2018 Annual Groundwater Monitoring and Corrective Action Report

Hennepin Landfill – CCR Unit ID 801
Hennepin Power Station
13498 East 800th Street
Hennepin, Illinois 61327

Dynegy Midwest Generation, LLC

January 31, 2019

OBG
Part of Ramboll

JANUARY 31, 2019 | PROJECT #70100

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Hennepin Landfill – CCR Unit ID 801
Hennepin Power Station
Hennepin, Illinois

Prepared for:

Dynegy Midwest Generation, LLC

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ACRONYMS AND ABBREVIATIONS

ASD	Alternate Source Demonstration
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
mg/L	milligrams per liter
NRT/OBG	Natural Resource Technology, an OBG Company
OBG	O'Brien & Gere Engineers, part of Ramboll
SSI	Statistically Significant Increase
S.U.	Standard Units
TDS	Total Dissolved Solids

SECTION 1: INTRODUCTION

This report has been prepared on behalf of Dynegy Midwest Generation, LLC by O'Brien & Gere Engineers, part of Ramboll (OBG), to provide the information required by the Code of Federal Regulations (CFR) found in 40 CFR 257.90(e) for the Hennepin Landfill located at Hennepin Power Station near Hennepin, Illinois.

In accordance with 40 CFR § 257.90(e), the owner or operator of an existing Coal Combustion Residuals (CCR) unit must prepare an annual groundwater monitoring and corrective action report, for the preceding calendar year, that documents the status of the groundwater monitoring and corrective action program for the CCR unit, summarizes key actions completed, describes any problems encountered, discusses actions to resolve the problems, and projects key activities for the upcoming year. At a minimum, the annual report must contain the following information, to the extent available:

1. A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit.
2. Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken.
3. In addition to all the monitoring data obtained under §§ 257.90 through 257.98, a summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs.
4. A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels).
5. Other information required to be included in the annual report as specified in §§ 257.90 through 257.98[1].

This report provides the required information for the Hennepin Landfill for calendar year 2018.

[1] For calendar year 2018, corrective action and other information required to be included in the annual report as specified in §§ 257.96 through 257.98 is not applicable.

SECTION 2: MONITORING AND CORRECTIVE ACTION PROGRAM STATUS

Detection Monitoring Program sampling event dates and parameters collected are provided in the detection monitoring program summary table below. One sample was collected from each background and downgradient well in the monitoring system during the sampling events in November 2017, September 2018, and December 2018. Resampling was conducted in June 2018 on a subset of the Appendix III parameters. Analytical data was evaluated after each event in accordance with the Statistical Analysis Plan, Hennepin Power Station, Dynegy Midwest Generation, LLC (NRT/OBG, 2017a) to identify any statistically significant increases (SSIs) of Appendix III parameters over background concentrations. The dates the SSIs were evaluated are provided in the detection monitoring program summary table below.

Detection Monitoring Program Summary

Sampling Dates	Parameters Collected	SSIs	ASD Completion
November 16, 2017	Appendix III	Yes	April 10, 2018
June 14, 2018	Appendix III	No	To Be Determined
September 13, 2018	SSI parameters	Not Applicable	Not Applicable
December 12 and 13, 2018	Appendix III	To Be Determined	To Be Determined

Potential alternate sources were evaluated as outlined in the 40 CFR § 257.94(e)(2). An alternate source demonstration (ASD) was completed and certified by a qualified professional engineer. The date the ASD was completed is provided in the detection monitoring program summary table. The ASD is included in Appendix A.

Statistical background values are provided in Table 1. Analytical results from the events summarized in the detection monitoring program summary table above are included in Table 2.

The Hennepin Landfill remains in the Detection Monitoring Program in accordance with 40 CFR § 257.94.

SECTION 3: KEY ACTIONS COMPLETED IN 2018

Three groundwater monitoring events were completed in 2018 under the Detection Monitoring Program. These events occurred in June, September, and December, and are detailed in Section 2. One sample was collected from each background and downgradient well in the monitoring system during the sampling events in September 2018 and December 2018. Resampling was conducted in June 2018 on a subset of the Appendix III parameters. All samples were collected and analyzed in accordance with the Sampling and Analysis Plan (NRT/OBG, 2017b). All monitoring data obtained under 40 CFR §§ 257.90 through 257.98 (as applicable) in 2018 are presented in Table 2.

The groundwater monitoring system, including the CCR unit and all background and downgradient monitoring wells, is presented in Figure 1.

SECTION 4: PROBLEMS ENCOUNTERED AND ACTIONS TO RESOLVE THE PROBLEMS

No problems were encountered with the groundwater monitoring program during 2018. Groundwater samples were collected and analyzed in accordance with the Sampling and Analysis Plan (NRT/OBG, 2017b), and all data was accepted.

SECTION 5: KEY ACTIVITIES PLANNED FOR 2019

The following key activities are planned for 2019:

- Continuation of the Detection Monitoring Program with semi-annual sampling scheduled for the first and third quarters of 2019.
- Complete evaluation of analytical data from the downgradient wells, using background data to determine whether an SSI of Appendix III parameters over background concentrations has occurred.
- If an SSI is identified, potential alternate sources (i.e., a source other than the CCR unit caused the SSI or that SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality) will be evaluated. If an alternate source is demonstrated to be the cause of the SSI, a written demonstration will be completed within 90 days of SSI determination and included in the annual groundwater monitoring and corrective action report for 2019.
  - If an alternate source(s) is not identified to be the cause of the SSI, the applicable requirements of 40 CFR §§ 257.94 through 257.98 (e.g., assessment monitoring) as may apply in 2019 will be met, including associated recordkeeping/notifications required by 40 CFR §§ 257.105 through 257.108.

REFERENCES

Natural Resource Technology, an OBG Company, 2017a, Statistical Analysis Plan, Baldwin Energy Complex, Havana Power Station, Hennepin Power Station, Wood River Power Station, Dynegy Midwest Generation, LLC, October 17, 2017.

Natural Resource Technology, an OBG Company, 2017b, Sampling and Analysis Plan, Hennepin Landfill, Hennepin Power Station, Hennepin, Illinois, Project No. 2285, Revision 0, October 17, 2017.

Figures

DRAWN BY/DATE:
SDS 11/28/18
REVIEWED BY/DATE:
AJB 1/24/19
APPROVED BY/DATE:
SLG 1/28/19

GROUNDWATER SAMPLING WELL LOCATION MAP
HENNEPIN LANDFILL
UNIT ID: 801

2018 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
ALTERNATE SOURCE DEMONSTRATION
VISTRA CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 70100

FIGURE NO: 1

OBG Part of Ramboll

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Tables

Table 1. Statistical Background Values

2018 Annual Groundwater Monitoring and Corrective Action Report
Hennepin Power Station
Unit ID 801 - Hennepin Landfill

Parameter	Statistical Background Value
Appendix III	
Boron (mg/L)	0.1503
Calcium (mg/L)	274.172
Chloride (mg/L)	384
Fluoride (mg/L)	0.12
pH (S.U.)	6.6 / 7.5
Sulfate (mg/L)	196
TDS (mg/L)	1493

[O: KLS 8/22/18, C: RAB 8/28/18]

Notes:
mg/L = milligrams per liter
S.U. = Standard Units
TDS = Total Dissolved Solids

Table 2. Appendix III Analytical Results

2018 Annual Groundwater Monitoring and Corrective Action Report
Hennepin Power Station
Unit ID 801 - Hennepin Landfill

Sample Location	Date Sampled	B, total (mg/L)	Ca, total (mg/L)	Cl, total (mg/L)	F, total (mg/L)	pH (field) (S.U.)	SO4, total (mg/L)	TDS (mg/L)
Background / Upgradient Monitoring Wells								
07	11/16/2017	0.0702	136	48	0.12	7.2	68	658
	6/14/2018	0.0865	133	50	<0.1	6.8	67	644
	9/13/2018	0.0731	168	44	<0.1	6.8	67	684
	12/13/2018	0.0790	155	39	<0.1	7.0	60	656
08	11/16/2017	0.135	243	277	0.10	7.0	167	1370
	6/14/2018	0.168	211	290	<0.1	6.7	128	1280
	9/13/2018	0.114	235	241	<0.1	6.7	184	1200
	12/13/2018	0.151	273	288	0.11	6.8	264	1520
08D	11/16/2017	0.122	189	200	0.12	7.0	157	1200
	6/14/2018	0.133	204	315	0.12	6.8	114	1310
	9/13/2018	0.0941	252	269	<0.1	6.7	161	1330
	12/13/2018	0.116	205	251	0.11	6.8	182	1320
Downgradient Monitoring Wells								
05DR	11/16/2017	1.11	75.0	63	0.13	7.7	71	466
	6/14/2018	1.01	85.3	71	0.12	6.9	79	516
	9/13/2018	1.26	NA	NA	NA	7.5	NA	NA
	12/13/2018	1.03	82.8	81	0.14	7.5	76	534
05R	11/16/2017	0.978	71.6	63	0.13	7.8	67	474
	6/14/2018	0.927	76.0	66	0.11	7.0	68	468
	9/13/2018	1.05	NA	NA	NA	7.6	NA	NA
	12/13/2018	0.964	78.8	76	0.12	7.6	73	506
40S	11/16/2017	3.02	68.9	57	0.20	8.0	103	492
	6/14/2018	2.52	75.8	68	0.17	7.0	110	484
	9/13/2018	2.83	NA	NA	0.15	7.7	NA	NA
	12/12/2018	3.08	78.9	79	0.16	7.7	114	528
48	11/16/2017	1.04	72.3	59	0.18	7.9	66	396
	6/14/2018	1.12	86.4	70	0.16	7.0	86	522
	9/13/2018	1.06	NA	NA	0.15	7.7	NA	NA
	12/12/2018	0.869	82.6	81	0.17	7.6	72	516

[O: RAB 12/26/18, C: JQW 12/27/18][U: RAB 1/26/19]

Notes:
mg/L = milligrams per liter
S.U. = Standard Units
TDS = Total Dissolved Solids
NA = Not Analyzed
< = concentration is less than the reporting limit

Appendix A

Alternate Source Demonstration

40 CFR § 257.94(E)(2): Alternate Source Demonstration
Hennepin Landfill

Hennepin Power Station
Hennepin, Illinois

Dynegy Midwest Generation, LLC

April 10, 2018

OBG

APRIL 10, 2018 | PROJECT #67719

40 CFR § 257.94(E)(2): Alternate Source Demonstration Hennepin Landfill

Hennepin Power Station
Hennepin, Illinois

Prepared for:
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ACRONYMS AND ABBREVIATIONS

ASD	alternate source demonstration
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
IEPA	Illinois Environmental Protection Agency
mg/L	milligrams per liter
msl	mean sea level
NGVD	National Geodetic Vertical Datum
NPDES	National Pollutant Discharge Elimination System
NRT/OBG	Natural Resource Technology, an OBG Company
OBG	O'Brien & Gere Engineers, Inc.
SSI	statistically significant increase
STD	standard units

1 INTRODUCTION

1.1 OVERVIEW

This alternate source demonstration report has been prepared on behalf of Dynegy Midwest Generation, LLC by O'Brien & Gere Engineers, Inc. (OBG) to provide pertinent information pursuant to 40 CFR § 257.94(e)(2) for the Hennepin Landfill located at Hennepin Power Station near Hennepin, Illinois.

Initial background groundwater monitoring consisting of a minimum of eight samples as required under 40 CFR § 257.94(b) was initiated in October 2015 and completed prior to October 17, 2017. The first semi-annual detection monitoring sample was collected on November 16, 2017 for which analytical data was received on December 8, 2017. Evaluation of analytical data from the first detection monitoring sample for statistically significant increases (SSIs) of 40 CFR Part 257 Appendix III parameters over background concentrations was completed within 90 days of sample collection and receipt of sample results (January 10, 2018). That evaluation identified SSIs at downgradient monitoring wells as follows:

- Boron at wells 05R, 05DR, 40S and 48
- Fluoride at wells 05R, 05DR, 40S, and 48
- pH at wells 05R, 05DR, 40S, and 48

40 CFR § 257.94(e)(2) allows the owner or operator 90 days from the date of determination of an SSI to demonstrate that a source other than the CCR unit caused the SSI, or that the SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality ("alternate source demonstration"). Pursuant to 40 CFR § 257.94(e)(2), the following demonstrates that sources other than the Hennepin Landfill were the cause of the SSIs listed above. This alternate source demonstration (ASD) was completed within 90 days of determination of the SSIs (April 10, 2018) as required by 40 CFR § 257.94(e)(2).

1.2 LOCATION

The Hennepin Power Station is located in the northeast quarter of Section 26, Township 33 North, Range 2 West, Putnam County, Illinois and approximately 3 miles north-northeast of the Village of Hennepin. The Hennepin Landfill is located east of the power station and situated less than 200 feet from the south bank of the Illinois River and approximately one mile east of the Big Bend, where the river shifts course from predominantly west to predominantly south.

The Hennepin Landfill is one of four CCR units complying with requirements under 40 CFR Part 257 (CCR Rule) at the Hennepin Power Station. Three of these CCR units are located adjacent or near each other in the eastern portion of the Hennepin Power Station known as Hennepin East. The fourth is located west of the Hennepin Power Station. The three Hennepin East CCR units include the Hennepin Ash Pond No. 2 (Ash Pond No. 2) and Hennepin East Ash Pond (East Ash Pond). The CCR units at Hennepin East, shown on Figure 1, are also referred to as the East Ash Pond System.

Surrounding areas include industrial properties to the east and south of Hennepin Landfill, agricultural land to the southwest, and the Hennepin Power Station to the west (also shown on Figure 1). The industrial properties include:

- Tri-Con Materials is located immediately east of the site at 13559 Esk Street. Tri-Con Materials is an aggregate business providing various fill and washed sand, gravel, crushed rock, rock and boulder products.
- Washington Mills (formerly known as Exolon) is located south of the East Ash Pond at 13230 Esk Street. Washington Mills produces abrasive grains and specialty electro-fused minerals.
- Between the East Ash Pond and Washington Mills, north of Esk Street, is a 9-acre parcel that was once owned by Advanced Asphalt. The currently unoccupied property includes several abandoned buildings.

1.3 GROUNDWATER MONITORING

The Landfill groundwater monitoring system for compliance with the CCR Rule consists of three upgradient monitoring wells (08, 08D, 07) and four downgradient monitoring wells (05R, 05DR, 40S, and 48). A map showing the groundwater monitoring system, including the CCR unit and all background and downgradient monitoring wells, is presented in Figure 2.

Groundwater samples are collected and analyzed in accordance with the Sampling and Analysis Plan (NRT/OBG, 2017a) prepared for the Landfill. All monitoring data obtained under 40 CFR §§ 257.90 through 257.98 (as applicable) are presented in Tables 1 and 2. Statistical evaluation of analytical data was performed in accordance with the Statistical Analysis Plan (NRT/OBG, 2017b).

Groundwater monitoring at the East Ash Pond System was initiated in 1994 around Ash Pond No. 2 and has been expanded in response to state and federal groundwater monitoring requirements. This ASD also presents data collected from wells 12 and 13, which are located upgradient of the Landfill but downgradient of the East Ash Pond (intermediate wells), and from wells 16 and 17 which are located upgradient of Hennepin East.

1.4 SITE HISTORY

The Hennepin Power Station had two coal-fired units constructed in 1953 and 1959 with a capacity of 210 MW. The coal source changed several times since the station was constructed. Historical information related to the Hennepin East CCR units shown on Figure 1 includes:

Ash Pond No. 2: Ash Pond No. 2 was used to store and dispose fly ash, bottom ash, and other non-CCR waste streams, including coal pile runoff. The pond originally encompassed the area that currently includes the existing Ash Pond No. 2, the Landfill, and the Leachate Pond (not a CCR unit). It has been inactive since 1996 and currently encompasses approximately 18 acres. It is unlined with a variable but lowermost bottom elevation of 451 feet above mean sea level (msl). The approximate dates of construction affecting Ash Pond No. 2 are summarized below (Table 3).

Date	Event
1958	Construction of Ash Pond No. 2
1978	Embankment raise of Ash Pond No. 2
1985	Embankment raise of Ash Pond No. 2 to elevation 484 feet above msl
1989	Embankment raise of Ash Pond No. 2 to elevation 494 feet above msl
1996	Pond was removed from service and completely dewatered
2009 to 2010	Eastern portion of Ash Pond No. 2 was removed to facilitate construction of the Leachate Pond.
2010 / 2011	Landfill Phase I cell was constructed in 2010 over placed CCR in Ash Pond No. 2 adjacent to the Leachate Pond. In February 2011, 7,500 cubic yards of bottom ash was placed into the Phase I cell as a post-construction freeze-protection measure to protect the leachate collection system and geomembrane liner. No other material (fly ash or bottom ash) has been placed in the landfill since then.
2014	North Embankment tree removal, grading, and vegetation re-establishment adjacent to Ash Pond No. 2.

Table 3. Construction Events Affecting Ash Pond No. 2

A Modified Closure Work Plan was submitted in 2010 which indicated the Ash Pond No. 2 would be closed by capping as future landfill phases were constructed. This Work Plan was approved by the Illinois Environmental Protection Agency (IEPA) in a letter dated March 3, 2010. The Landfill is Phase I of this 2010 closure plan. The former proposed Landfill Phases II, III and IV will no longer be constructed above Ash Pond No. 2. Therefore, a revised closure plan for Ash Pond No. 2 was submitted for IEPA approval in February 2018 (CEC, 2018).

Landfill: The Landfill Phase I cell, covering approximately 4.5 acres, was constructed in 2010 over existing, dewatered CCR in the underlying portion of Ash Pond No. 2 as part of the 2010 closure plan for Ash Pond No. 2.

The Phase I cell was constructed with a 60-mil HDPE liner overlying two feet of compacted clay with a leachate collection system that transfers collected precipitation and leachate to the Leachate Pond. Ash fill underlying the Landfill is known to be as deep as elevation 454 feet above msl.

In February 2011, 7,500 cubic yards of bottom ash was placed into the Landfill as a post-construction freeze-protection measure to protect the leachate collection system and geomembrane liner. No other material has been placed in the Landfill since then. The Landfill has not yet been placed into service.

East Ash Pond: Used to store and dispose bottom ash, fly ash, and other non-CCR waste and to clarify process water prior to discharge in accordance with the station's NPDES permit. The 510-acre-foot pond was constructed in two phases. The first phase occurred in 1995 when the pond bottom and sidewalls were constructed to a total depth of 32 feet with a variable but lowermost bottom elevation of 458 feet. The bottom and sidewall liners were constructed with 48 inches of compacted clay with a hydraulic conductivity of 1×10^{-7} centimeters per second (cm/sec). The sidewall liners constructed during the first phase extended 20 feet above the bottom liner, and the water level within the pond was limited to 15 feet above the bottom liner. The second phase of construction occurred in 2003 when the sidewall liners were raised an additional 12 feet and the total water depth was raised to approximately 30 feet above the bottom liner. The raised sidewalls were lined with 12 inches of compacted clay having a hydraulic conductivity of 1×10^{-6} cm/s, a 45-mil polypropylene geomembrane, and a polypropylene geotextile fabric. This pond remains in service for the treatment of bottom ash transport water, miscellaneous low volume wastewater streams, and unsold fly ash.

Figure 1 also shows two additional unlabeled ponds that are not subject to CCR Rule requirements including the Polishing Pond (east of the East Ash Pond) and the Leachate Pond (east of the Landfill). The Polishing Pond was constructed in 1995 with a 48-inch thick compacted clay liner having a vertical hydraulic conductivity of 1×10^{-7} cm/sec. The Leachate Pond is a 25.5-acre-foot pond constructed with a composite liner consisting of 60-mil HDPE overlying two feet of compacted clay with a vertical hydraulic conductivity of 1×10^{-7} cm/sec. Construction was completed December 2010.

1.5 OVERVIEW OF SITE HYDROGEOLOGY AND STRATIGRAPHY

A detailed hydrogeological assessment of the Hennepin East area was completed and submitted as part of the February 2018 closure plan for Ash Pond No. 2 (previously referenced). Information pertinent to this ASD is included in this report, however, more complete information on site hydrogeology and stratigraphy is available in the 2018 closure plan.

There are three geomorphic features dominant in the immediate vicinity of the Hennepin Power Station: an upper river terrace at an elevation of about 500 to 550 feet above msl, a lower river terrace at an elevation of about 450 to 460 feet above msl, and the current river valley filled with alluvium to an elevation of about 445 feet above msl. The power plant, Ash Pond No. 2, and the Landfill were constructed on the original narrow lower terrace between the Illinois River and the uplands. The original lower terrace is approximately 10 to 20 feet above normal river level (elevation 441 feet above msl at the Hennepin Power Station). The East Ash Pond and Polishing Pond were constructed on the upper terrace at an elevation of approximately 500 to 505 feet above msl, or 60 to 65 feet above normal river level. The lower road on the north side of the Site lies at an elevation of 480 to 485 feet above msl. The upper road along the top of the north berm for Ash Pond No. 2 is at an elevation of approximately 494 to 500 feet above msl. The berm slopes steeply toward the river and its base is close to the river bank.

