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2019 Annual Groundwater Monitoring and Corrective Action Report

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2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

HENNEPIN LANDFILL, HENNEPIN POWER STATION

RAMBOLL Bright ideas. Sustainable change.

2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
HENNEPIN LANDFILL, HENNEPIN POWER STATION

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Checked by	**Staci L. Goetz**
Approved by	**Eric J. Tlachac**
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Ramboll
234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA

T 414-837-3607
F 414-837-3608
https://ramboll.com

Kristen L. Theesfeld
Hydrogeologist

Staci L. Goetz
Managing Geologist

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ACRONYMS AND ABBREVIATIONS

ASD	Alternate Source Demonstration
CCR	Coal Combustion Residuals
LF	Landfill
SAP	Sampling and Analysis Plan
SSI	Statistically Significant Increase

EXECUTIVE SUMMARY

This report has been prepared to provide the information required by Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257.90(e) for the Hennepin Landfill (LF) located at Hennepin Power Station near Hennepin, Illinois.

Groundwater is being monitored at Hennepin LF in accordance with the Detection Monitoring Program requirements specified in 40 C.F.R. § 257.94.

No changes were made to the monitoring system in 2019 (no wells were installed or decommissioned).

The following Statistically Significant Increases (SSIs) of 40 C.F.R. Part 257 Appendix III parameter concentrations greater than background concentrations were determined during one or more sampling events in 2019:

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

Alternate Source Demonstrations (ASDs) were completed for the SSIs referenced above and Hennepin LF remains in the Detection Monitoring Program.

1. INTRODUCTION

This report has been prepared by Ramboll on behalf of Dynegy Midwest Generation, LLC, to provide the information required by 40 C.F.R. § 257.90(e) for Hennepin LF located at Hennepin Power Station near Hennepin, Illinois.

In accordance with 40 C.F.R. § 257.90(e), the owner or operator of a 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 relative to background levels).
5. Other information required to be included in the Annual Report as specified in §§ 257.90 through 257.98.

This report provides the required information for Hennepin LF for calendar year 2019.

2. MONITORING AND CORRECTIVE ACTION PROGRAM STATUS

No changes have occurred to the monitoring program status in calendar year 2019, and Hennepin LF remains in the Detection Monitoring Program in accordance with 40 C.F.R. § 257.94.

3. KEY ACTIONS COMPLETED IN 2019

The Detection Monitoring Program is summarized in Table A. The groundwater monitoring system, including the CCR unit and all background and downgradient monitoring wells, is presented in Figure 1. No changes were made to the monitoring system in 2019 (no wells were installed or decommissioned). In general, one groundwater sample was collected from each background and downgradient well during each monitoring event. All samples were collected and analyzed in accordance with the Sampling and Analysis Plan (SAP) (NRT/OBG, 2017a). All monitoring data obtained under 40 C.F.R. §§ 257.90 through 257.98 (as applicable) in 2019 are presented in Table 1. Analytical data were evaluated in accordance with the Statistical Analysis Plan (NRT/OBG, 2017b) to determine any SSIs of Appendix III parameters relative to background concentrations.

Statistical background values are provided in Table 2.

Analytical results for the December 2018 sampling event were provided in the 2018 Annual Groundwater Monitoring and Corrective Action Report.

Potential alternate sources were evaluated as outlined in the 40 C.F.R. § 257.94(e)(2). ASDs were completed and certified by a qualified professional engineer. The dates the ASDs were completed are provided in Table A. The ASDs completed in 2019 are included in Appendix A.

Table A – 2018–2019 Detection Monitoring Program Summary

Sampling Date	Analytical Data Receipt Date	Parameters Collected	SSI(s)	SSI(s) Determination Date	ASD Completion Date
June 14, 2018	August 3, 2018	Appendix III	Boron (05DR, 05R, 40S, 48) Fluoride (40S, 48)	October 7, 2018 Revised April 17, 2019	January 7, 2019
September 13, 2018	October 23, 2019	Appendix III Greater than Background [1]	NA	NA	NA
December 12-13, 2018	January 14, 2019	Appendix III	Boron (05DR, 05R, 40S, 48) Fluoride (05DR, 40S, 48) pH (05R, 40S, 48)	April 15, 2019	July 15, 2019
March 13- 14, 2019	April 15, 2019	Appendix III	Boron (05DR, 05R, 40S, 48) Fluoride (05DR, 05R, 40S, 48) pH (05DR, 05R, 40S, 48)	July 15, 2019	October 14, 2019
September 17-18, 2019	October 15, 2019	Appendix III	TBD	TBD	TBD

Notes:

NA: Not Applicable
TBD: To Be Determined
1. To confirm SSIs, as allowed by the Statistical Analysis Plan, groundwater samples were collected and analyzed for Appendix III parameters initially detected at concentrations greater than statistical background values in the preceding sampling event.

