	2018-03-16	2018-09-12	2019-03-12	2019-09-24	2016-12-02	2017-02-08	2017-03-27	2017-05-01	2017-06-27
		N	N	N	N	N	N	N	N	N	N	N
Analyte	Unit											
Alkalinity, Total as CaCO3	mg/L			610	570	590	590	350	346			
Aluminum	mg/L	0.22	0.05 U							2.4 J	2.8	0.057
Antimony	mg/L	0.002 U	0.002 U					0.00011	6E-05	0.0003 JB	0.00068 J	0.002 U
Arsenic	mg/L	0.00083 J	0.00089 J					0.00207	0.00113	0.0011 J	0.0015 J	0.001 J
Barium	mg/L	0.086 B	0.082					0.0676	0.05	0.057 B	0.058	0.041
Beryllium	mg/L	0.00035 J	0.001 U					0.000269	0.000122	0.001 U	0.00038 J	0.001 U
Bicarbonate Alkalinity as CaCO3	mg/L			610	570		590					
Bicarbonate Alkalinity as HCO3	mg/L					590						
Boron	mg/L	0.19	0.27 JB	0.2		0.2		0.256	25	0.31	0.32	0.35
Bromide	mg/L	2.5 U	2.5 U					0.82	0.65	0.94 J	0.77 J	0.96
Cadmium	mg/L	0.001 U	0.001 U					0.00037	0.0001	0.001 U	0.001 U	0.001 U
Calcium	mg/L	31 J	30	30	36	31		5.35	159	4 B	4.2	3.7
Carbonate Alkalinity as CaCO3	mg/L			5	5	5	5 U					
Chloride	mg/L	38	40	39	35	39	38	187	191	200	200	200
Chromium	mg/L	0.0025	0.0011 J					0.00653	0.00291	0.004 B	0.0054	0.002 U
Cobalt	mg/L	0.00048 J	0.00041 J					0.00516	0.00231	0.0016	0.0017	0.001 U
Conductivity, Field	uS/cm							1500	1574			
Copper	mg/L	0.0017 JB	0.002 U							0.0031 B	0.0066 B	0.002 U
Dissolved Oxygen, Field	mg/L			1.46				1.44	1.25			
Dissolved Solids, Total	mg/L	830	810 J	810		780	740	860	874	890 J	860 J	870
Fluoride	mg/L	0.99	0.95	1	0.94	0.91	1	1.14	1.08	1.4	1.3	1.3
Iron	mg/L	0.27	0.058 J							2 JB	2.2	0.058 J
Lead	mg/L	0.001 U	0.001 U					0.00481	0.00227	0.0018 J	0.0028	0.001 U
Lithium	mg/L	0.012	0.014					0.022	0.249	0.013	0.012	0.012
Magnesium	mg/L	9	8.6	8.1	9.3	8.8		2.21	171	1.4 B	1.5	0.92 J
Manganese	mg/L	0.1	0.28							0.034 B	0.03	0.02 B
Mercury	mg/L	0.0002 U	0.0002 U					0.000131	6E-06	0.0002 U	0.0002 U	0.0002 U
Mercury	ug/L											
Molybdenum	mg/L	0.0046 J	0.0048 J					0.011	0.0107	0.012	0.011	0.023
Nickel	mg/L	0.0018 J	0.0022							0.0037 B	0.0036	0.002 U
pH, Field	pH units	7.2	7.11	7.31	7.59	7.51	7.43	8.61	8.49	8.59	8.4	8.4
Potassium	mg/L	1.5	1.6	1.5	1.9	1.7		2.09	18.4	1.6 B	1.7	0.84 J
Radium 226	pCi/L	0.181	0.188					0.658	0.221	0.154	0.149	0.199
Radium-226/228	pCi/L	0.276 U	0.786					0.7334	0.711	0.378	0.235 U	0.353
Radium-228	pCi/L	0.0949 U	0.597					0.0754	0.49	0.224 U	0.0855 U	0.154 U
Redox Potential, Field	mV							-14.2	69.1			
Selenium	mg/L	0.005 U	0.0012 J					0.0007	0.0003	0.005 U	0.0011 J	0.005 U
Silver	mg/L	0.001 U	0.001 U							0.00084 J	0.0012	0.001 U
Sodium	mg/L	270	290 JB	290	260	290		277	213	320 JB	350 B	350
Specific Conductivity, Field	uS/cm			13.31								
Strontium	mg/L	0.55 B	0.65					0.166	1.28	0.15 B	0.16 B	0.13
Sulfate	mg/L	72	71	68	68	73	69	116	113	130 J	130	130
Temperature, Field	deg C			16.8				11	12.4			
Thallium	mg/L	0.001 U	0.001 U					7E-05	4E-05	0.001 U	0.001 U	0.001 U
Turbidity, Field	NTU	1.6	7.5	2.1	35.3		5	301.9	74.3	110.6	40.6	53.8
Vanadium	mg/L		0.005 U									
Zinc	mg/L	0.02 U	0.02 U							0.0093 J	0.02 U	0.02 U