The hydrogeological assessment identified that the stratigraphy within and immediately surrounding the Site consists of fill, unlithified river alluvium, and Pleistocene-age glacial outwash deposits overlying Pennsylvanian-age shale bedrock. Surficial soils encountered at most boring locations at the site are coal ash fill and manmade berms constructed of a variety of locally available materials, primarily sand, gravel, and coal ash. Where undisturbed or partially excavated, the surficial soil at the Site is poorly drained, moderately permeable silty clay loam formed in alluvium on floodplains.

There are two hydrogeologic units present at the site: alluvium and Henry Formation sands and gravels. The river is immediately adjacent to the lower terrace, east of the site, and there is minimal alluvium between the Site and the river. The highly permeable Henry Formation sands and gravels make up the upper and lower terraces, and fill the valley beneath the alluvium. The sand and gravels of the two terraces are indistinguishable, consisting of a heterogeneous mixture of silty-sandy gravel, with cobble zones and with boulders up to several feet in diameter. The Henry formation is more than 100 feet thick in the river valley and at least 130 feet thick on the upper terrace.

The Henry Formation and alluvium comprise the uppermost aquifer at the Site and extend from the water table to the bedrock. This uppermost aquifer extends about 7,000 feet upgradient from the site to the south where clay-rich glacial till is encountered. Glacial tills such as this typically yield little water.

The Pennsylvanian-age bedrock consists of interbedded layers of shale with thin limestone, sandstone, and coal beds. The shale bedrock unit has low hydraulic conductivity and defines the lower boundary of the uppermost aquifer.

2 LINES OF EVIDENCE

2.1 SUMMARY

Statistical analysis of the first detection monitoring sample for statistically significant increases (SSIs) of 40 CFR Part 257 Appendix III parameters over background concentrations identified the following SSIs at downgradient monitoring wells:

- Boron at wells 05R, 05DR, 40S and 48
- Fluoride at wells 05R, 05DR, 40S, and 48
- pH at wells 05R, 05DR, 40S, and 48

As allowed by 40 CFR 257.94(e)(2), this ASD demonstrates that sources other than Hennepin Landfill (the CCR unit) caused the SSI based on the following lines of evidence:

- Landfill Design and Inventory: The Hennepin Landfill was constructed in 2010 with a 60-mil HDPE liner overlying two feet of compacted clay. The only material ever placed in the lined landfill was bottom ash that was placed as a post-construction freeze-protection measure to protect the leachate collection system and geomembrane liner. The available laboratory leachate data for the bottom ash placed in the landfill does not indicate that the bottom ash is capable of leaching boron in concentrations observed in the downgradient monitoring wells.
- Ash Fill Underlying the Landfill and in Ash Pond No. 2: The Landfill was constructed on top of a portion of the Hennepin Ash Pond No. 2 as Phase I of an IEPA-approved closure plan for the pond. Boring logs indicate that ash fill underlying the Hennepin Landfill extends at least as deep as 454 feet above msl and that the deepest ash deposits may become partially saturated during periods of high groundwater elevations that correspond to river flood events. Groundwater monitoring data indicates that increased leachate constituent concentrations from these intermittent episodes of ash saturation may be present in downgradient monitoring wells after normal groundwater flow resumes. Similarly, boring logs indicate that that the ash fill in the unlined Ash Pond No. 2 extends as deep as 451 above msl. These deeper ash deposits may also become partially saturated during periods of high groundwater elevation that correspond to river flood events.
- Surrounding Industrial Activity: Industrial activities upgradient of the Landfill include Tri-Con Materials (Tri-Con) and Washington Mills. Tri-Con is an aggregate business providing construction materials including sand, gravel, and crushed stone. The Washington Mills facility manufactures abrasive grains and specialty electro-fused minerals. Both facilities are upgradient to the Landfill and may be impacting groundwater quality monitored at the Landfill. Material storage piles and the production processes at these facilities may be contributing to downgradient concentrations of fluoride, pH and other constituents.
- East Ash Pond: The East Ash Pond is directly upgradient from the Landfill. SSIs were reported in downgradient wells of the East Ash Pond for the same Appendix III parameters – boron, fluoride and pH – as in wells downgradient from the Landfill. Elevated Appendix III parameters observed in the Landfill downgradient wells are significantly impacted by upgradient CCR leachate from the East Ash Pond, which percolates to groundwater and is transported laterally in the direction of groundwater flow towards the Illinois River and beneath the Landfill.
- Representation of Background Groundwater Quality: The groundwater contour maps in Appendix B show that there are two components of groundwater flow towards the Landfill. One comes primarily from the south and is represented by background wells 07, 08, and 08D, which are monitored under the CCR Rule. A second component comes from the east and southeast which may be influenced by the large pond located on the Tri-Con facility. Background groundwater quality for this second component of groundwater flow is not monitored under the CCR Rule, and therefore background groundwater quality may not be fully represented by data collected under the CCR Rule. This second component of background groundwater flow may be an alternate source.

Data and information supporting these ASD lines of evidence are discussed in more detail below.

2.2 SUPPORTING INFORMATION

2.2.1 Landfill Design and Inventory

This ASD line of evidence is supported by the fact that the Landfill was constructed relatively recently and incorporates a 60-mil high density polyethylene (HDPE) liner overlying two feet of compacted clay. Precipitation and/or leachate that collects on top of the liner is removed by a leachate collection system and transferred to the Leachate Pond for management. The Leachate Pond is also lined with a 60-mil HDPE liner overlying two feet of compacted clay. The only material that has been placed in the Landfill consists of a layer of coarse bottom ash (7,500 cubic yards or 113,375 tons) to protect the leachate collection system and geomembrane liner from freezing. There has been no activity within the lined area since the bottom ash freeze protection layer was installed and there is no evidence that leakage from the lined landfill has occurred.

Analytical data from two samples of bottom ash leachate derived in the laboratory (extraction method ASTM D3987, shake extraction with water) identified the following constituents in in concentrations greater than the laboratory reporting limit (Appendix A):

- Barium: 0.116 mg/L (2009 sample), 0.0699 mg/L (2008 sample)
- Boron: 0.193 mg/L (2009 sample), 0.197 mg/L (2008 sample)
- Iron: 0.0687 mg/L (2009 sample), 0.110 mg/L (2008 sample)

The boron concentrations of 0.19-0.20 mg/L in the laboratory leachate samples are close to background concentrations at wells 08 and 08D, which are 0.08-0.14 mg/L and are well below the boron concentrations of downgradient wells as shown in Figure 3. Although, the boron concentrations in the leachate derived in the laboratory may not be representative of boron concentrations in leachate from the bottom ash contained in the Hennepin Landfill, they do not appear consistent with the higher concentrations observed in downgradient wells.

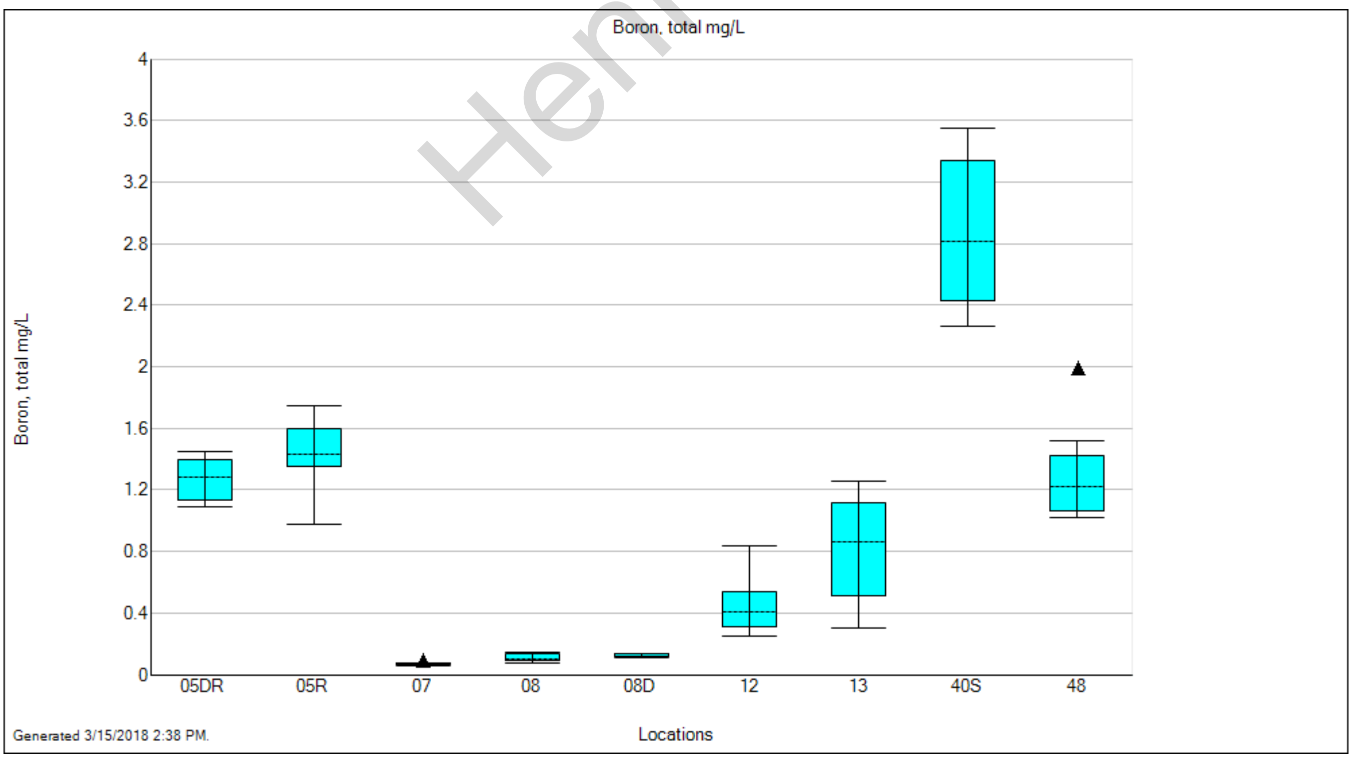

Figure 3. Box-whisker plot showing distribution of boron concentrations for data collected under the CCR Rule monitoring program for monitoring wells upgradient (07, 08, 08D), between the East Ash Pond and Landfill (12, 13) and downgradient (05R, 05DR, 40S, 48) of the Hennepin Landfill.

Bottom ash leachate data was not available for fluoride or pH.

2.2.2 Ash Fill Underlying the Landfill and in Ash Pond No. 2

The hydrogeological assessment submitted with the 2018 revised closure plan for Ash Pond No. 2(CEC, 2018) documents that that river stage during high precipitation and/or flood events may rise above adjacent groundwater elevations causing groundwater gradients to temporarily reverse as the river recharges the aquifer. These flood events are intermittent, but typically occur between March and June. However, they may also occur irregularly during autumn or winter months. The hydrogeological report also documents that during these groundwater flow reversals, groundwater levels may rise high enough to partially saturate low lying sections of ash fill for short periods of time.

Comparison of groundwater and river elevation data confirms that natural variation in river elevation related to flood events occasionally causes groundwater flow reversal and rapid increase in groundwater elevations measured at the Hennepin East groundwater monitoring wells. When river elevations rise above 451-454 feet above msl, low-lying ash deposits underlying the Landfill can become partially saturated generating leachate that can impact the downgradient monitoring wells when groundwater flow direction returns to normal. Since boron is the primary indicator of coal ash leachate, elevated boron concentrations indicate the presence of increased concentrations of coal ash leachate in groundwater. Inundating river water may also affect concentrations of other groundwater constituents and change geochemical conditions, such as pH and redox potential, affecting the solubility of metals.

Since groundwater sampling occurs quarterly, the effects of groundwater recharge and potential localized ash saturation may not always be evidenced. However, the April 26-27, 2017 sampling event appears to have captured this phenomenon as evidenced by a spike in dissolved boron concentrations at downgradient well 40S, and to a lesser extent well 05R, as shown in Figure 4 below. Wells 40S, 05R, and 05DR are located downgradient of the ash fill area under Hennepin Landfill, with a base depth of approximately 453.5 feet above msl. Intermediate non-CCR Rule monitoring wells 12 and 13 and background wells 07, 08, and 08D are shown for comparison. Figure 5 also shows elevated total boron concentration at well 40S in second quarter 2017.

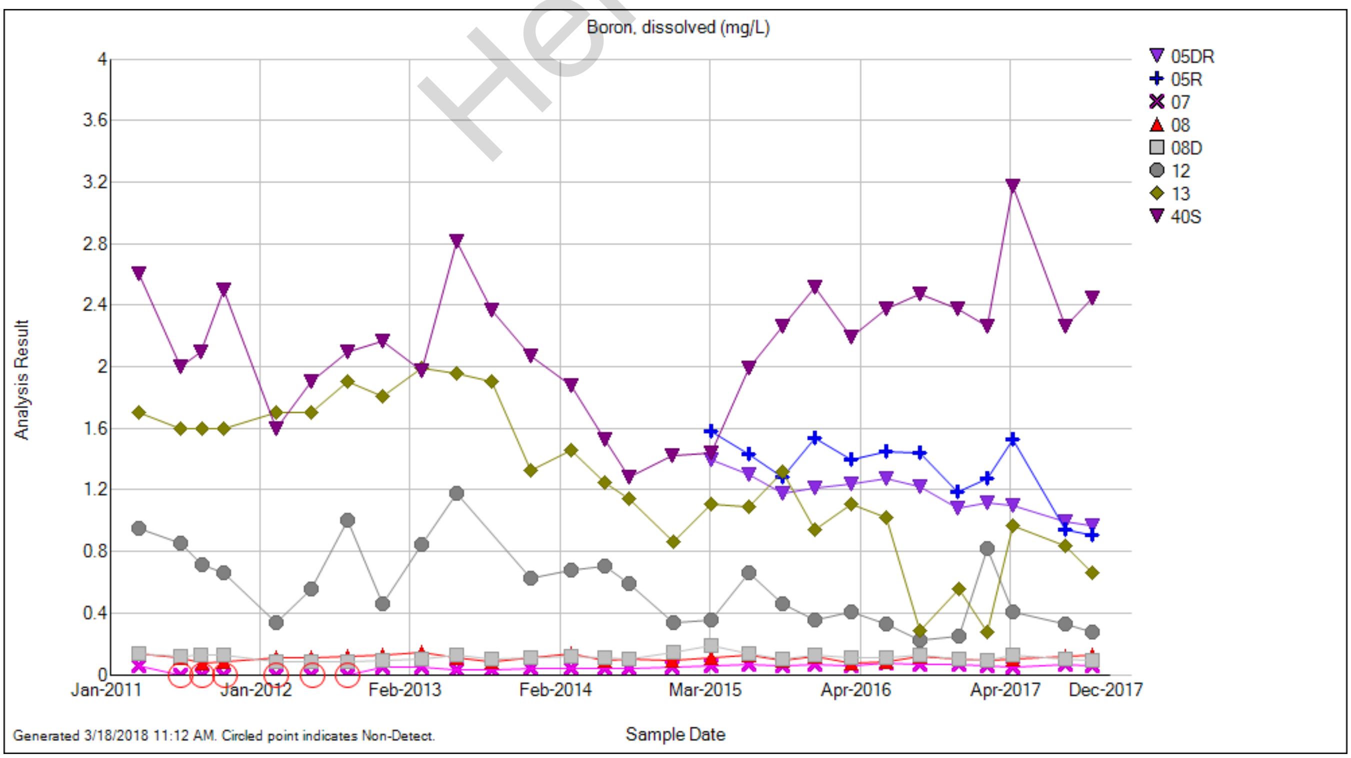

Figure 4. Trends in dissolved boron, 2011-2017. Dissolved boron is shown rather than total boron due to the availability of long-term trend data.

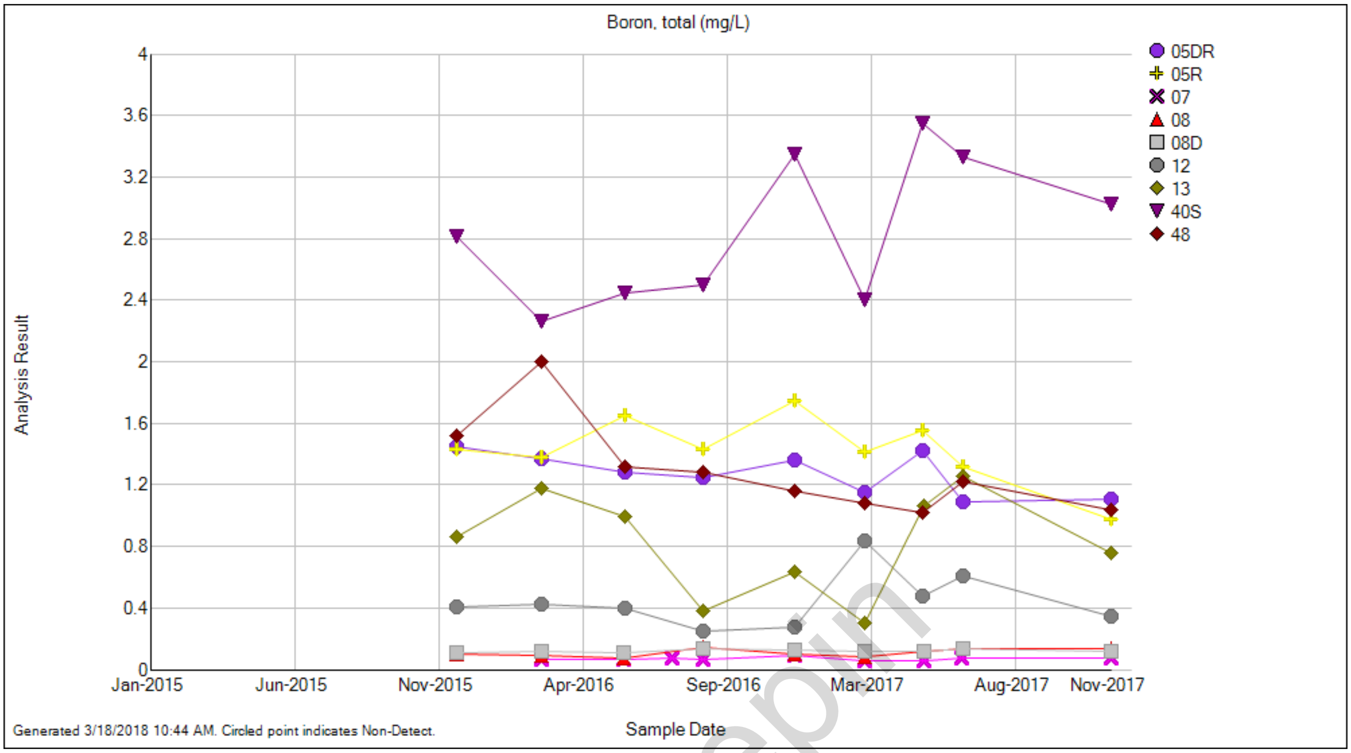

Figure 5. Trends in total boron concentration.

The pH trends shown in Figure 6 show a dip in pH corresponding to the second quarter 2017 sampling event, which could be related to geochemical changes corresponding to the preceding river flood event.