4. PROBLEMS ENCOUNTERED AND ACTIONS TO RESOLVE THE PROBLEMS

No problems were encountered with the Groundwater Monitoring Program during 2019. Groundwater samples were collected and analyzed in accordance with the SAP (NRT/OBG, 2017a), and all data were accepted.

5. KEY ACTIVITIES PLANNED FOR 2020

The following key activities are planned for 2020:

- Continuation of the Detection Monitoring Program with semi-annual sampling scheduled for the first and third quarters of 2020.
- Complete evaluation of analytical data from the downgradient wells, using background data to determine whether an SSI of Appendix III parameters detected at concentrations greater than 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 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 2020 Annual Groundwater Monitoring and Corrective Action Report.
  - If an alternate source(s) is not identified to be the cause of the SSI, the applicable requirements of 40 C.F.R. §§ 257.94 through 257.98 as may apply in 2020 (e.g., Assessment Monitoring) will be met, including associated recordkeeping/notifications required by 40 C.F.R. §§ 257.105 through 257.108.

6. REFERENCES

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

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

TABLES

TABLE 1.
2019 ANALYTICAL RESULTS - GROUNDWATER ELEVATION AND APPENDIX III PARAMETERS
2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
HENNEPIN POWER STATION
UNIT ID 801 - HENNEPIN LANDFILL
HENNEPIN, ILLINOIS
DETECTION MONITORING PROGRAM

Well Identification Number	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Date & Time Sampled	Depth to Groundwater (ft)[1]	Groundwater Elevation (ft NAVD88)	40 C.F.R. Part 257 Appendix III						
						Boron, total (mg/L) 6020A[2]	Calcium, total (mg/L) 6020A[2]	Chloride, total (mg/L) 9251[2]	Fluoride, total (mg/L) 9214[2]	pH (field) (S.U.) SM 4500 H+B[2]	Sulfate, total (mg/L) 9036[2]	Total Dissolved Solids (mg/L) SM 2540C[2]
Background / Upgradient Monitoring Wells												
07	41.297944	-89.305756	3/14/2019 13:05	65.50	452.77	0.0869	140	44	<0.10	6.9	59	590
			9/18/2019 8:48	64.60	453.67	0.0797	147	33	0.11	6.3	55	666
08	41.300653	-89.304486	3/14/2019 11:53	51.59	449.79	0.172	239	272	<0.10	6.8	193	1370
			9/18/2019 9:42	50.82	450.56	0.151	242	220	<0.10	6.6	195	1360
08D	41.300797	-89.304532	3/14/2019 11:31	51.89	449.45	0.170	184	246	0.12	6.8	143	1220
			9/18/2019 9:15	50.90	450.44	0.117	187	226	0.12	6.7	121	1230
Downgradient Monitoring Wells												
05DR	41.305160	-89.305471	3/13/2019 14:53	38.95	449.42	1.13	80.5	83	0.14	7.6	71	502
			9/17/2019 17:31	38.52	449.85	1.13	89.8	71	0.17	7.3	85	552
05R	41.305163	-89.305449	3/13/2019 15:08	38.96	449.47	1.13	79.8	75	0.13	7.7	81	512
			9/17/2019 17:18	38.53	449.90	0.90	85.6	75	0.15	7.4	73	528
40S	41.305292	-89.304363	3/13/2019 15:40	38.28	449.39	3.75	92.9	77	0.15	7.6	129	578
			9/17/2019 16:48	37.75	449.92	2.38	90.9	66	0.19	7.5	104	570
48	41.305227	-89.304931	3/13/2019 15:26	37.91	449.55	0.937	80.3	81	0.18	7.7	72	518
			9/17/2019 17:06	37.44	450.02	1.47	86.2	69	0.21	7.5	85	558

[O: RAB 12/23/19, C: KLT 12/24/19]

Notes:
40 C.F.R. = Title 40 of the Code of Federal Regulations
ft = foot/feet
mg/L = milligrams per liter
NAVD88 = North American Vertical Datum of 1988
S.U. = Standard Units
< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method; estimated concentrations below the reporting limit and associated qualifiers are not provided since not utilized in statistics to determine Statistically Significant Increases (SSIs) over background.
[1]All depths to groundwater were measured on the first day of the sampling event.
[2]4-digit numbers represent SW-846 analytical methods.