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Appendix C
Analytical Data Summary
Residual Water Landfill
Gavin Power Plant

	Location ID	FEDERAL 9806	FEDERAL 9806	FEDERAL 9806	FEDERAL 9806
	Date	2018-03-20	2018-09-11	2019-03-14	2019-09-26
		N	N	N	N
Analyte	Unit				
Alkalinity, Total as CaCO3	mg/L	330	330	390	320
Aluminum	mg/L				
Antimony	mg/L		0.002		
Arsenic	mg/L		0.005		
Barium	mg/L		0.031		
Beryllium	mg/L		0.00061		
Bicarbonate Alkalinity as CaCO3	mg/L	300	310	390	300
Bicarbonate Alkalinity as HCO3	mg/L				
Boron	mg/L	0.29	0.27		
Bromide	mg/L			0.23	
Cadmium	mg/L		0.001		
Calcium	mg/L	3.6	9.6		
Carbonate Alkalinity as CaCO3	mg/L	22	19	5	26
Chloride	mg/L	210	94	38	190
Chromium	mg/L		0.002		
Cobalt	mg/L		0.001		
Conductivity, Field	uS/cm				
Copper	mg/L				
Dissolved Oxygen, Field	mg/L	1.78			
Dissolved Solids, Total	mg/L	880	850	1000	1900
Fluoride	mg/L	1.3	0.87	0.34	1.4
Iron	mg/L				
Lead	mg/L		0.001		
Lithium	mg/L		0.036		
Magnesium	mg/L	0.85			
Manganese	mg/L				
Mercury	mg/L		0.0002	0.0002	
Mercury	ug/L				
Molybdenum	mg/L		0.0061		
Nickel	mg/L				
pH, Field	pH units	8.64	8.5	7.74	8.73
Potassium	mg/L	0.96			
Radium 226	pCi/L		0.151	0.0571	
Radium-226/228	pCi/L		0.257	0.0148	
Radium-228	pCi/L		0.106	-0.0422	
Redox Potential, Field	mV				
Selenium	mg/L		0.0015		
Silver	mg/L				
Sodium	mg/L	320			
Specific Conductivity, Field	uS/cm	1533			
Strontium	mg/L				
Sulfate	mg/L	130	240	450	130
Temperature, Field	deg C	11.8			
Thallium	mg/L		0.001		
Turbidity, Field	NTU	13	4.33		32
Vanadium	mg/L				
Zinc	mg/L				

Notes:
FD = Field duplicate sample
N = Normal environmental sample
deg C = Degree Celcius
mg/L = Milligrams per liter
mV = Milivolts
NTU = Nephelometric Turbidity Unit
uS/cm = Microsiemens per centimeter
pCi/L = Picocuries per liter
B: Compound was found in the blank and sample.
J: Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.
U: Indicates the analyte was analyzed for but not detected.
Empty cells = Not analyzed

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