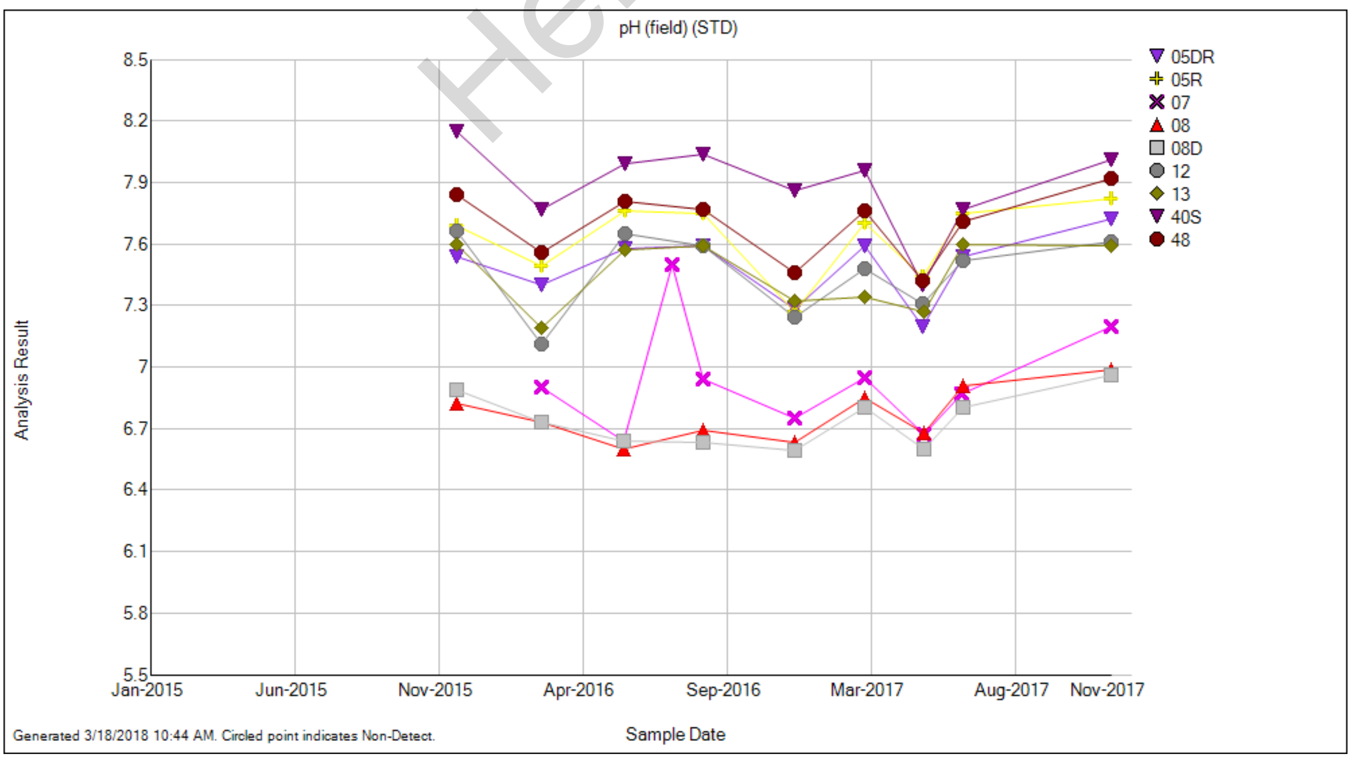

Figure 6. Trends in pH.

This demonstrates that low-lying ash deposits located underneath the Landfill that can occasionally become wetted due to natural variation in river elevation represent an alternate source for the boron SSIs identified at the groundwater monitoring wells located downgradient of the Landfill.

2.2.3 Surrounding Industrial Activity

As stated in Section 1.0, surrounding areas include industrial properties to the east and south of the Landfill, agricultural land to the southwest, and the Hennepin Power Station to the west (Figure 1). The industrial properties to the east and south that are upgradient of the Landfill include:

- Tri-Con Materials (Tri-Con), located immediately east of the site at 13559 Esk Street. Tri-Con is an aggregate business providing various fill and washed sand, gravel, crushed rock, rock and boulder products.
- Washington Mills (formerly known as Exolon), located south of the East Ash Pond at 13230 Esk Street. Washington Mills produces abrasive grains and specialty electro-fused minerals.
- The former Advanced Asphalt facility, located between the East Ash Pond and Washington Mills, north of Esk Street. The currently unoccupied 9-acre property includes several abandoned buildings.

Tri-Con and Washington Mills may potentially be impacting groundwater quality monitored at the Landfill. The photo below (Figure 7), dated 9/2/2015, shows the sand and gravel mining and processing activities of Tri-Con to the east and southeast (beige colored area), and the aggregate material storage and processing areas of Washington Mills to the south of the Landfill (black area that includes blue covered storage piles).

Figure 7. Photo of Hennepin East and surrounding industrial areas dated 9/2/2015.

Tri-Con's Hennepin facility is the largest active gravel pit located on the Illinois River according to their website. Tri-Con's products include various grades of natural and washed sand and gravel, as well as specialty materials including black dirt, fill dirt, boulders and rocks. The photo shows a large pond, presumably containing site runoff, wash waters, and water from mine pit dewatering located to the southeast of the Polishing Pond, Leachate Pond, and Landfill. The groundwater contour maps in Appendix B show a major component of groundwater flow from the east or southeast. Therefore, it is likely that the Tri-Con pond shown in the photo to the southeast of the Polishing Pond, Leachate Pond and Landfill is a high infiltration (recharge) zone. The upgradient wells monitored under the CCR Rule for the Landfill are located to the west of Tri-Con Materials and are not positioned to monitor groundwater flowing towards the Landfill from the east or southeast. Other Hennepin East wells located to monitor water quality downgradient of Tri-Con and upgradient of the Landfill include wells 12, 13, 46, 15, 16, and 17. Well 04R is not typically upgradient of the Landfill as it is too far east and close to the river, but it is downgradient of the Tri-Con facility. Wells 12, 13, and 46 are located between the East Ash Pond and the Landfill and will be referred to as "intermediate" wells. A box-whisker plot of dissolved fluoride concentrations collected between 2015-2017 at these and other monitoring wells at Hennepin East is shown below (Figure 8), Well 46 is not included on Figure 8 due to the lack of dissolved fluoride data at this location.

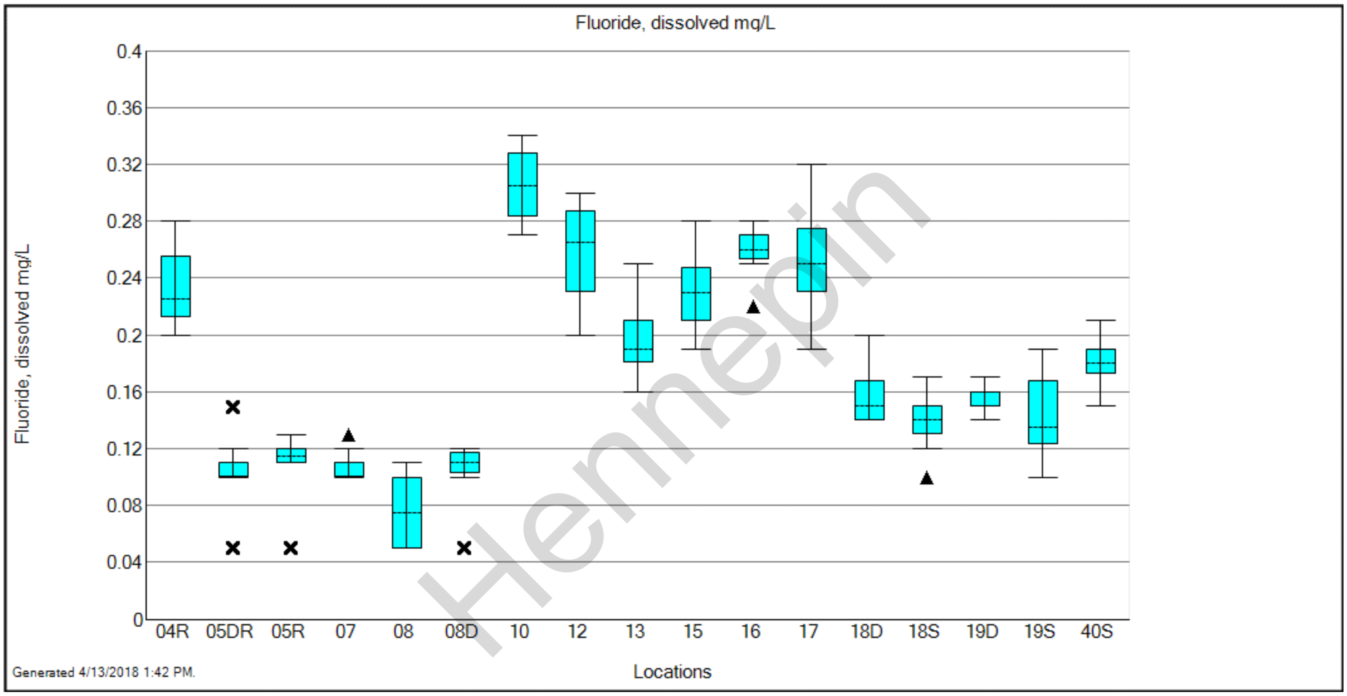

Figure 8. Distribution of dissolved fluoride concentrations at Hennepin East wells.

Also included on this figure are other "intermediate" wells located between the various Hennepin East ponds (wells 10, 15) and other wells located along the river (18D, 18S, 19D, 19S). Dissolved fluoride is plotted rather than total fluoride due to the greater availability of data. The box-whisker plot shows three groupings of dissolved fluoride concentrations as follows:

- Lowest Concentrations: The lowest concentrations are at CCR Rule upgradient wells 07, 08, and 08D and CCR Rule downgradient wells 05DR and 05R.
- Moderate Concentrations: The groundwater monitoring wells with moderate fluoride concentration include wells located along the river and in the vicinity of the Landfill: wells 18D, 18S, 19D, 19S, and CCR Rule downgradient well 40S.
- High Concentrations: The highest concentrations of fluoride occur at "intermediate wells" 10, 12, 13, 15, 16, 17 and well 04R located along the river downgradient of Tri-Con.

Given that the highest concentrations of fluoride are upgradient of the Landfill and downgradient of Tri-Con, it is likely that natural sources of fluoride exposed due to the mining and processing operations at the Tri-Con facility are contributing to and an alternate source of fluoride concentrations observed in the downgradient wells monitored under the CCR Rule. Fluoride may be present in groundwater from weathering of fluoride-containing minerals and it is likely that the sand and gravel mined at Tri-Con may contain trace amounts of fluorite that may release fluoride to groundwater after exposure to oxygen and water from mining and mineral processing.

The existing Washington Mills facility, located upgradient of the East Ash Pond and Landfill, manufactures abrasive grains and specialty electro-fused minerals. Their primary product is silicon carbide which uses coke as a raw material and produces sulfur gas as a byproduct. Washington Mills also manufactures products including potassium fluoroborate, boron carbide, iron pyrite, and sulfur cake, although it could not be determined from internet sources if these products are manufactured or processed at their Hennepin facility. Production or grinding of these products could potentially release boron, fluoride, iron, and sulfur to the environment. The photo above shows extensive piles of a dark material that may include coke and/or silicon carbide (black area of the photo). These storage piles are not protected from the elements and may represent a source for infiltration of contaminants to groundwater or transfer of minerals to nearby locations due to windblown dust particles. Therefore, the Washington Mills facility could potentially be a source of boron, fluoride, and sulfate observed in monitoring wells downgradient of their facility. Background wells 08 and 08D are downgradient of Washington Mills and have the highest concentrations of calcium, chloride and sulfate, and the lowest pH (including background well 07) at the site indicating a source other than the Hennepin Landfill for these constituents.

It is unknown if the former Advanced Asphalt plant that is upgradient of the East Ash Pond, Landfill, and Polishing Pond is a source of contaminants due to former industrial activities.

2.2.4 East Ash Pond

The East Ash Pond lies directly upgradient from the Landfill. Groundwater impacted by CCR leachate beneath the East Ash Pond moves downgradient beneath the Landfill, where it mixes with groundwater impacted by leachate from former Ash Pond No. 2 CCRs, located beneath the Landfill. It has been established that groundwater from beneath the East Ash Pond flows laterally beneath the Landfill and former Ash Pond No. 2, and northward towards the Illinois River. The Appendix III parameters with SSIs (boron, fluoride and pH) in CCR Rule monitoring wells immediately downgradient of the East Ash Pond – wells 12, 13, 46 and 47 – are the same parameters that have SSIs in the wells downgradient from the Landfill – wells 05R, 05DR, 40S and 48.

Total boron concentrations with SSIs at wells downgradient from the East Ash Pond versus Landfill are shown on Figure 9. The Upper Prediction Limit (UPL) for boron of 0.1503 milligrams per Liter (mg/L) was exceeded at all wells. Although wells downgradient from the East Ash Pond typically have lower boron concentrations than those downgradient from the Landfill, the boron impacts from the East Ash Pond are a contributing factor to, and alternate source of, the elevated boron concentrations observed in the Landfill monitoring wells.

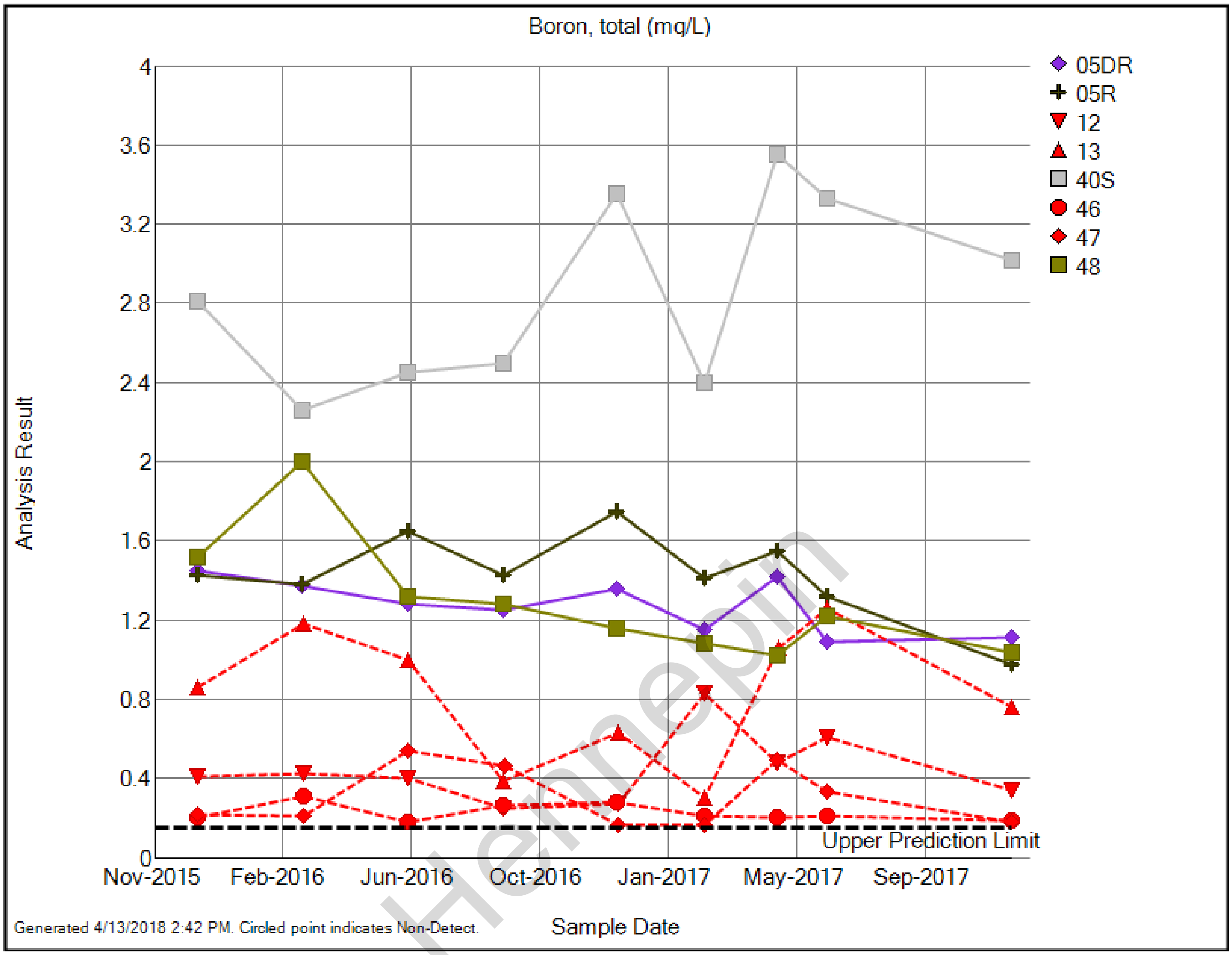

Figure 9. Boron concentration time-series in wells downgradient from the East Ash Pond and Landfill.

Total fluoride concentrations with SSIs at wells downgradient from the East Ash Pond versus Landfill are shown on Figure 10. The Upper Prediction Limit (UPL) for fluoride of 0.12 mg/L was exceeded at all wells. Unlike boron, the highest observed fluoride concentrations are in the East Ash Pond downgradient wells and the lower concentrations in the Landfill downgradient wells, which supports the ASD for fluoride from an off-site anthropogenic source, as discussed in Section 2.2.3. Fluoride concentrations decrease along the groundwater flow path from the East Ash Pond to the wells downgradient of the Landfill. As seen on Figure 10, wells upgradient from the Landfill (downgradient from East Ash Pond) have fluoride concentrations ranging from 0.18 to 0.40 mg/L, whereas wells downgradient from the Landfill have concentrations ranging from 0.05 to 0.20 mg/L, or approximately two times lower than upgradient wells. Fluoride concentrations decrease beneath the Landfill, which establishes that groundwater beneath the Landfill is not being impacted with fluoride from either the Landfill or the ash beneath the landfill, and is from another source located upgradient – either the East Ash Pond and/or an off-site anthropogenic source.

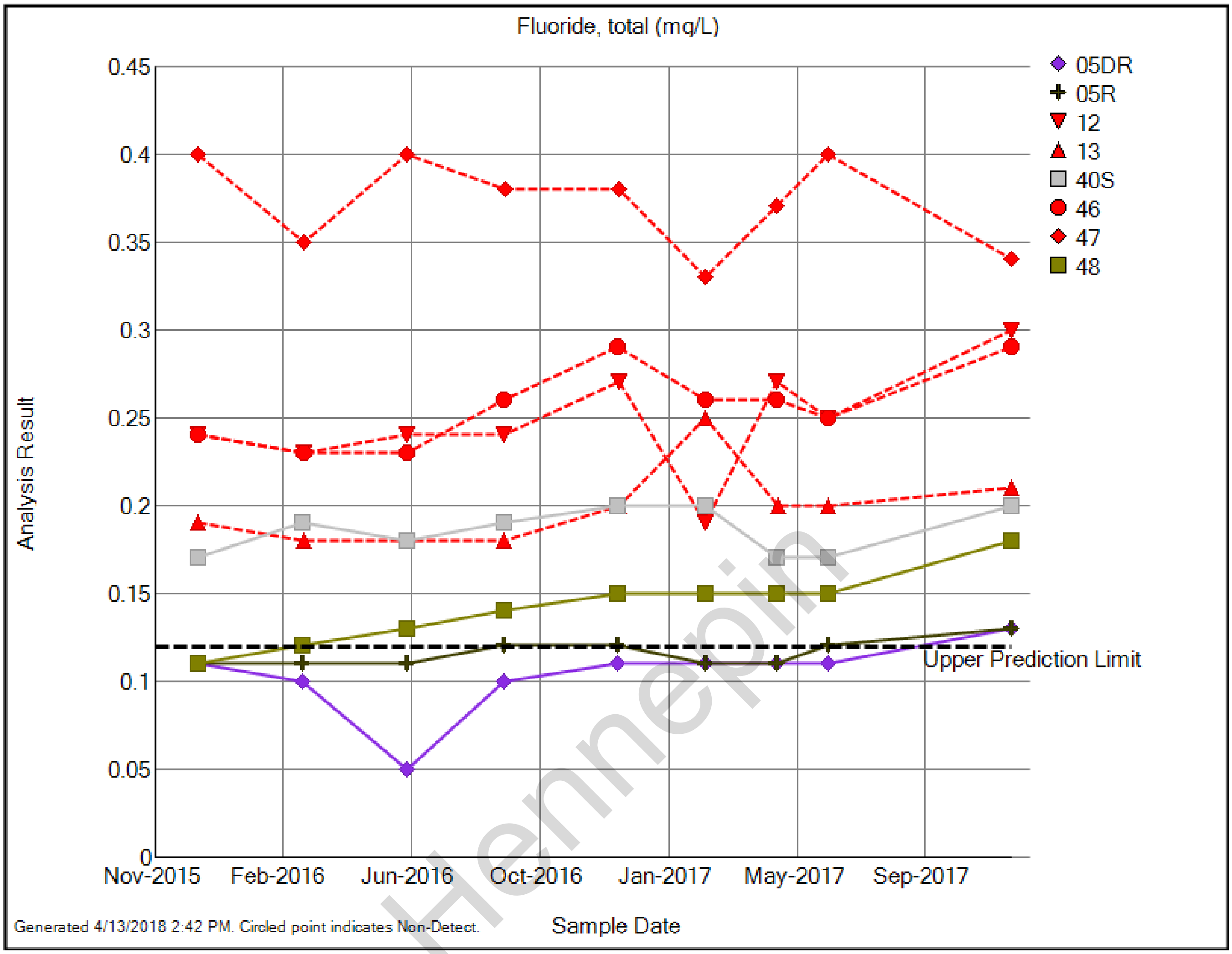

Figure 10. Fluoride concentration time-series in wells downgradient from the East Ash Pond and Landfill.

Groundwater monitoring locations with SSIs for pH at wells downgradient from the East Ash Pond versus Landfill are shown on Figure 11. The Upper Prediction Limit (UPL) for pH of 7.50 STD was exceeded at all four Landfill wells and three East Ash Pond wells. pH is slightly higher downgradient of the Landfill than upgradient (i.e. downgradient East Ash Pond wells), indicating that pH increases slightly as groundwater moves beneath the Landfill and underlying ash. For the period of November 2015 to November 2017 (Figure 11), the observed pH at wells downgradient from the East Ash Pond ranges from 7.1 to 7.7 STD. Wells downgradient from the Landfill range from 7.2 to 8.2 STD (rounded off to nearest tenth). The minimum measured pH of groundwater in wells downgradient from the Landfill is only 0.1 STD greater than the minimum pH downgradient from the East Ash Pond. Similarly, the maximum measured pH of groundwater downgradient from the Landfill is 0.5 STD greater than the maximum pH measured downgradient from the East Ash Pond. The pH of groundwater is already sufficiently elevated downgradient of the East Ash Pond to trigger SSIs, and only increases slightly as it moves further downgradient to the Landfill wells, which also have SSIs.

Based on boron, fluoride, and pH all having SSIs in the East Ash Pond downgradient wells, which are also upgradient of the Landfill, the East Ash Pond is an alternate source for those three parameters as detected at SSI concentrations in the downgradient Landfill wells.

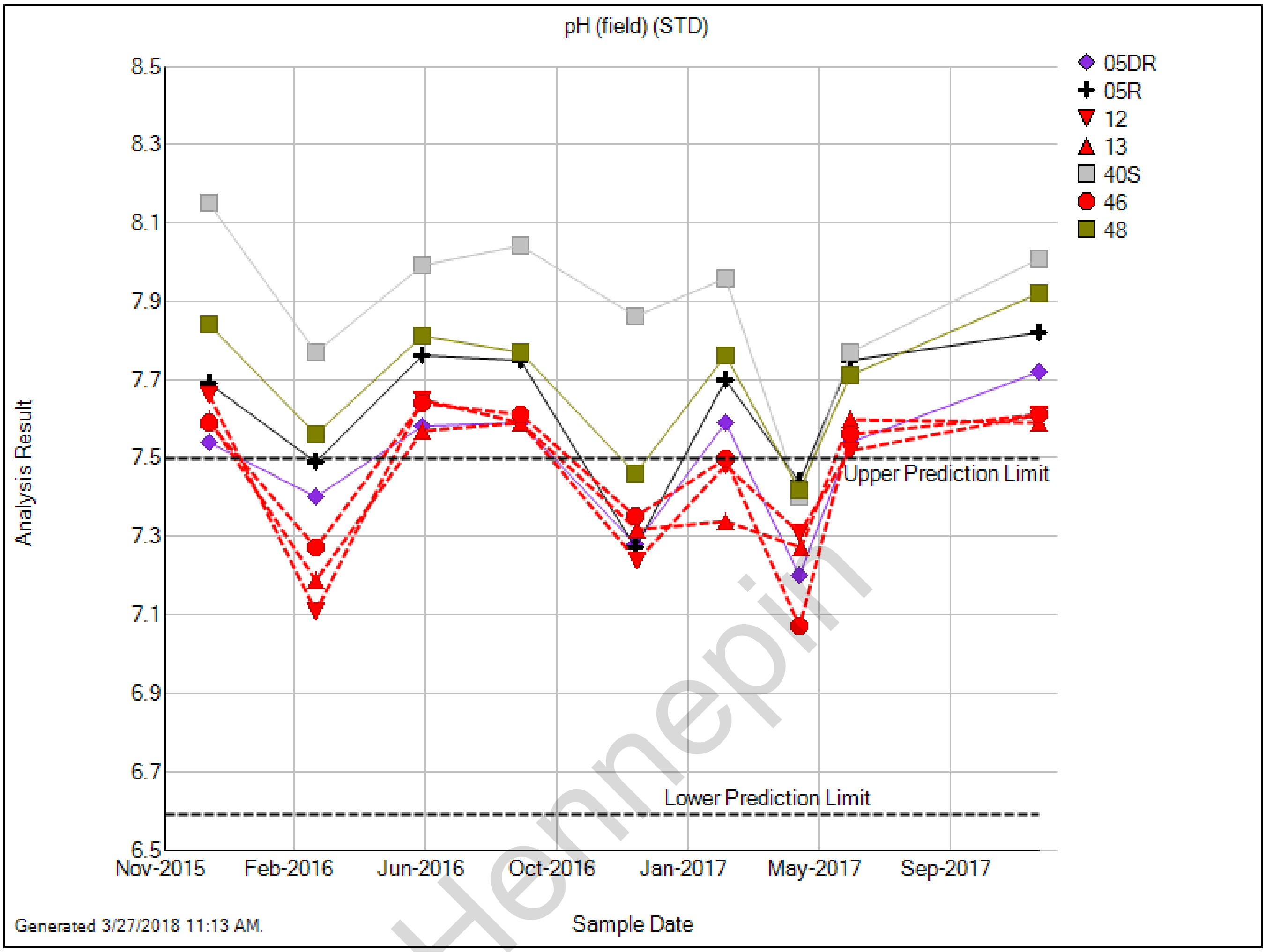

Figure 11. pH time-series in wells downgradient from the East Ash Pond and Landfill.

2.2.5 Representation of Background Groundwater Quality

As shown by the groundwater contour maps in Appendix B, there are two components of groundwater flow towards the Landfill. One comes primarily from the south and is represented by background wells 07, 08, and 08D which are monitored under the CCR Rule. A second component comes from the east and southeast which may be influenced by the large pond located on the Tri-Con facility. Background groundwater quality for this second component of groundwater flow is not monitored under the CCR Rule, however, limited data from wells 16 and 17 are available for partial characterization of groundwater flowing towards the Landfill from this direction. Presented below are comparisons of available data for these two sources of background groundwater.

Figure 12 below compares pH across most of the upgradient, intermediate, and downgradient wells surrounding the Landfill.

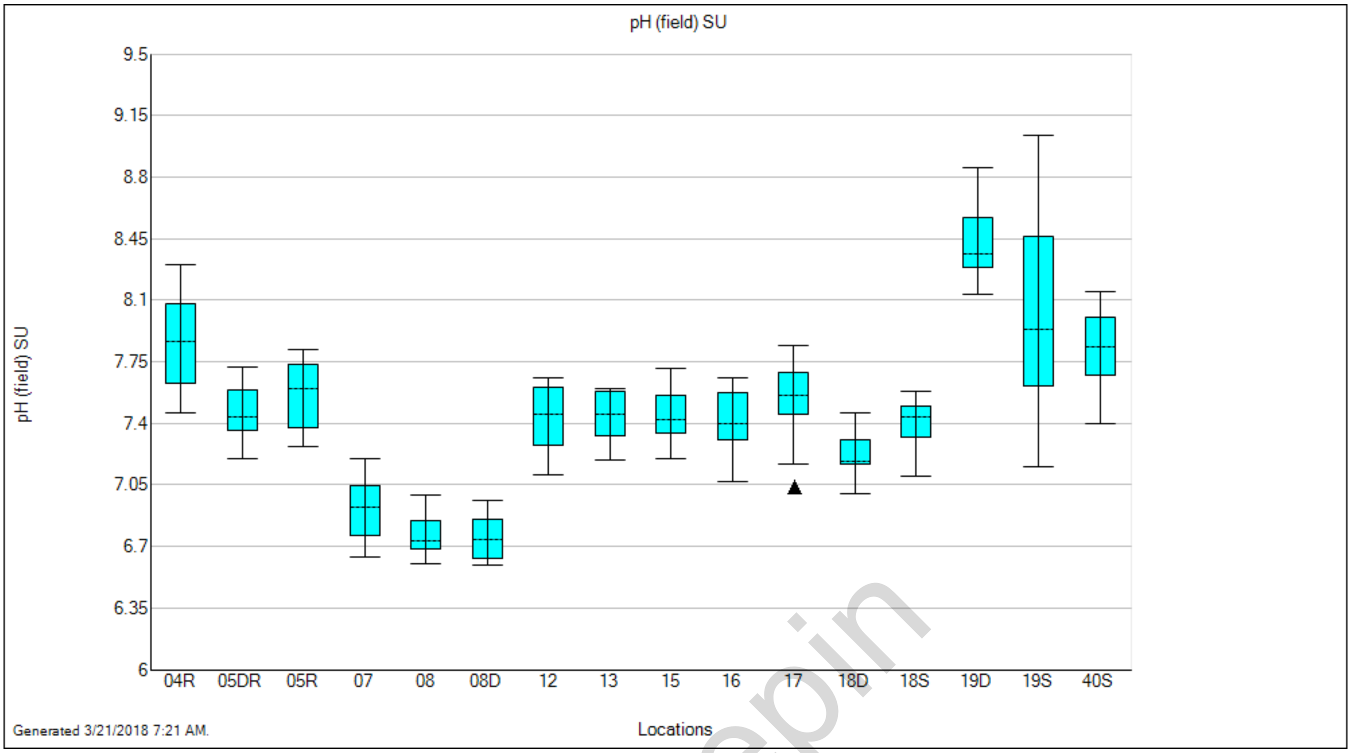

Figure 12. Distribution of pH at Hennepin East wells.

This figure shows that the CCR Rule background wells 07, 08, and 08D have the lowest pH at Hennepin East. Wells 16 and 17 representing background groundwater coming from the southeast have pH values that are more in-line with pH values seen at the downgradient wells monitored under the CCR Rule, wells 05DR, 05R, 40S, and 48 (pH values at well 48 are not shown on this figure because data from this well is not included in the database from which this figure was generated. pH values at well 48 are similar to those at well 05R as shown previously in Figure 11).

The dissolved boron distribution across the site is shown in Figure 13 below. This diagram shows that wells 16 and 17 are not impacted by coal ash leachate as evidenced by the lack of elevated concentrations of the primary indicator for coal ash leachate - boron. Therefore, wells 16 and 17 are representative of background groundwater quality coming from the southeast direction.

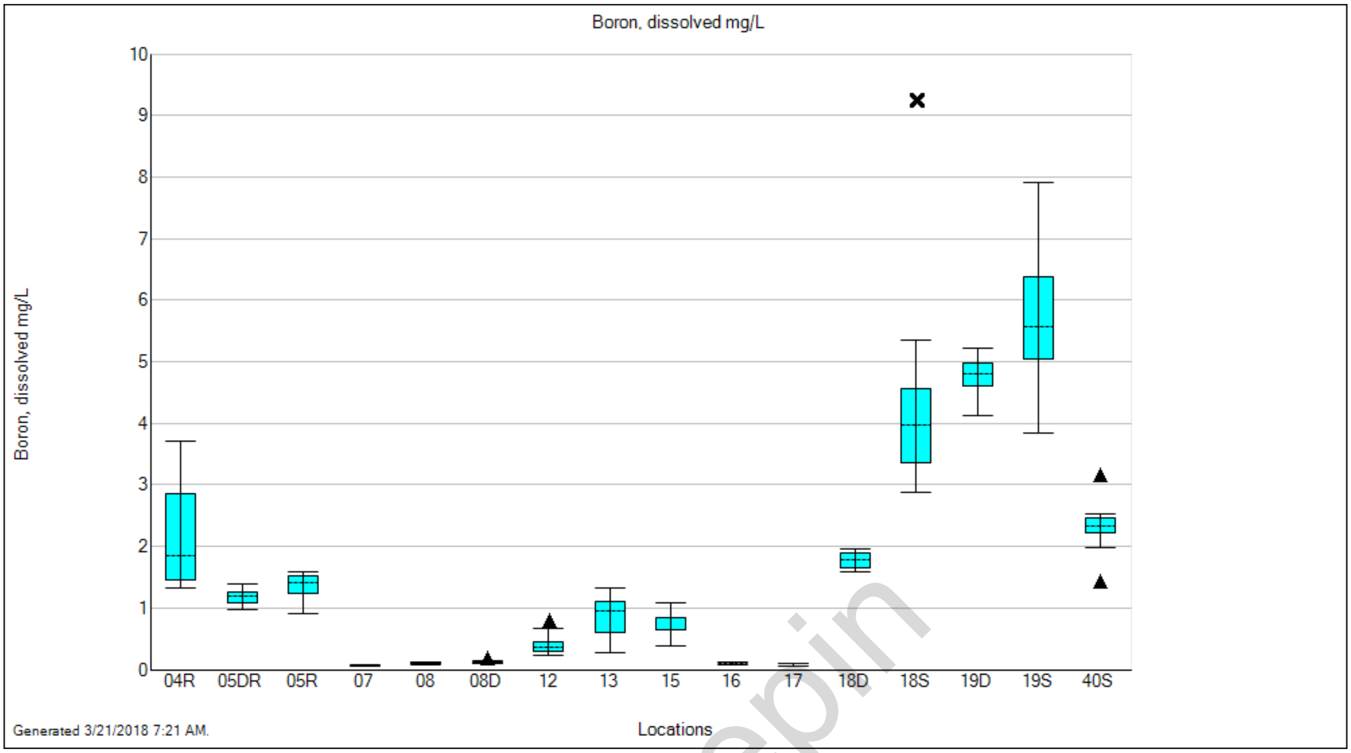

Figure 13. Distribution of dissolved boron at Hennepin East wells.

The dissolved chloride concentration distribution across the site (Figure 14) also shows a distinct difference for background wells 08 and 08D indicating that this background source may be different than what most of the downgradient wells in this area are receiving.

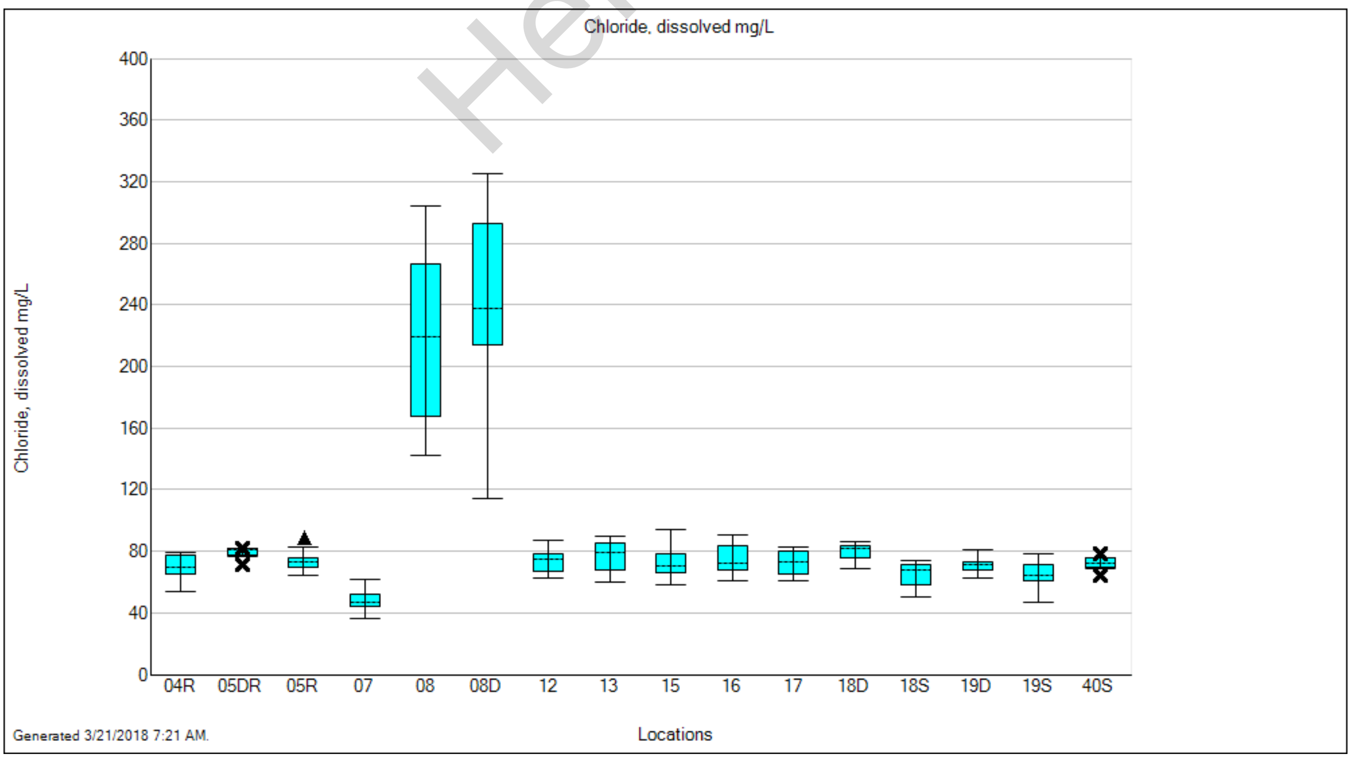

Figure 14. Distribution of dissolved chloride at Hennepin East wells.

Due to incomplete data sets, it is not possible to represent differences in the two background groundwater sources using Piper (trilinear) Diagrams. However, Figures 15 and 16 presented below show additional available comparisons in groundwater quality from these two sources.

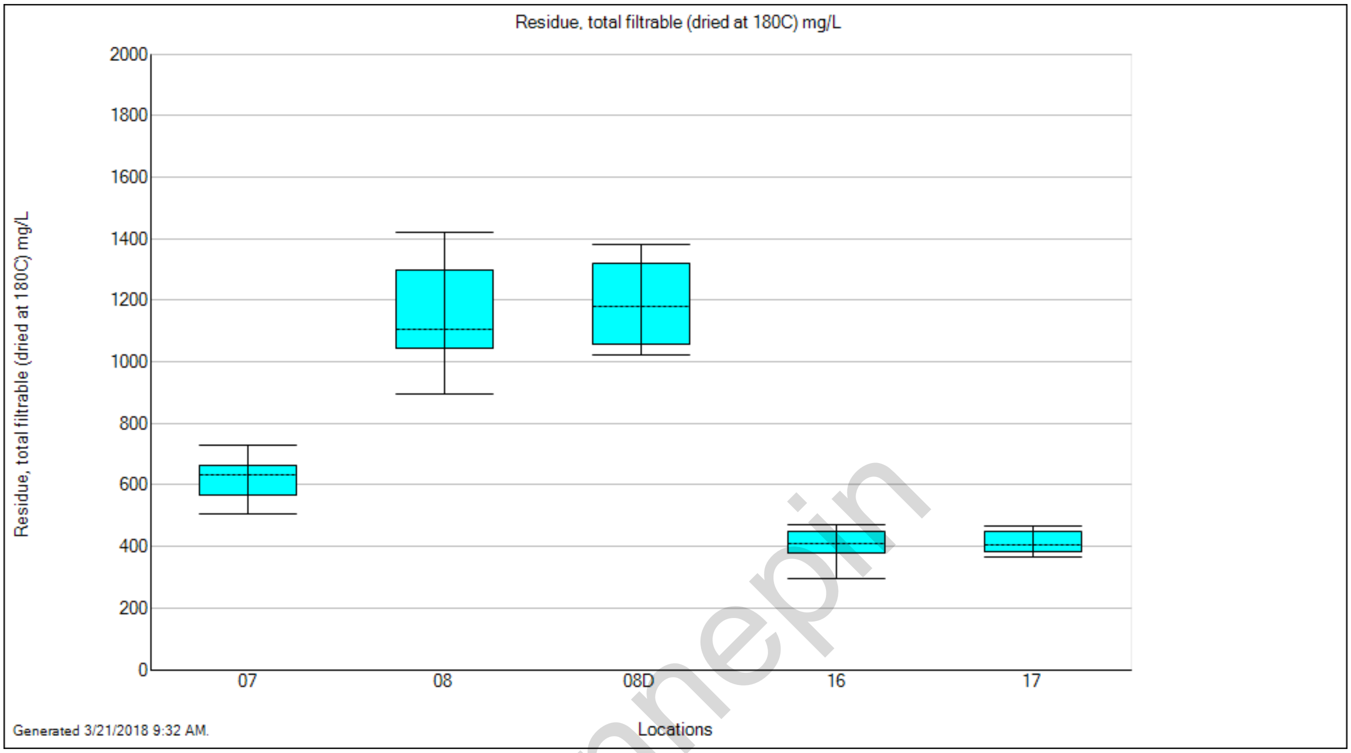

Figure 15. Distribution of total dissolved solids (also called residue, total filterable) at background wells.

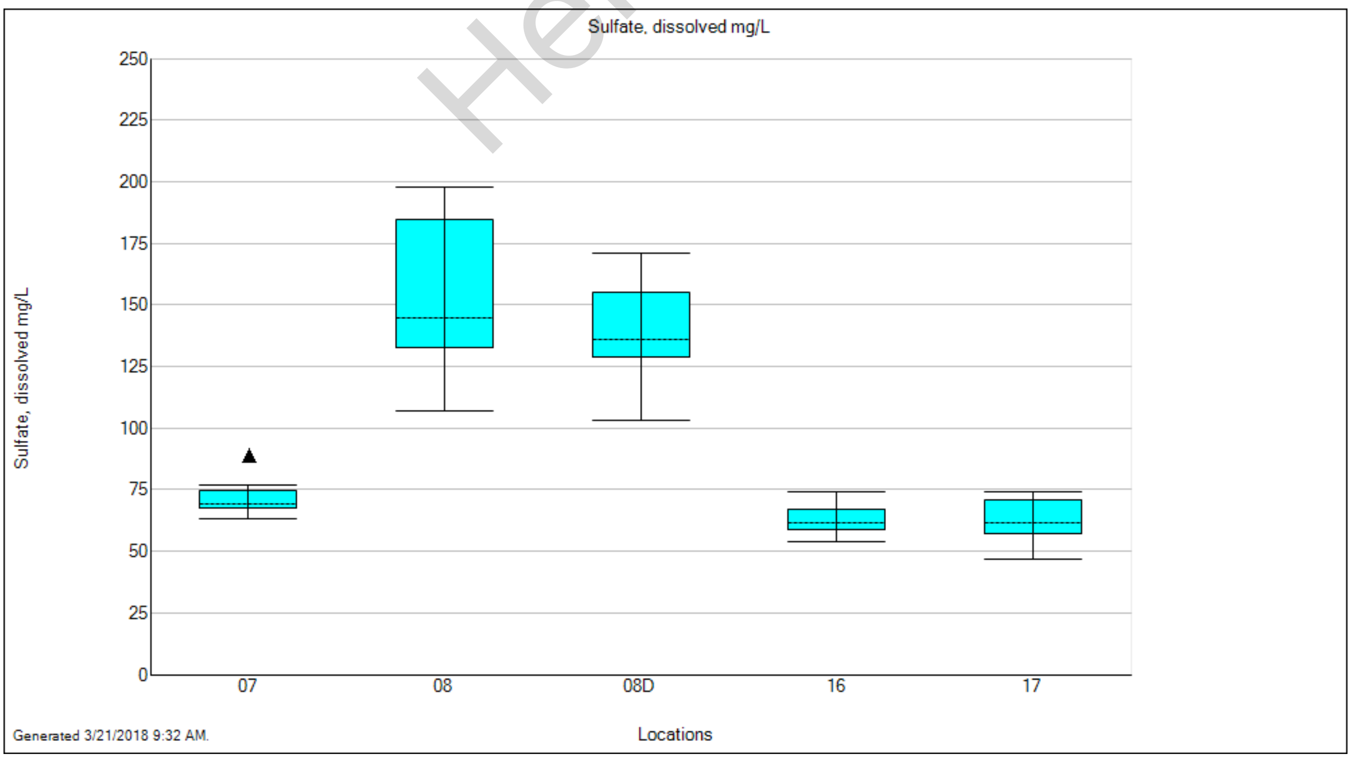

Figure 16. Distribution of dissolved sulfate at background wells.

These comparisons confirm that the background wells monitored under the CCR Rule (wells 07, 08, and 08D) are not providing complete characterization of the background groundwater quality that affects the downgradient wells monitoring under the CCR Rule for the Landfill (wells 05R, 05DR, 40S and 48). Because the groundwater flow contours show two components of directional flow and available groundwater analytical data shows that the two background sources are different, consideration should be given to adding background wells 16 and 17 to CCR Rule groundwater monitoring system. Since background water was not completely characterized by the CCR Rule groundwater monitoring program, the SSIs for pH and fluoride reflect this alternate background water source.

3 CONCLUSIONS AND CERTIFICATION

Pursuant to 40 CFR 257.94(e)(2), the following lines of evidence were presented in this report to demonstrate that the SSIs identified above (Section 2.1) at the Hennepin Landfill are due to alternate sources as follows:

- Landfill Design and Inventory
- Ash Fill Underlying the Landfill and in Ash Pond No. 2
- Surrounding Industrial Activity
- East Ash Pond
- Representation of Background Groundwater Quality

Based on the lines of evidence presented, the following alternate sources are causing the SSIs observed for the Landfill's downgradient wells:

- Boron: SSIs for boron are caused by leachate from the East Ash Pond, as well as ash deposits beneath and outside the Landfill boundary, with periodic wetting of low lying ash deposits beneath the Landfill during river flood events causing increased leachate and elevated boron concentrations in downgradient wells.
- Fluoride: It is likely that mining and processing activities at the Tri-Con facility upgradient of the Landfill are an alternate source of fluoride due to weathering of naturally occurring fluorite minerals. Due to the incomplete representation of background groundwater quality, this upgradient source of fluoride was not captured in the background dataset. Leachate from the East Ash Pond may also be contributing to fluoride concentrations downgradient of the Landfill.
- pH: The data presented in this report show that background wells 07, 08, and 08D have a lower pH value than other wells monitored at the site and that wells positioned to monitor pH from groundwater traveling from the southeast towards the Landfill have pH values that are more representative of the downgradient pH values. Since groundwater approaches the Landfill from two sources, the south and east/southeast, and these sources have different geochemistry, the SSIs for pH in the downgradient wells are likely a result of the incomplete characterization of background groundwater quality.

This information serves as the written alternate source demonstration report prepared in accordance with 40 CFR § 257.94(e)(2) that SSIs observed during the detection monitoring program were not caused by the Hennepin Landfill but were from anthropogenic impacts located upgradient (south) of the Hennepin Landfill. Therefore, an assessment monitoring program is not required and the Hennepin Landfill will remain in detection monitoring.

I, Eric J. Tlachac, a qualified professional engineer in good standing in the State of Illinois, certify the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
O'Brien & Gere Engineers, Inc.
Date: April 10, 2018

I, Stuart J. Cravens, a qualified professional hydrogeologist, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Stuart J. Cravens
Licensed Professional Geologist
196-000108
Illinois
O'Brien & Gere Engineers, Inc.
Date: April 10, 2018

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Civil & Environmental Consultants, Inc. (CEC), Closure and Post-Closure Care Plan for the Hennepin East Ash Pond No. 2. February 2018.

40 CFR 257

Tables

Table 1. Hennepin Landfill: Appendix III Analytical Results

Location ID	Sample Date	B, tot, mg/L	Ca, tot, mg/L	Cl, tot, mg/L	F, tot, mg/L	pH (field), STD	SO4, tot, mg/L
05DR	12/9/2015	1.450	89.50	74.00	0.1100	7.540	92.00
	3/9/2016	1.370	81.80	81.00	0.1000	7.400	96.00
	6/8/2016	1.280	87.90	91.00	<0.1000	7.580	99.00
	8/31/2016	1.250	77.10	88.00	0.1000	7.590	88.00
	12/8/2016	1.360	83.10	87.00	0.1100	7.280	82.00
	2/22/2017	1.150	77.20	69.00	0.1100	7.590	72.00
	4/26/2017	1.420	74.60	71.00	0.1100	7.200	77.00
	6/9/2017	1.090	74.10	76.00	0.1100	7.540	82.00
	11/16/2017	1.110	75.00	63.00	0.1300	7.720	71.00
05R	12/9/2015	1.430	81.20	64.00	0.1100	7.690	104.0
	3/9/2016	1.380	84.70	77.00	0.1100	7.490	99.00
	6/8/2016	1.650	78.50	84.00	0.1100	7.760	102.0
	8/31/2016	1.430	76.70	85.00	0.1200	7.750	89.00
	12/8/2016	1.750	81.40	90.00	0.1200	7.270	88.00
	2/22/2017	1.410	74.50	78.00	0.1100	7.700	81.00
	4/26/2017	1.550	69.50	74.00	0.1100	7.440	90.00
	6/9/2017	1.320	71.20	71.00	0.1200	7.750	90.00
	11/16/2017	0.9780	71.60	63.00	0.1300	7.820	67.00

Table 1. Hennepin Landfill: Appendix III Analytical Results

Location ID	Sample Date	TDS, mg/L
05DR	**12/9/2015**	586.0
	3/9/2016	468.0
	6/8/2016	560.0
	8/31/2016	552.0
	12/8/2016	532.0
	2/22/2017	486.0
	4/26/2017	510.0
	6/9/2017	480.0
	11/16/2017	466.0
05R	**12/9/2015**	584.0
	3/9/2016	466.0
	6/8/2016	516.0
	8/31/2016	516.0
	12/8/2016	276.0
	2/22/2017	482.0
	4/26/2017	502.0
	6/9/2017	468.0
	11/16/2017	474.0

Table 1. Hennepin Landfill: Appendix III Analytical Results

Location ID	Sample Date	B, tot, mg/L	Ca, tot, mg/L	Cl, tot, mg/L	F, tot, mg/L	pH (field), STD	SO4, tot, mg/L
07	3/10/2016	0.06290	126.0	51.00	0.1000	6.900	70.00
	6/7/2016	0.06730	154.0	55.00	<0.1000	6.640	82.00
	7/29/2016	0.07450	131.0	48.00	<0.1000	7.500	71.00
	9/1/2016	0.06970	150.0	49.00	0.1000	6.940	75.00
	12/9/2016	0.09390	158.0	63.00	0.1000	6.750	82.00
	2/22/2017	0.05440	137.0	46.00	<0.1000	6.950	66.00
	4/27/2017	0.05880	125.0	48.00	<0.1000	6.670	69.00
	6/8/2017	0.07010	118.0	56.00	0.1000	6.870	75.00
	11/16/2017	0.07020	136.0	48.00	0.1200	7.200	68.00
08	12/8/2015	0.09720	198.0	216.0	<0.1000	6.820	164.0
	3/10/2016	0.08780	213.0	145.0	<0.1000	6.730	133.0
	6/7/2016	0.07500	191.0	202.0	<0.1000	6.600	129.0
	9/1/2016	0.1420	299.0	312.0	<0.1000	6.690	209.0
	12/9/2016	0.1030	244.0	241.0	<0.1000	6.630	198.0
	2/22/2017	0.08730	208.0	223.0	<0.1000	6.850	140.0
	4/27/2017	0.1210	182.0	300.0	<0.1000	6.680	139.0
	6/9/2017	0.1330	152.0	127.0	<0.1000	6.910	134.0
	11/16/2017	0.1350	243.0	277.0	0.1000	6.990	167.0

Table 1. Hennepin Landfill: Appendix III Analytical Results

Location ID	Sample Date	TDS, mg/L
07	3/10/2016	536.0
	6/7/2016	758.0
	7/29/2016	632.0
	9/1/2016	574.0
	12/9/2016	718.0
	2/22/2017	660.0
	4/27/2017	630.0
	6/8/2017	572.0
	11/16/2017	658.0
08	12/8/2015	1170.
	3/10/2016	918.0
	6/7/2016	1060.
	9/1/2016	1370.
	12/9/2016	1200.
	2/22/2017	1160.
	4/27/2017	1310.
	6/9/2017	972.0
	11/16/2017	1370.

Table 1. Hennepin Landfill: Appendix III Analytical Results

Location ID	Sample Date	B, tot, mg/L	Ca, tot, mg/L	Cl, tot, mg/L	F, tot, mg/L	pH (field), STD	SO4, tot, mg/L
08D	12/8/2015	0.1090	174.0	184.0	0.1200	6.890	119.0
	3/10/2016	0.1220	187.0	209.0	0.1000	6.730	130.0
	6/7/2016	0.1110	177.0	217.0	0.1000	6.640	113.0
	9/1/2016	0.1390	287.0	325.0	0.1200	6.630	161.0
	12/9/2016	0.1250	233.0	313.0	0.1000	6.590	164.0
	2/22/2017	0.1150	220.0	262.0	<0.1000	6.800	124.0
	4/27/2017	0.1180	175.0	315.0	0.1000	6.600	119.0
	6/9/2017	0.1390	208.0	366.0	<0.1000	6.800	123.0
	11/16/2017	0.1220	189.0	200.0	0.1200	6.960	157.0
40S	12/9/2015	2.810	64.80	69.00	0.1700	8.150	120.0
	3/9/2016	2.260	59.10	80.00	0.1900	7.770	101.0
	6/8/2016	2.450	59.00	88.00	0.1800	7.990	124.0
	8/31/2016	2.500	62.60	86.00	0.1900	8.040	104.0
	12/8/2016	3.350	62.90	83.00	0.2000	7.860	109.0
	2/22/2017	2.400	58.00	66.00	0.2000	7.960	99.00
	4/26/2017	3.550	74.70	69.00	0.1700	7.400	148.0
	6/9/2017	3.330	77.70	69.00	0.1700	7.770	162.0
	11/16/2017	3.020	68.90	57.00	0.2000	8.010	103.0

Table 1. Hennepin Landfill: Appendix III Analytical Results

Location ID	Sample Date	TDS, mg/L
08D	12/8/2015	1050.
	3/10/2016	1060.
	6/7/2016	1090.
	9/1/2016	1340.
	12/9/2016	954.0
	2/22/2017	1220.
	4/27/2017	1250.
	6/9/2017	1320.
	11/16/2017	1200.
40S	12/9/2015	488.0
	3/9/2016	400.0
	6/8/2016	466.0
	8/31/2016	448.0
	12/8/2016	460.0
	2/22/2017	426.0
	4/26/2017	524.0
	6/9/2017	486.0
	11/16/2017	492.0

Table 1. Hennepin Landfill: Appendix III Analytical Results

Location ID	Sample Date	B, tot, mg/L	Ca, tot, mg/L	Cl, tot, mg/L	F, tot, mg/L	pH (field), STD	SO4, tot, mg/L
48	**12/9/2015**	1.520	79.90	70.00	0.1100	7.840	103.0
	3/9/2016	2.000	78.40	79.00	0.1200	7.560	99.00
	6/8/2016	1.320	78.20	89.00	0.1300	7.810	100.0
	8/31/2016	1.280	74.50	87.00	0.1400	7.770	89.00
	12/8/2016	1.160	75.50	79.00	0.1500	7.460	83.00
	2/22/2017	1.080	70.90	59.00	0.1500	7.760	69.00
	4/26/2017	1.020	64.20	64.00	0.1500	7.420	74.00
	6/9/2017	1.220	72.40	65.00	0.1500	7.710	93.00
	11/16/2017	1.040	72.30	59.00	0.1800	7.920	66.00

Table 1. Hennepin Landfill: Appendix III Analytical Results

Location ID	Sample Date	TDS, mg/L
48	12/9/2015	524.0
	3/9/2016	420.0
	6/8/2016	526.0
	8/31/2016	502.0
	12/8/2016	480.0
	2/22/2017	438.0
	4/26/2017	488.0
	6/9/2017	462.0
	11/16/2017	396.0

Table 2. Hennepin Landfill : Appendix IV Analytical Results

Location ID	Sample Date	As, tot, mg/L	Ba, tot, mg/L	Be, tot, mg/L	Cd,tot, mg/L	Co, tot, mg/L	Cr, tot, mg/L
05DR	**12/9/2015**	<0.001000	0.06480	<0.001000	<0.001000	0.001700	<0.001000
	3/9/2016	<0.001000	0.06050	<0.001000	<0.001000	0.001800	<0.001000
	6/8/2016	<0.001000	0.06330	<0.001000	<0.001000	0.001600	<0.001000
	8/31/2016	<0.001000	0.05720	<0.001000	<0.001000	0.001300	<0.001000
	12/8/2016	<0.001000	0.06110	<0.001000	<0.001000	0.001400	<0.001000
	2/22/2017	<0.001000	0.05230	<0.001000	<0.001000	0.001200	<0.001000
	4/26/2017	<0.001000	0.04980	<0.001000	<0.001000	0.001300	<0.001000
	6/9/2017	<0.001000	0.05040	<0.001000	<0.001000	0.001400	<0.001000
05R	**12/9/2015**	0.001000	0.05960	<0.001000	0.002000	0.001400	<0.001000
	3/9/2016	0.001100	0.06240	<0.001000	0.001800	0.001300	<0.001000
	6/8/2016	<0.001000	0.05790	<0.001000	0.001300	<0.001000	0.001400
	8/31/2016	0.001100	0.05710	<0.001000	0.001200	<0.001000	<0.001000
	12/8/2016	0.001600	0.07090	<0.001000	0.001200	<0.001000	<0.001000
	2/22/2017	0.001200	0.05400	<0.001000	<0.001000	<0.001000	<0.001000
	4/26/2017	0.001200	0.05310	<0.001000	<0.001000	<0.001000	<0.001000
	6/9/2017	0.001200	0.05040	<0.001000	<0.001000	<0.001000	0.001500
07	**3/10/2016**	<0.001000	0.1040	<0.001000	<0.001000	<0.001000	<0.001000
	6/7/2016	<0.001000	0.1300	<0.001000	<0.001000	<0.001000	<0.001000

Table 2. Hennepin Landfill : Appendix IV Analytical Results

Location ID	Sample Date	F, tot, mg/L	Hg, tot, mg/L	Li, tot, mg/L	Mo, tot, mg/L	Pb, tot, mg/L	Ra-226,228, tot, pCi/L
05DR	12/9/2015	0.1100	<0.0002000	0.03710	0.01180	<0.001000	1.000
	3/9/2016	0.1000	<0.0002000	0.03430	0.01140	<0.001000	1.004
	6/8/2016	<0.1000	<0.0002000	0.03920	0.01150	<0.001000	0.6100
	8/31/2016	0.1000	<0.0002000	0.03900	0.01070	<0.001000	0.7100
	12/8/2016	0.1100	<0.0002000	0.03180	0.01350	<0.001000	0.2800
	2/22/2017	0.1100	<0.0002000	0.03230	0.01140	<0.001000	1.680
	4/26/2017	0.1100	<0.0002000	0.03600	0.01120	<0.001000	1.430
	6/9/2017	0.1100	<0.0002000	0.03160	0.01160	<0.001000	0.9700
05R	12/9/2015	0.1100	<0.0002000	0.05680	0.02400	<0.001000	1.000
	3/9/2016	0.1100	<0.0002000	0.05630	0.02370	<0.001000	0.5150
	6/8/2016	0.1100	<0.0002000	0.05820	0.02730	<0.001000	0.6200
	8/31/2016	0.1200	<0.0002000	0.06480	0.02700	<0.001000	0.07000
	12/8/2016	0.1200	<0.0002000	0.05020	0.03570	<0.001000	1.420
	2/22/2017	0.1100	<0.0002000	0.05480	0.03000	<0.001000	0.1700
	4/26/2017	0.1100	<0.0002000	0.05470	0.03070	<0.001000	0.8600
	6/9/2017	0.1200	<0.0002000	0.05130	0.02900	<0.001000	0.1100
07	3/10/2016	0.1000	<0.0002000	0.007900	<0.001000	<0.001000	0.1200
	6/7/2016	<0.1000	<0.0002000	0.008500	<0.001000	<0.001000	1.090

Hennepin

Table 2. Hennepin Landfill : Appendix IV Analytical Results

Location ID	Sample Date	Sb, tot, mg/L	Se, tot, mg/L	Tl, tot, mg/L
05DR	12/9/2015	<0.001000	0.001100	<0.001000
	3/9/2016	<0.001000	0.001600	<0.001000
	6/8/2016	<0.001000	0.001200	<0.001000
	8/31/2016	<0.001000	<0.001000	<0.001000
	12/8/2016	<0.001000	0.001600	<0.001000
	2/22/2017	<0.001000	0.001500	<0.001000
	4/26/2017	<0.001000	0.001100	<0.001000
	6/9/2017	<0.001000	0.001600	<0.001000
05R	12/9/2015	<0.001000	0.004700	<0.001000
	3/9/2016	<0.001000	0.002400	<0.001000
	6/8/2016	<0.001000	0.007600	<0.001000
	8/31/2016	<0.001000	0.004500	<0.001000
	12/8/2016	<0.001000	0.005600	<0.001000
	2/22/2017	<0.001000	0.007500	<0.001000
	4/26/2017	<0.001000	0.008100	<0.001000
	6/9/2017	<0.001000	0.007300	<0.001000
07	3/10/2016	<0.001000	<0.001000	<0.001000
	6/7/2016	<0.001000	0.001100	<0.001000

Table 2. Hennepin Landfill : Appendix IV Analytical Results

Location ID	Sample Date	As, tot, mg/L	Ba, tot, mg/L	Be, tot, mg/L	Cd,tot, mg/L	Co, tot, mg/L	Cr, tot, mg/L
07	**7/29/2016**	<0.001000	0.1110	<0.001000	<0.001000	<0.001000	<0.001000
	9/1/2016	<0.001000	0.1300	<0.001000	<0.001000	<0.001000	<0.001000
	12/9/2016	<0.001000	0.1680	<0.001000	<0.001000	<0.001000	0.001000
	2/22/2017	<0.001000	0.1150	<0.001000	<0.001000	<0.001000	<0.001000
	4/27/2017	<0.001000	0.1040	<0.001000	<0.001000	<0.001000	<0.001000
	6/8/2017	<0.001000	0.1010	<0.001000	<0.001000	<0.001000	<0.001000
08	**12/8/2015**	<0.001000	0.1180	<0.001000	<0.001000	0.002900	<0.001000
	3/10/2016	<0.001000	0.1480	<0.001000	<0.001000	0.001700	<0.001000
	6/7/2016	<0.001000	0.1270	<0.001000	<0.001000	0.003400	<0.001000
	9/1/2016	<0.001000	0.1460	<0.001000	<0.001000	0.02850	<0.001000
	12/9/2016	<0.001000	0.1070	<0.001000	<0.001000	0.02160	<0.001000
	2/22/2017	<0.001000	0.1110	<0.001000	<0.001000	0.01390	<0.001000
	4/27/2017	<0.001000	0.1190	<0.001000	<0.001000	0.01580	<0.001000
	6/9/2017	<0.001000	0.09920	<0.001000	<0.001000	0.008300	<0.001000
08D	**12/8/2015**	<0.001000	0.1330	<0.001000	<0.001000	0.01220	<0.001000
	3/10/2016	<0.001000	0.1550	<0.001000	<0.001000	0.003600	<0.001000
	6/7/2016	<0.001000	0.1380	<0.001000	<0.001000	0.002800	<0.001000
	9/1/2016	<0.001000	0.2300	<0.001000	0.001100	0.01300	<0.001000

Table 2. Hennepin Landfill : Appendix IV Analytical Results

Location ID	Sample Date	F, tot, mg/L	Hg, tot, mg/L	Li, tot, mg/L	Mo, tot, mg/L	Pb, tot, mg/L	Ra-226,228, tot, pCi/L
07	**7/29/2016**	<0.1000	<0.0002000	0.009000	<0.001000	<0.001000	1.100
	9/1/2016	0.1000	<0.0002000	0.009100	<0.001000	<0.001000	0.3600
	12/9/2016	0.1000	<0.0002000	0.008400	0.001000	<0.001000	1.210
	2/22/2017	<0.1000	<0.0002000	0.008400	<0.001000	<0.001000	0.6700
	4/27/2017	<0.1000	<0.0002000	0.008800	<0.001000	<0.001000	0.8100
	6/8/2017	0.1000	<0.0002000	0.008100	<0.001000	<0.001000	0.7900
08	**12/8/2015**	<0.1000	<0.0002000	0.01000	0.001500	<0.001000	0.8900
	3/10/2016	<0.1000	<0.0002000	0.009100	0.001600	<0.001000	0.7200
	6/7/2016	<0.1000	<0.0002000	0.009200	0.001300	<0.001000	0.7400
	9/1/2016	<0.1000	<0.0002000	0.01270	0.001400	<0.001000	0.3300
	12/9/2016	<0.1000	<0.0002000	0.009500	0.001400	<0.001000	0.6300
	2/22/2017	<0.1000	<0.0002000	0.009300	0.001400	<0.001000	0.8500
	4/27/2017	<0.1000	<0.0002000	0.01180	0.001300	<0.001000	1.010
	6/9/2017	<0.1000	<0.0002000	0.009400	0.001500	<0.001000	0.8500
08D	**12/8/2015**	0.1200	<0.0002000	0.01210	0.001400	<0.001000	0.9400
	3/10/2016	0.1000	<0.0002000	0.01430	0.001300	<0.001000	0.1200
	6/7/2016	0.1000	<0.0002000	0.01080	0.001100	<0.001000	0.3500
	9/1/2016	0.1200	<0.0002000	0.01640	0.001400	<0.001000	0.5500

Table 2. Hennepin Landfill : Appendix IV Analytical Results

Location ID	Sample Date	Sb, tot, mg/L	Se, tot, mg/L	Tl, tot, mg/L
07	7/29/2016	<0.001000	<0.001000	<0.001000
	9/1/2016	<0.001000	0.001400	<0.001000
	12/9/2016	<0.001000	0.001100	<0.001000
	2/22/2017	<0.001000	<0.001000	<0.001000
	4/27/2017	<0.001000	0.001000	<0.001000
	6/8/2017	<0.001000	0.001000	<0.001000
08	12/8/2015	<0.001000	<0.001000	<0.001000
	3/10/2016	<0.001000	<0.001000	<0.001000
	6/7/2016	<0.001000	<0.001000	<0.001000
	9/1/2016	<0.001000	<0.001000	<0.001000
	12/9/2016	<0.001000	<0.001000	<0.001000
	2/22/2017	<0.001000	<0.001000	<0.001000
	4/27/2017	<0.001000	<0.001000	<0.001000
	6/9/2017	<0.001000	<0.001000	<0.001000
08D	12/8/2015	<0.001000	<0.001000	<0.001000
	3/10/2016	<0.001000	<0.001000	<0.001000
	6/7/2016	<0.001000	<0.001000	<0.001000
	9/1/2016	<0.001000	<0.001000	<0.001000

Table 2. Hennepin Landfill : Appendix IV Analytical Results

Location ID	Sample Date	As, tot, mg/L	Ba, tot, mg/L	Be, tot, mg/L	Cd,tot, mg/L	Co, tot, mg/L	Cr, tot, mg/L
08D	**12/9/2016**	<0.001000	0.1810	<0.001000	<0.001000	0.01520	<0.001000
	2/22/2017	<0.001000	0.1670	<0.001000	<0.001000	0.007800	<0.001000
	4/27/2017	<0.001000	0.1580	<0.001000	0.002300	0.03850	<0.001000
	6/9/2017	<0.001000	0.1840	<0.001000	0.001100	0.01620	<0.001000
40S	**12/9/2015**	0.002100	0.04440	<0.001000	<0.001000	<0.001000	<0.001000
	3/9/2016	0.002300	0.04020	<0.001000	<0.001000	<0.001000	<0.001000
	6/8/2016	0.002200	0.03940	<0.001000	<0.001000	<0.001000	<0.001000
	8/31/2016	0.002100	0.03680	<0.001000	<0.001000	<0.001000	<0.001000
	12/8/2016	0.002900	0.04630	<0.001000	<0.001000	<0.001000	<0.001000
	2/22/2017	0.002200	0.03660	<0.001000	<0.001000	<0.001000	<0.001000
	4/26/2017	0.001800	0.04840	<0.001000	<0.001000	<0.001000	<0.001000
	6/9/2017	0.001900	0.04570	<0.001000	<0.001000	<0.001000	<0.001000
48	**12/9/2015**	0.001100	0.04820	<0.001000	<0.001000	<0.001000	<0.001000
	3/9/2016	0.001200	0.04480	<0.001000	<0.001000	<0.001000	<0.001000
	6/8/2016	0.001000	0.04440	<0.001000	<0.001000	<0.001000	<0.001000
	8/31/2016	0.001100	0.04250	<0.001000	<0.001000	<0.001000	<0.001000
	12/8/2016	0.001300	0.04360	<0.001000	<0.001000	<0.001000	<0.001000
	2/22/2017	0.001100	0.03830	<0.001000	<0.001000	<0.001000	<0.001000

Table 2. Hennepin Landfill : Appendix IV Analytical Results

Location ID	Sample Date	F, tot, mg/L	Hg, tot, mg/L	Li, tot, mg/L	Mo, tot, mg/L	Pb, tot, mg/L	Ra-226,228, tot, pCi/L
08D	**12/9/2016**	0.1000	<0.0002000	0.01310	0.001200	<0.001000	0.3500
	2/22/2017	<0.1000	<0.0002000	0.01360	0.001100	<0.001000	0.3800
	4/27/2017	0.1000	<0.0002000	0.01710	0.001000	0.001500	1.410
	6/9/2017	<0.1000	<0.0002000	0.01660	0.001700	<0.001000	0.9400
40S	**12/9/2015**	0.1700	<0.0002000	0.06000	0.1190	<0.001000	0.1000
	3/9/2016	0.1900	<0.0002000	0.05810	0.08680	<0.001000	0.09000
	6/8/2016	0.1800	<0.0002000	0.06130	0.09350	<0.001000	0.8200
	8/31/2016	0.1900	<0.0002000	0.06590	0.1210	<0.001000	0.4300
	12/8/2016	0.2000	<0.0002000	0.06080	0.1290	<0.001000	0.1800
	2/22/2017	0.2000	<0.0002000	0.06370	0.09380	<0.001000	0.6900
	4/26/2017	0.1700	<0.0002000	0.07190	0.08990	<0.001000	0.4000
	6/9/2017	0.1700	<0.0002000	0.06900	0.09760	<0.001000	0.3000
48	**12/9/2015**	0.1100	<0.0002000	0.04600	0.1300	<0.001000	1.000
	3/9/2016	0.1200	<0.0002000	0.04890	0.1220	<0.001000	0.3610
	6/8/2016	0.1300	<0.0002000	0.04630	0.1010	<0.001000	0.8200
	8/31/2016	0.1400	<0.0002000	0.04720	0.09130	<0.001000	0.2500
	12/8/2016	0.1500	<0.0002000	0.04070	0.1180	<0.001000	0.5000
	2/22/2017	0.1500	<0.0002000	0.04130	0.1040	<0.001000	0.7600

Table 2. Hennepin Landfill : Appendix IV Analytical Results

Location ID	Sample Date	Sb, tot, mg/L	Se, tot, mg/L	Tl, tot, mg/L
08D	12/9/2016	<0.001000	<0.001000	<0.001000
	2/22/2017	<0.001000	<0.001000	<0.001000
	4/27/2017	<0.001000	<0.001000	<0.001000
	6/9/2017	<0.001000	<0.001000	<0.001000
40S	12/9/2015	<0.001000	0.01160	<0.001000
	3/9/2016	0.001100	0.006700	<0.001000
	6/8/2016	0.001000	0.01320	<0.001000
	8/31/2016	<0.001000	0.009900	<0.001000
	12/8/2016	<0.001000	0.01430	<0.001000
	2/22/2017	<0.001000	0.008300	<0.001000
	4/26/2017	<0.001000	0.01560	<0.001000
	6/9/2017	<0.001000	0.01500	<0.001000
48	12/9/2015	<0.001000	0.009000	<0.001000
	3/9/2016	<0.001000	0.01290	<0.001000
	6/8/2016	<0.001000	0.01010	<0.001000
	8/31/2016	<0.001000	0.007900	<0.001000
	12/8/2016	<0.001000	0.007400	<0.001000
	2/22/2017	<0.001000	0.009100	<0.001000

Hennepin

Table 2. Hennepin Landfill : Appendix IV Analytical Results

Location ID	Sample Date	As, tot, mg/L	Ba, tot, mg/L	Be, tot, mg/L	Cd,tot, mg/L	Co, tot, mg/L	Cr, tot, mg/L
48	**4/26/2017**	0.001300	0.03690	<0.001000	<0.001000	<0.001000	<0.001000
	6/9/2017	0.001200	0.03910	<0.001000	<0.001000	<0.001000	<0.001000

Hennepin

Table 2. Hennepin Landfill : Appendix IV Analytical Results

Location ID	Sample Date	F, tot, mg/L	Hg, tot, mg/L	Li, tot, mg/L	Mo, tot, mg/L	Pb, tot, mg/L	Ra-226,228, tot, pCi/L
48	4/26/2017	0.1500	<0.0002000	0.03920	0.09930	<0.001000	0.09600
	6/9/2017	0.1500	<0.0002000	0.03940	0.09690	<0.001000	0.3700

Table 2. Hennepin Landfill : Appendix IV Analytical Results

Location ID	Sample Date	Sb, tot, mg/L	Se, tot, mg/L	Tl, tot, mg/L
48	**4/26/2017**	<0.001000	0.007900	<0.001000
	6/9/2017	<0.001000	0.01430	<0.001000

Figures

DRAWN BY/DATE: SDS 8/30/17
REVIEWED BY/DATE: RJK 8/30/17
APPROVED BY/DATE: SJC 9/8/17

GROUNDWATER SAMPLING WELL LOCATION MAP

EAST ASH POND, ASH POND NO. 2, AND LANDFILL
ALTERNATE SOURCE DEMONSTRATION
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 67719

FIGURE NO: 1

Y:\Mapping\Projects\22\2285_Hennepin East\MXD\SAP\Figure 1_Groundwater Sampling Well Location Map.mxd Author: BartelAB; Date/Time: 4/13/2018, 1:26:30 PM

DRAWN BY/DATE: SDS 1/9/18
REVIEWED BY/DATE: KLT 1/9/18
APPROVED BY/DATE: SJC 1/25/18

HENNEPIN LANDFILL MONITORING WELL LOCATION MAP
HENNEPIN LANDFILL, UNIT ID: 801

ALTERNATE SOURCE DEMONSTRATION
DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 67719

FIGURE NO: 2

Y:\Mapping\Projects\22\2285_Hennepin East\MXD\Figure 2_GWS_WellLoc_HenLF.mxd Author: BartelAB; Date/Time: 4/13/2018, 1:42:44 PM

Appendix A

Bottom Ash Leachate Data

TEKLAB, INC.

5445 HORSESHOE LAKE ROAD
COLLINSVILLE, ILLINOIS 62234

ENVIRONMENTAL TESTING LABORATORY

TEL: 618-344-1004
FAX: 618-344-1005

August 03, 2009

John Augspols
Dynegy Midwest Generation
13498 East 800th Street
Hennepin, IL 61327
TEL: (815) 339-9218
FAX:

NELAP Accredited #100226

RE: Hennepin Station Bottom Ash

WorkOrder: 09070896

Dear John Augspols:

TEKLAB, INC received 1 sample on 7/24/2009 9:00:00 AM for the analysis presented in the following report.

Samples are analyzed on an as received basis unless otherwise requested and documented. The sample results contained in this report relate only to the requested analytes of interest as directed on the chain of custody. IL ELAP and NELAP accredited fields of testing are indicated by the letters NELAP under the Certification column.

All quality control criteria applicable to the test methods employed for this project have been satisfactorily met and are in accordance with NELAP except where noted. The following report shall not be reproduced, except in full, without the written approval of Teklab, Inc.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

Heather A. White

Heather A. White
Project Manager
(618)344-1004 ex 20

TEKLAB, INC.

5445 HORSESHOE LAKE ROAD
COLLINSVILLE, ILLINOIS 62234

ENVIRONMENTAL TESTING LABORATORY

TEL: 618-344-1004
FAX: 618-344-1005

Client: Dynegy Midwest Generation
Project: Hennepin Station Bottom Ash
LabOrder: 09070896
Report Date: 03-Aug-09

CASE NARRATIVE

Cooler Receipt Temp: 22.8 °C

State accreditations:

KS: NELAP #E-10347 | KY: UST #0073 | MO: DNR #00930 | AR: ADEQ #70-028-0

Qualifiers

DF - Dilution Factor	**B** - Analyte detected in the associated Method Blank	**C** - Client requested RL below PQL
RL - Reporting Limit	**J** - Analyte detected below reporting limits	**D** - Diluted out of sample
ND - Not Detected at the Reporting Limit	**R** - RPD outside accepted recovery limits	**E** - Value above quantitation range
Surr - Surrogate Standard added by lab	**S** - Spike Recovery outside accepted recovery limits	**H** - Holding time exceeded
TNTC - Too numerous to count (> 200 CFU)	X - Value exceeds Maximum Contaminant Level	**MI** - Matrix interference
Q - QC criteria failed or noncompliant CCV	# - Unknown hydrocarbon	**DNI** - Did not ignite
NELAP - IL ELAP and NELAP Accredited Field of Testing	**IDPH** - IL Dept. of Public Health	

TEKLAB, INC.

5445 HORSESHOE LAKE ROAD
COLLINSVILLE, ILLINOIS 62234

ENVIRONMENTAL TESTING LABORATORY

TEL: 618-344-1004
FAX: 618-344-1005

LABORATORY RESULTS

Client: Dynegy Midwest Generation
WorkOrder: 09070896
Lab ID: 09070896-001
Report Date: 03-Aug-09

Client Project: Hennepin Station Bottom Ash
Client Sample ID: Hennipin Station Bottom Ash
Collection Date: 7/22/2009 11:00:00 AM
Matrix: SOLID

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Analyst
ASTM D3987, SW-846 3005A, 6010B, METALS IN SHAKE EXTRACT BY ICP								
Arsenic		0.0250		**< 0.0250**	mg/L	1	7/29/2009 3:49:50 PM	LAL
Barium		0.0050		**0.116**	mg/L	1	7/29/2009 11:19:44 AM	LAL
Beryllium		0.0010		**< 0.0010**	mg/L	1	7/29/2009 11:19:44 AM	LAL
Boron		0.0200		**0.193**	mg/L	1	8/3/2009 10:30:48 AM	LAL
Cadmium		0.0020		**< 0.0020**	mg/L	1	7/29/2009 3:49:50 PM	LAL
Chromium		0.0100		**< 0.0100**	mg/L	1	7/29/2009 11:19:44 AM	LAL
Cobalt		0.0100		**< 0.0100**	mg/L	1	7/29/2009 11:19:44 AM	LAL
Copper		0.0100		**< 0.0100**	mg/L	1	7/29/2009 11:19:44 AM	LAL
Iron		0.0300		**0.0687**	mg/L	1	7/29/2009 3:49:50 PM	LAL
Manganese		0.0050		**< 0.0050**	mg/L	1	7/29/2009 3:49:50 PM	LAL
Nickel		0.0100		**< 0.0100**	mg/L	1	7/29/2009 3:49:50 PM	LAL
Selenium		0.0500		**< 0.0500**	mg/L	1	7/29/2009 3:49:50 PM	LAL
Silver		0.0100		**< 0.0100**	mg/L	1	7/29/2009 11:19:44 AM	LAL
Zinc		0.0100		**< 0.0100**	mg/L	1	7/29/2009 11:19:44 AM	LAL
ASTM D3987, SW-846 3020A, METALS IN SHAKE EXTRACT BY GFAA								
Antimony, SHAKE by GFAA	7041	0.0050		**< 0.0050**	mg/L	1	7/29/2009 2:45:16 PM	MEK
Lead, SHAKE by GFAA	7421	0.0020	J	**0.0011**	mg/L	1	7/29/2009 10:18:30 AM	MEK
Thallium, SHAKE by GFAA	7841	0.0020		**< 0.0020**	mg/L	1	7/29/2009 2:41:30 PM	MEK
ASTM D3987, SW-846 7470A IN SHAKE EXTRACT								
Mercury, SHAKE		0.00020		**< 0.00020**	mg/L	1	7/28/2009	ALU

Sample Narrative

TEKLAB, INC.

5445 HORSESHOE LAKE ROAD
COLLINSVILLE, ILLINOIS 62234

ENVIRONMENTAL TESTING LABORATORY

TEL: 618-344-1004
FAX: 618-344-1005

RECEIVING CHECK LIST

Client: Dynegy Midwest Generation
Project: Hennepin Station Bottom Ash
Lab Order: 09070896
Report Date: 03-Aug-09

Carrier: UPS

Received By: DB

Completed by: Marvin L. Darling II
On: 24-Jul-09
Marvin L. Darling

Reviewed by: Heather A. White
On: 24-Jul-09
Heather A. White

Pages to follow: Chain of custody 1 Extra pages included 2

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐	Temp °C 22.8
Type of thermal preservation?	None ☑	Ice ☐	Blue Ice ☐	Dry Ice ☐
Chain of custody present?	Yes ☐	No ☑		
Chain of custody signed when relinquished and received?	Yes ☐	No ☑		
Chain of custody agrees with sample labels?	Yes ☑	No ☐		
Samples in proper container/bottle?	Yes ☑	No ☐		
Sample containers intact?	Yes ☑	No ☐		
Sufficient sample volume for indicated test?	Yes ☑	No ☐		
All samples received within holding time?	Yes ☑	No ☐		
Reported field parameters measured:	Field ☐	Lab ☐	NA ☑	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐		

When thermal preservation is required, samples are compliant with a temperature between 0.1°C - 6.0°C, or when samples are received on ice the same day as collected.

Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	

Any No responses must be detailed below or on the COC.

Sample id and collection date/time obtained from sample container. Per John Augspols, sample ID and collection/date time on the container are correct. Analyze for the same list of parameters as in 2008. EAH 7/27/09

09070896

TEKLAB, INC
5445 Horseshoe Lake Road
Collinsville, IL 62234-7425
TEL: (618) 344-1004
FAX: (618) 344-1005

CHAIN-OF-CUSTODY RECORD

WorkOrder: 09070896

Client:

Dynegy Midwest Generation
13498 East 800th Street
Hennepin, IL 61327

TEL: (815) 339-9218
FAX:
Project: Hennepin Station Bottom As

24-Jul-09

Sample ID	ClientSampID	Matrix	Date Collected	Bottle	Requested Tests: D3987/6010B	D3987/7000G	D3987/SW7470A				
09070896-001	Hennipin Station Bottom	Solid	7/22/2009 11:00:00 AM		A	A	A				

Comments:

22.8°c ICE

	Date/Time		Date/Time
Relinquished by:		Received by: (signature) (UPS)	7/24/09 900
Relinquished by:		Received by:	
Relinquished by:		Received by:	

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.

Bottle Type: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Plastic OT-Other

Teklab: 7/22/09

Please find enclosed a bottom ash sample to be run for the same parameters as last year. I enclosed those results with the sample. I would like to pay for this with a credit card. If you have any questions please contact me :

John Augspols

Supv. Environmental and Chemistry

(815) 339-9218

Fax (815) 339 -2772

TEKLAB, INC.

5445 HORSESHOE LAKE ROAD
COLLINSVILLE, ILLINOIS 62234

ENVIRONMENTAL TESTING LABORATORY

TEL: 618-344-1004
FAX: 618-344-1005

LABORATORY RESULTS

Client: Dynegy Midwest Generation
WorkOrder: 08060909
Lab ID: 08060909-001
Report Date: 02-Jul-08

Client Project: Hennepin Station Bottom Ash
Client Sample ID: Hennipin Station Botton Ash
Collection Date: 6/24/2008 9:00:00 AM
Matrix: SOLID

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Analyst
ASTM D3987, SW-846 3005A, 6010B, METALS IN SHAKE EXTRACT BY ICP								
Arsenic		0.0250		< 0.0250	mg/L	1	6/30/2008 12:29:55 PM	LAL
Barium		0.0050		0.0699	mg/L	1	6/30/2008 12:29:55 PM	LAL
Beryllium		0.0010		< 0.0010	mg/L	1	6/30/2008 12:29:55 PM	LAL
Boron		0.0200		0.197	mg/L	1	6/30/2008 12:29:55 PM	LAL
Cadmium		0.0020		< 0.0020	mg/L	1	6/30/2008 12:29:55 PM	LAL
Chromium		0.0100		< 0.0100	mg/L	1	6/30/2008 12:29:55 PM	LAL
Cobalt		0.0100		< 0.0100	mg/L	1	6/30/2008 12:29:55 PM	LAL
Copper		0.0100		< 0.0100	mg/L	1	6/30/2008 12:29:55 PM	LAL
Iron		0.0200		0.110	mg/L	1	6/30/2008 12:29:55 PM	LAL
Manganese		0.0050		< 0.0050	mg/L	1	6/30/2008 12:29:55 PM	LAL
Nickel		0.0100		< 0.0100	mg/L	1	6/30/2008 12:29:55 PM	LAL
Selenium		0.0500		< 0.0500	mg/L	1	6/30/2008 12:29:55 PM	LAL
Silver		0.0100		< 0.0100	mg/L	1	6/30/2008 12:29:55 PM	LAL
Zinc		0.0100	J	0.0025	mg/L	1	6/30/2008 12:29:55 PM	LAL
ASTM D3987, SW-846 3020A, METALS IN SHAKE EXTRACT BY GFAA								
Antimony, SHAKE by GFAA 7041		0.0050	J	0.0024	mg/L	1	6/30/2008 11:51:48 AM	JMW
Lead, SHAKE by GFAA 7421		0.0020		< 0.0020	mg/L	1	6/30/2008 9:45:10 AM	JMW
Thallium, SHAKE by GFAA 7841		0.0020	S	< 0.0020	mg/L	1	6/30/2008 11:17:06 AM	JMW
ASTM D3987, SW-846 7470A IN SHAKE EXTRACT								
Mercury, SHAKE		0.00020	J	0.00006	mg/L	1	6/30/2008	SRH

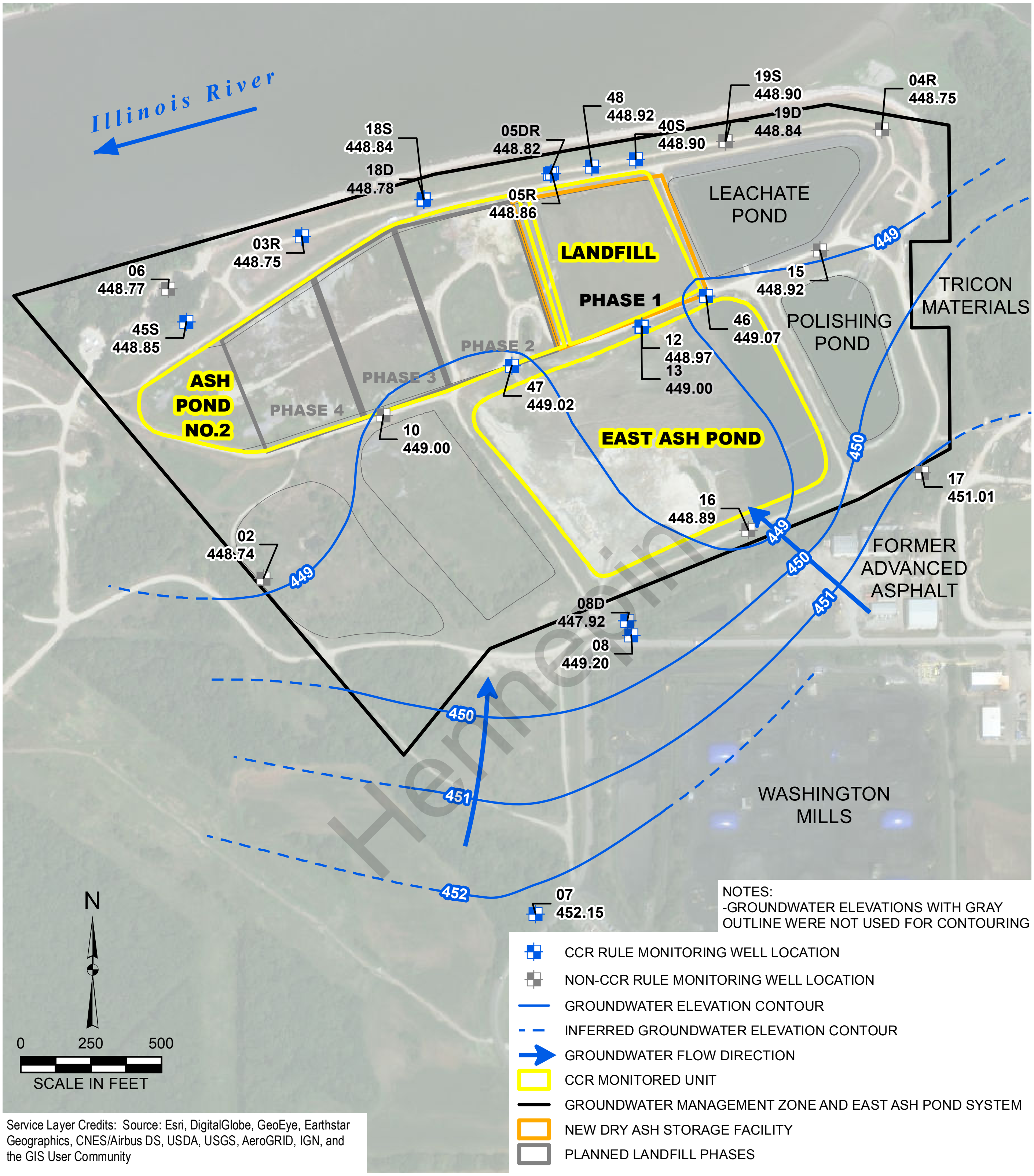
Sample Narrative
ASTM D3987, SW-846 3020A, Metals in Shake Extract by GFAA
Tl - Matrix interference present in sample.

22.8 noice
DB 7/24/09

900 FeVPS
DB 7/24/09

Appendix B

Groundwater Contour Maps, 2015-2017



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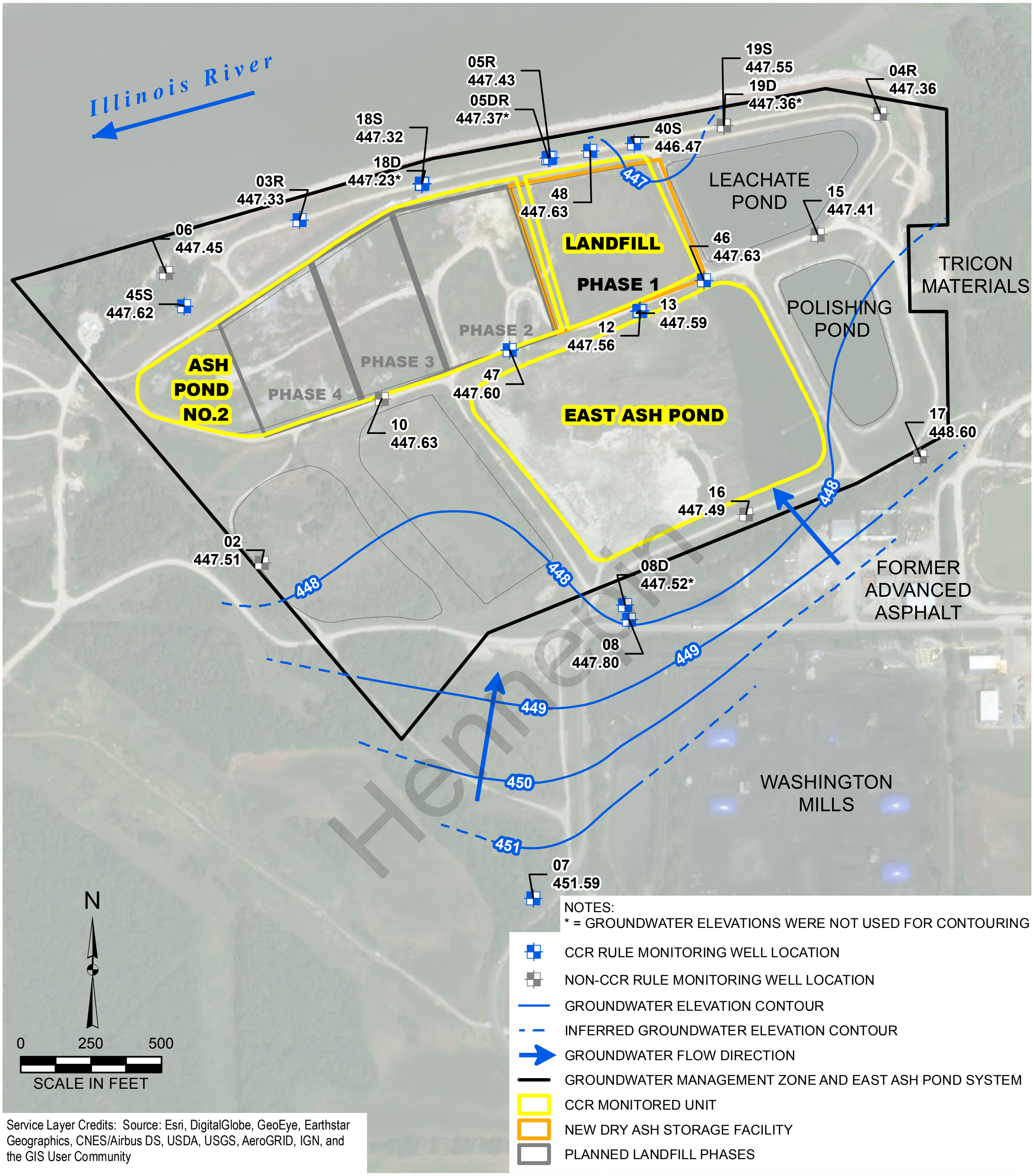
DRAWN BY/DATE:
SDS 3/27/18
REVIEWED BY/DATE:
JJW 3/27/18
APPROVED BY/DATE:
SJC 3/27/18

UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 1: DECEMBER 8, 2015

HENNEPIN LANDFILL (UNIT ID: 801)
ALTERNATE SOURCE DEMONSTRATION
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 67719



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

DRAWN BY/DATE:
SDS 3/27/18
REVIEWED BY/DATE:
JJW 3/27/18
APPROVED BY/DATE:
SJC 3/27/18

UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 2: MARCH 8, 2016

HENNEPIN LANDFILL (UNIT ID: 801)
ALTERNATE SOURCE DEMONSTRATION
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 67719

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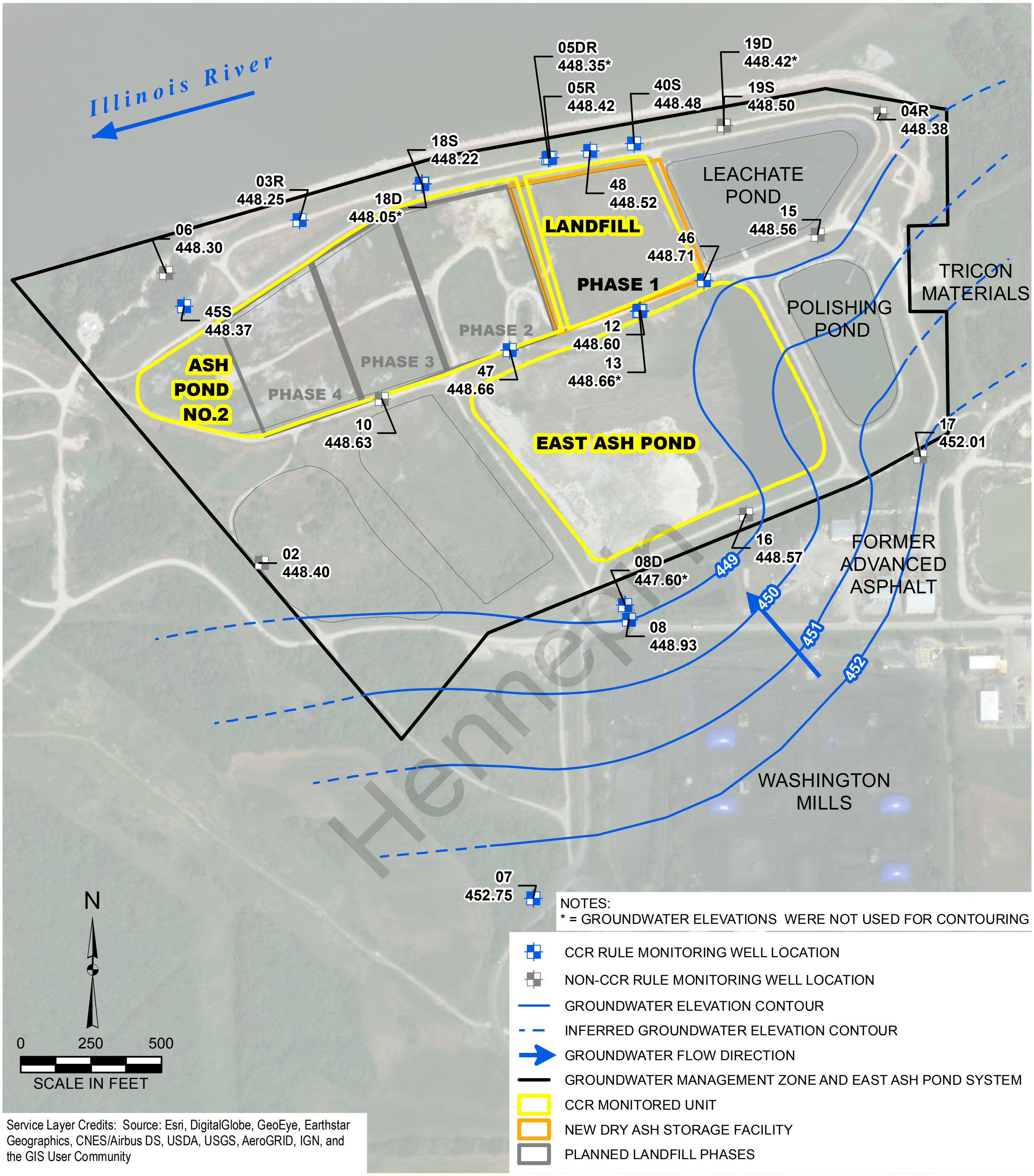

DRAWN BY/DATE:
SDS 3/27/18
REVIEWED BY/DATE:
JJW 3/27/18
APPROVED BY/DATE:
SJC 3/27/18

UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 3: JUNE 7, 2016

HENNEPIN LANDFILL (UNIT ID: 801)
ALTERNATE SOURCE DEMONSTRATION
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 67719

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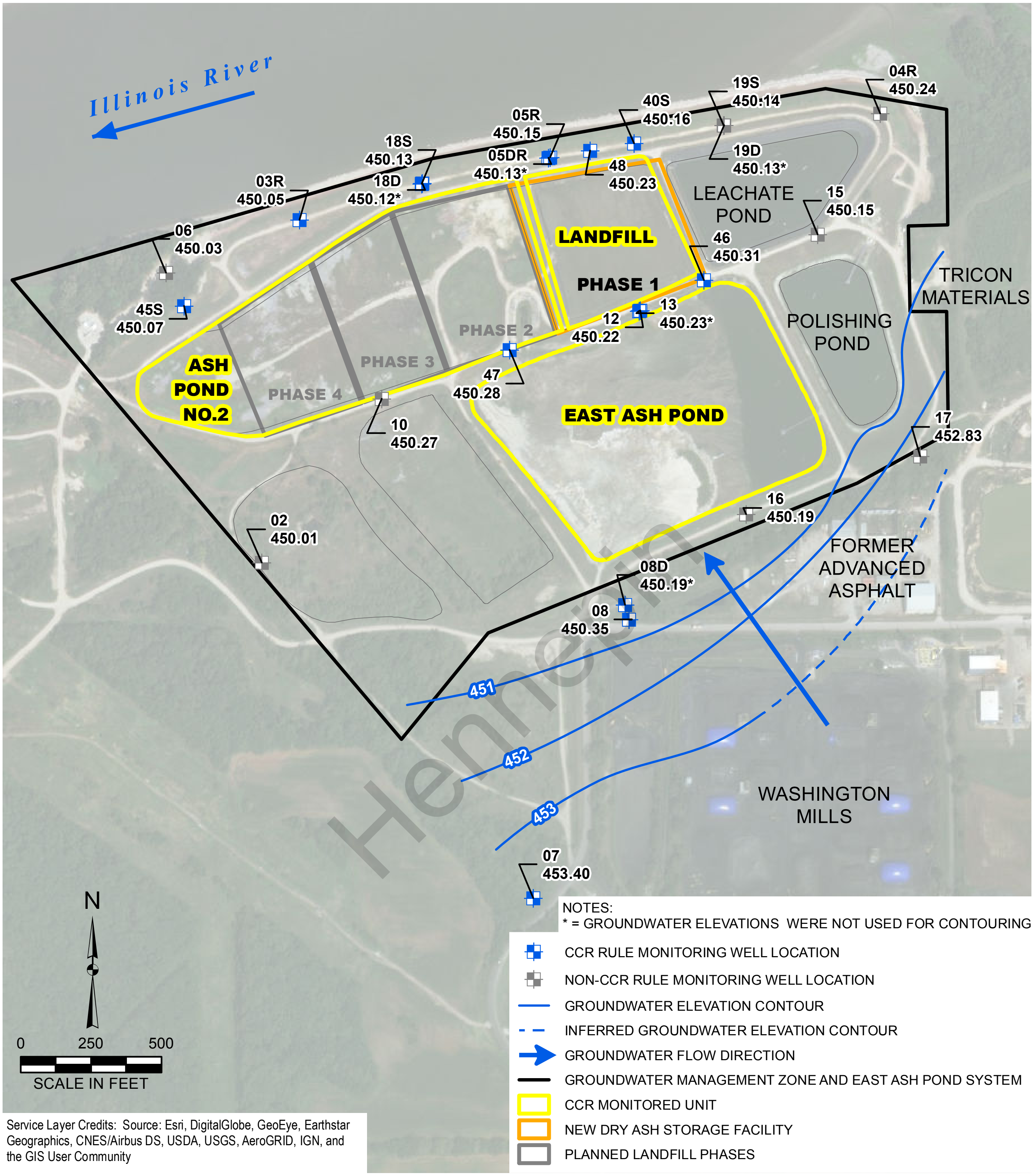


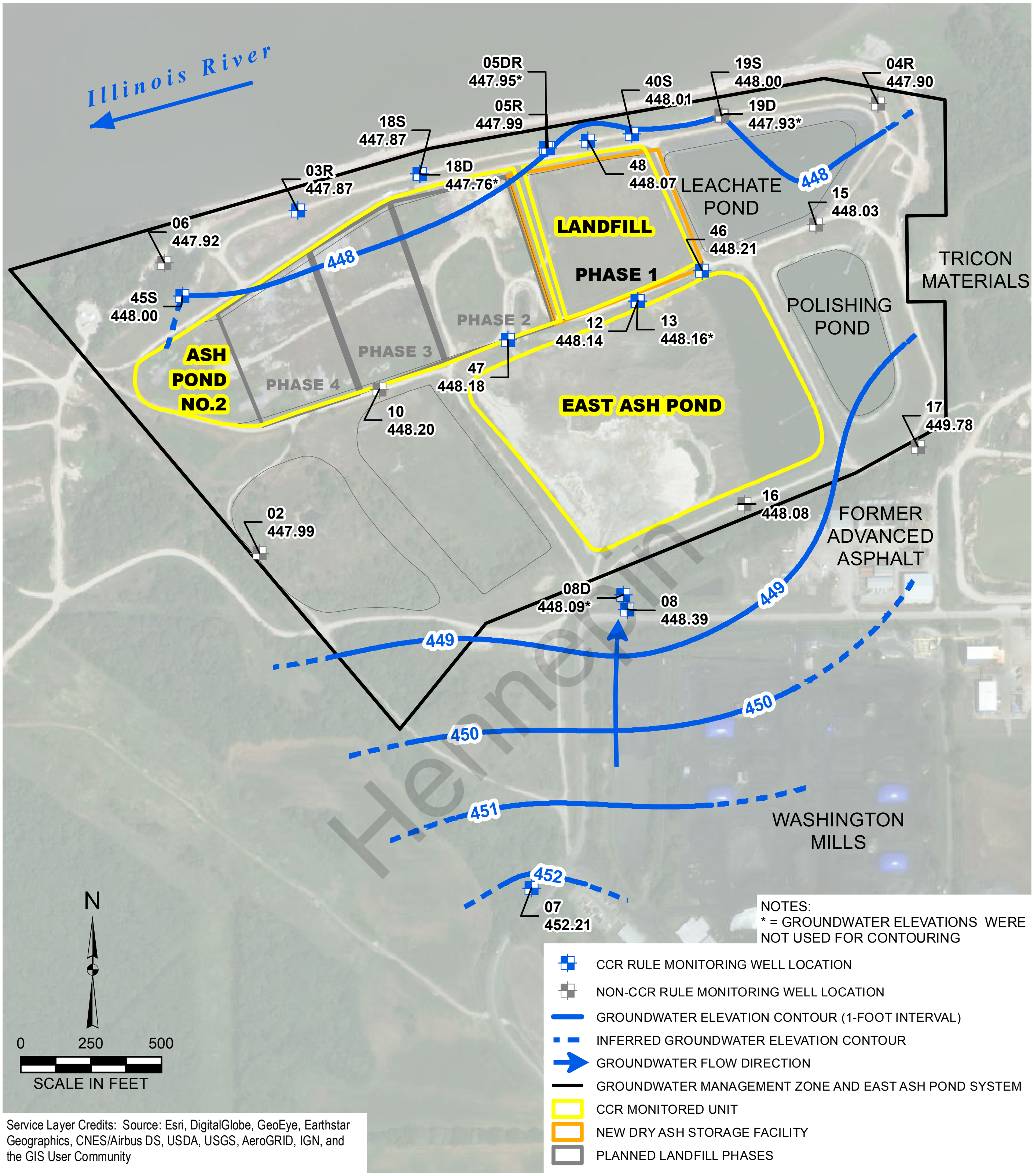
DRAWN BY/DATE:
SDS 3/27/18
REVIEWED BY/DATE:
JJW 3/27/18
APPROVED BY/DATE:
SJC 3/27/18

UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 4: SEPTEMBER 9, 2016

HENNEPIN LANDFILL (UNIT ID: 801)
ALTERNATE SOURCE DEMONSTRATION
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 67719

Y:\Mapping\Projects\22\2285_Hennepin East\MXD\Alt_Source_GWC\R4_HennepinEast_GW_Contours.mxd Author: BartelAB; Date/Time: 4/13/2018, 12:19:04 PM

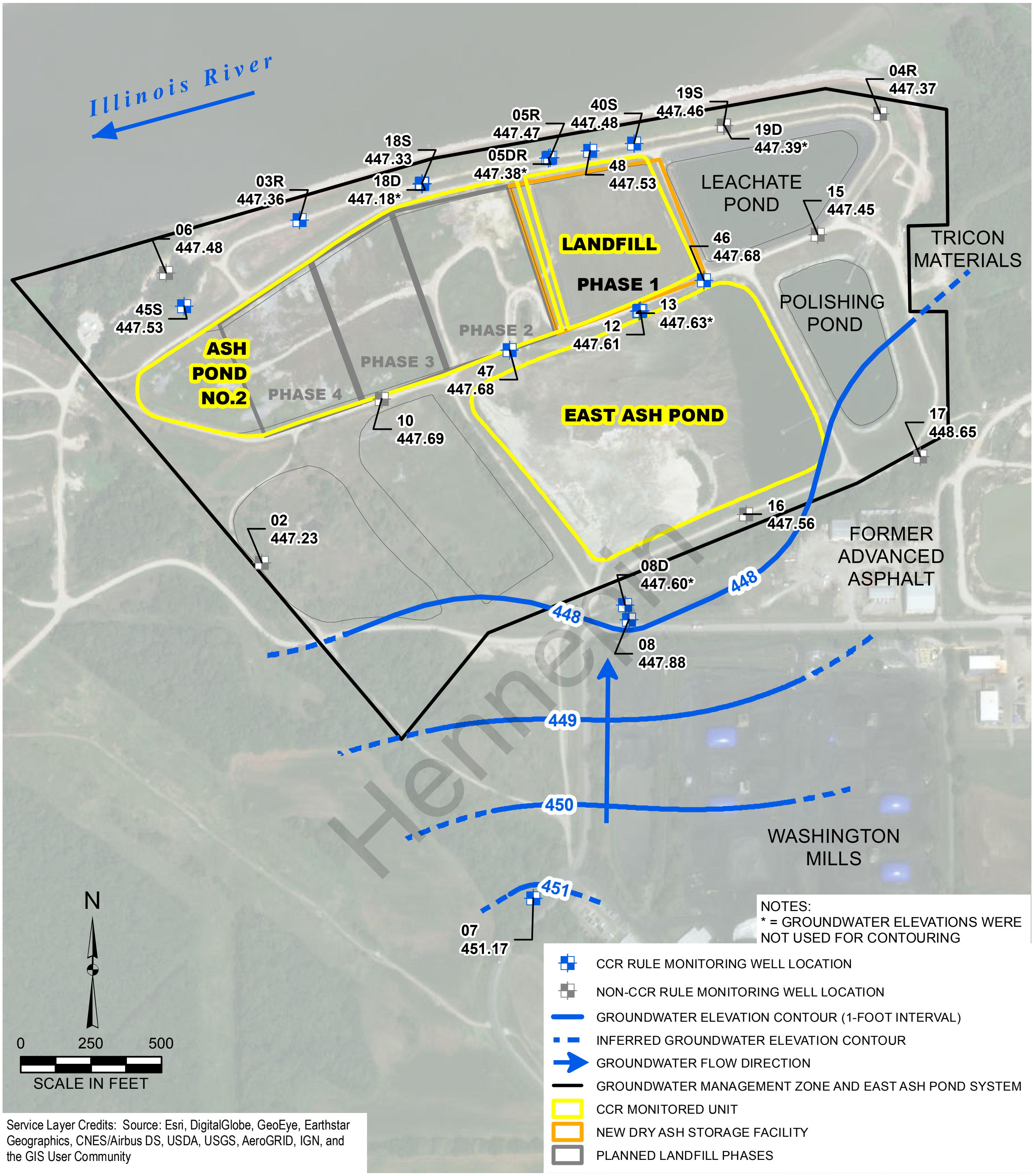


NOTES:
* = GROUNDWATER ELEVATIONS WERE NOT USED FOR CONTOURING

- CCR RULE MONITORING WELL LOCATION
- NON-CCR RULE MONITORING WELL LOCATION
- GROUNDWATER ELEVATION CONTOUR (1-FOOT INTERVAL)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- GROUNDWATER MANAGEMENT ZONE AND EAST ASH POND SYSTEM
- CCR MONITORED UNIT
- NEW DRY ASH STORAGE FACILITY
- PLANNED LANDFILL PHASES

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

DRAWN BY/DATE: SDS 3/27/18 REVIEWED BY/DATE: JJW 3/27/18 APPROVED BY/DATE: SJC 3/27/18	**UPPERMOST AQUIFER UNIT GROUNDWATER ELEVATION CONTOUR MAP ROUND 5: DECEMBER 7, 2016** HENNEPIN LANDFILL (UNIT ID: 801) ALTERNATE SOURCE DEMONSTRATION HENNEPIN POWER STATION HENNEPIN, ILLINOIS	PROJECT NO: 67719

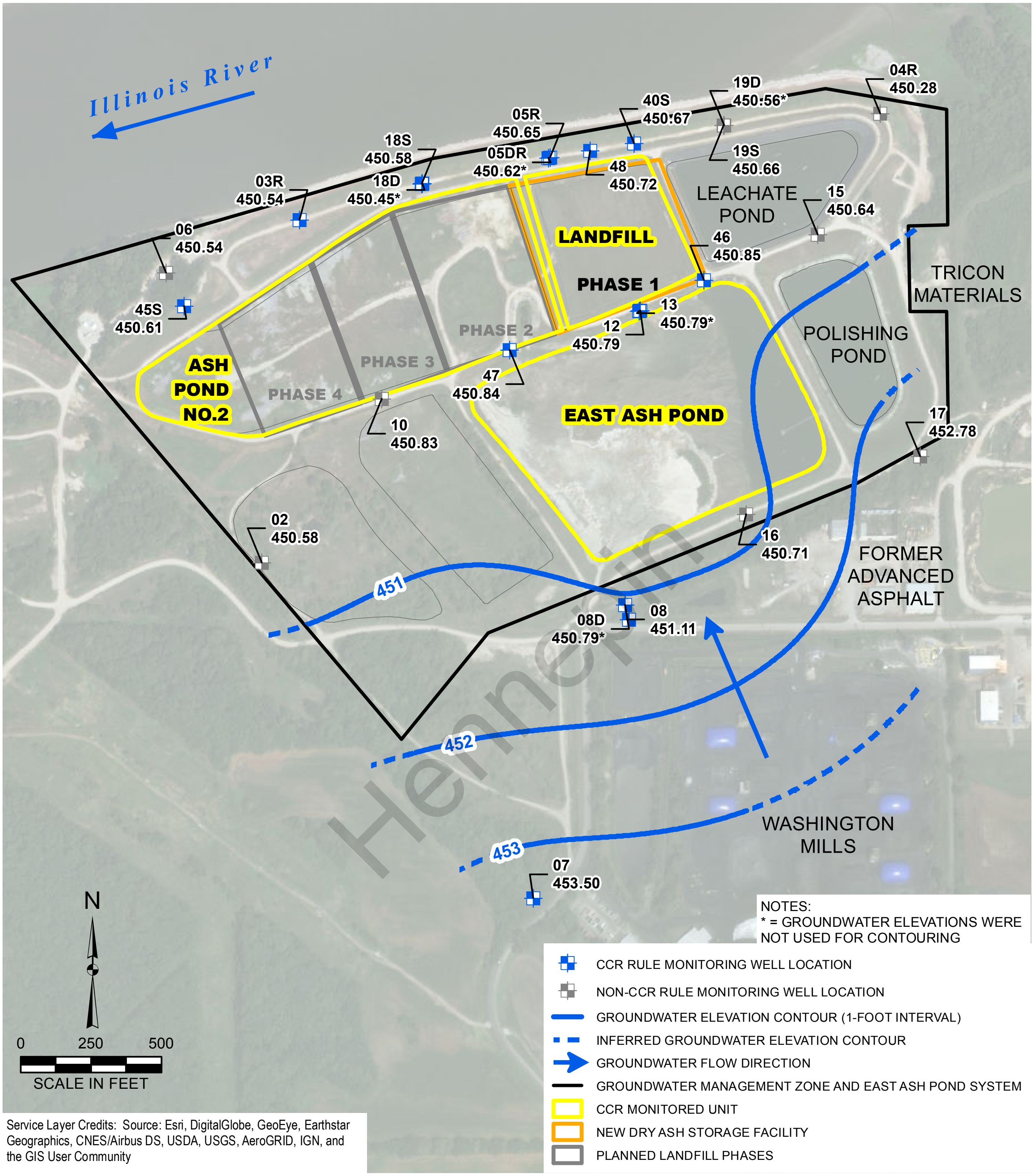


DRAWN BY/DATE:
SDS 3/27/18
REVIEWED BY/DATE:
JJW 3/27/18
APPROVED BY/DATE:
SJC 3/27/18

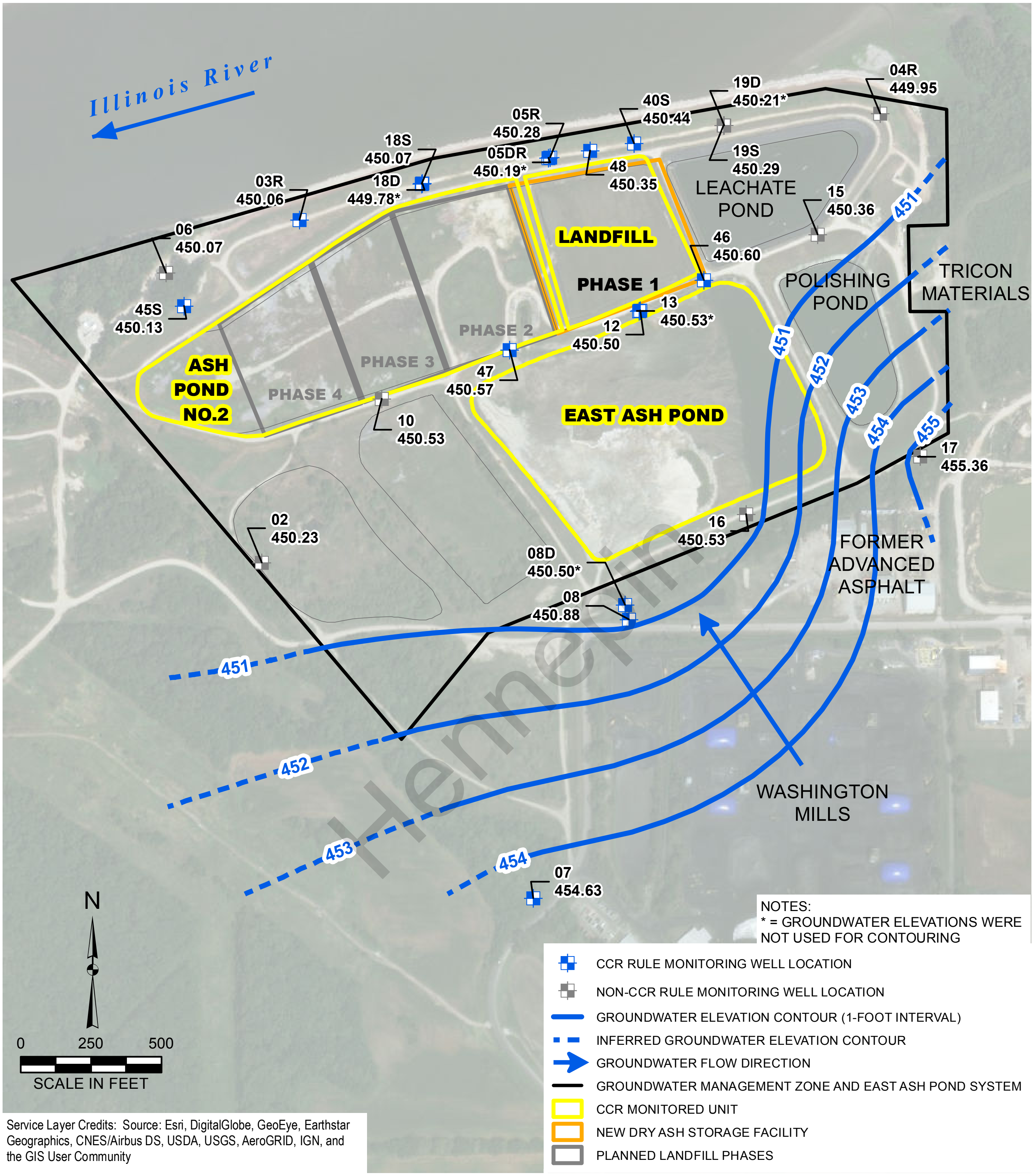
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 6: FEBRUARY 20, 2017

HENNEPIN LANDFILL (UNIT ID: 801)
ALTERNATE SOURCE DEMONSTRATION
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 67719



DRAWN BY/DATE: SDS 3/27/18 REVIEWED BY/DATE: JJW 3/27/18 APPROVED BY/DATE: SJC 3/27/18	**UPPERMOST AQUIFER UNIT GROUNDWATER ELEVATION CONTOUR MAP ROUND 7: APRIL 25, 2017** HENNEPIN LANDFILL (UNIT ID: 801) ALTERNATE SOURCE DEMONSTRATION HENNEPIN POWER STATION HENNEPIN, ILLINOIS	PROJECT NO: 67719



DRAWN BY/DATE:
SDS 3/27/18
REVIEWED BY/DATE:
JJW 3/27/18
APPROVED BY/DATE:
SJC 3/27/18

UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 8: JUNE 8, 2017

HENNEPIN LANDFILL (UNIT ID: 801)
ALTERNATE SOURCE DEMONSTRATION
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 67719

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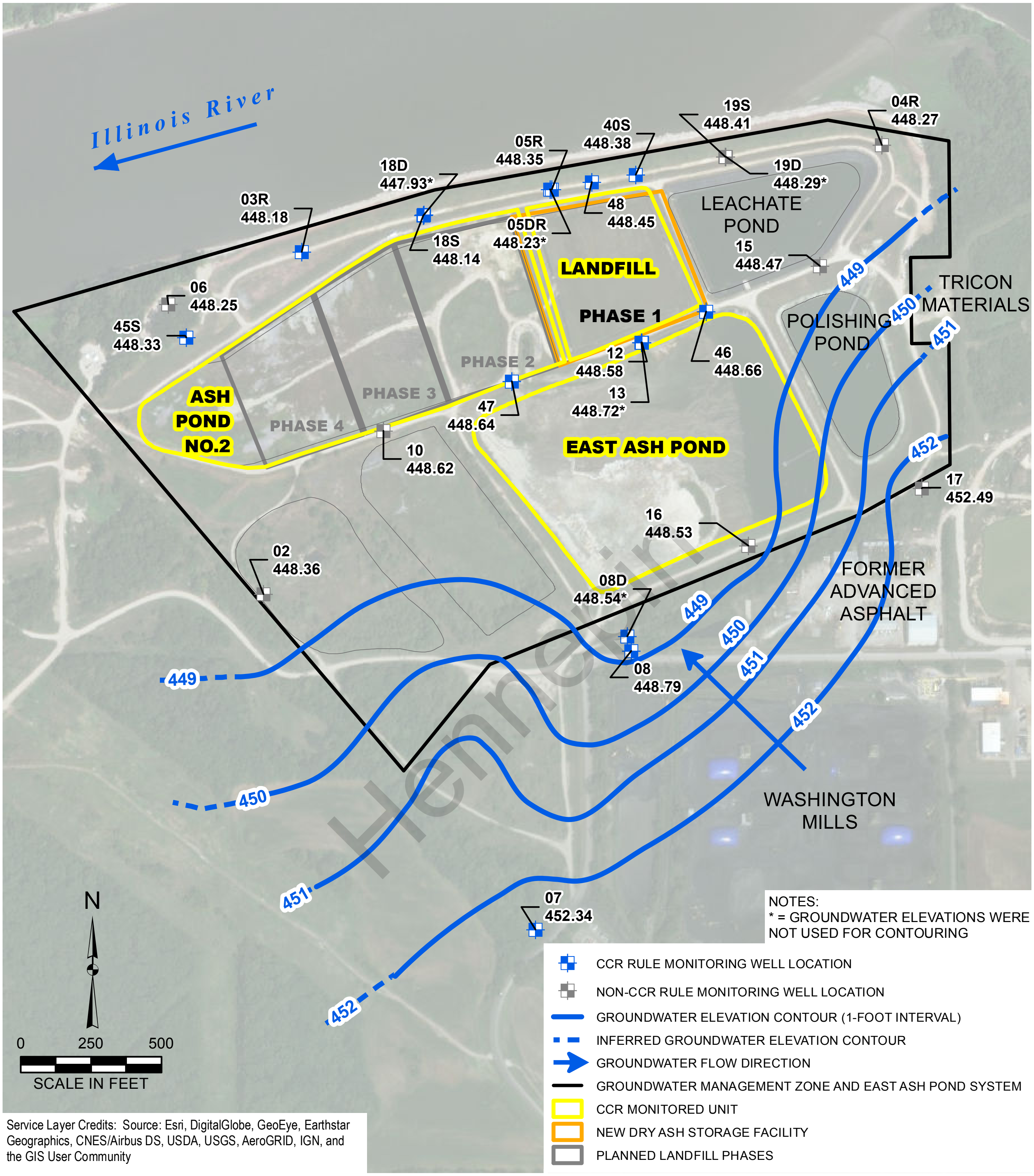

NOTES:
* = GROUNDWATER ELEVATIONS WERE NOT USED FOR CONTOURING

CCR RULE MONITORING WELL LOCATION
NON-CCR RULE MONITORING WELL LOCATION
GROUNDWATER ELEVATION CONTOUR (1-FOOT INTERVAL)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
GROUNDWATER MANAGEMENT ZONE AND EAST ASH POND SYSTEM
CCR MONITORED UNIT
NEW DRY ASH STORAGE FACILITY
PLANNED LANDFILL PHASES

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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DRAWN BY/DATE: SDS 3/27/18
REVIEWED BY/DATE: JJW 3/27/18
APPROVED BY/DATE: SJC 3/27/18

UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 9: NOVEMBER 15, 2017

HENNEPIN LANDFILL (UNIT ID: 801)
ALTERNATE SOURCE DEMONSTRATION
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 67719

OBG

Part of Ramboll