TABLE 2.
STATISTICAL BACKGROUND VALUES
2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
HENNEPIN POWER STATION
UNIT ID 801 - HENNEPIN LANDFILL
HENNEPIN, ILLINOIS
DETECTION MONITORING PROGRAM

Parameter	Statistical Background Value (UPL)
40 C.F.R. Part 257 Appendix III	
Boron (mg/L)	0.15
Calcium (mg/L)	274
Chloride (mg/L)	384
Fluoride (mg/L)	0.12
pH (S.U.)	6.6 / 7.5
Sulfate (mg/L)	196
Total Dissolved Solids (mg/L)	1493

[O: RAB 12/23/19, C: KLT 12/24/19]

Notes:
40 C.F.R. = Title 40 of the Code of Federal Regulations
mg/L = milligrams per liter
S.U. = Standard Units
UPL = Upper Prediction Limit

FIGURES

UPGRADIENT WELL LOCATION
DOWNGRADIENT WELL LOCATION
CCR MONITORED UNIT

0 175 350 Feet

MONITORING WELL LOCATION MAP
HENNEPIN LANDFILL
UNIT ID:801

2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
VISTRA CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

FIGURE 1

O'BRIEN & GERE ENGINEERS, INC.
A RAMBOLL COMPANY

APPENDIX A
ALTERNATE SOURCE DEMONSTRATIONS

40 C.F.R. § 257.94(e)(2): ALTERNATE SOURCE DEMONSTRATION
HENNEPIN LANDFILL
JANUARY 7, 2019

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

Hennepin Power Station
Hennepin, Illinois

Dynegy Midwest Generation, LLC

January 7, 2019

OBG
Part of Ramboll

JANUARY 7, 2019 | PROJECT #72756

40 C.F.R. § 257.94(E)(2): Alternate Source Demonstration Hennepin Landfill

Hennepin Power Station
Hennepin, Illinois

Prepared for:
Dynegy Midwest Generation, LLC

KRISTEN L. THEESFELD
Hydrogeologist

ERIC J. TLACHAC
Managing Engineer

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Figures 1 and 2 are attached, Figures 3-9 are included in the text.

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

ASD	Alternate Source Demonstration
Ash Pond No. 2	Hennepin Ash Pond No. 2
CCR	Coal Combustion Residuals
CCR Rule	40 C.F.R. Part 257
CEC	Civil & Environmental Consultants, Inc.
40 C.F.R.	Title 40 of the Code of Federal Regulations
cm/s	centimeters per second
East Ash Pond	Hennepin East Ash Pond
HDPE	High-density Polyethylene
IEPA	Illinois Environmental Protection Agency
Landfill	Hennepin Landfill
mg/L	milligrams per liter
msl	mean sea level
NPDES	National Pollutant Discharge Elimination System
NRT/OBG	Natural Resource Technology, an OBG Company
OBG	O'Brien & Gere Engineers, Inc., part of Ramboll
Site	Hennepin Power Station
SSI	Statistically Significant Increase
STD	Standard Units
UPL	Upper Prediction Limit

1 INTRODUCTION

1.1 OVERVIEW

Title 40 of the Code of Federal Regulations (40 C.F.R.) Section 257.94(e)(2) allows the owner or operator of a Coal Combustion Residuals (CCR) unit 90 days from the date of determination of Statistically Significant Increases (SSIs) over background for groundwater constituents listed in Appendix III of 40 C.F.R. Part 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSI(s), or that the SSI(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (Alternate Source Demonstration [ASD]).

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

The second semi-annual detection monitoring samples (Detection Monitoring Round 2 [D2]) were collected on June 14, 2018 and analytical data were received on August 3, 2018. In accordance with 40 C.F.R. § 257.93(h)(2), statistical analysis of the data to identify SSIs of 40 C.F.R. Part 257 Appendix III parameters over background concentrations was completed by October 7, 2018, within 90 days of receipt of the analytical data. The statistical determination identified the following SSIs at downgradient monitoring wells:

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

In accordance with the Statistical Analysis Plan (NRT/OBG, 2017a), to verify the SSIs, wells 05R, 05DR, 40S and 48 were resampled on September 13, 2018 and analyzed only for the SSI parameters at each well. Following evaluation of analytical data from the resample, the SSIs listed above were confirmed.

Pursuant to 40 C.F.R. § 257.94(e)(2), the following demonstrates that sources other than the Hennepin Landfill were the cause of the SSIs listed above. This ASD was completed by January 7, 2019, within 90 days of determination of the SSIs as required by 40 C.F.R. § 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 regulated under 40 C.F.R. 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 Landfill (Landfill), 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 East Ash Pond System 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, 2017b) prepared for the Landfill. Statistical evaluation of analytical data is performed in accordance with the Statistical Analysis Plan.

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 1).

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.
2014	North Embankment tree removal, grading, and vegetation re-establishment adjacent to Ash Pond No. 2.

Table 1. 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), and an addendum to this plan was submitted in October 2018 (OBG/CEC; 2018) to provide closure and post-closure care information for Ash Pond No. 4.

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 high-density polyethylene (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.

Ash Pond No. 4: A former unlined impoundment, now dry, is classified as a non-CCR Rule pond (capped or otherwise maintained). Based on review of aerial photographs and other site information, ash was placed in a former sand and gravel quarry between 1978 and 1984.

A Modified Closure Work Plan submitted and approved in 2010 indicated Ash Pond No. 4 would remain uncovered until such time that ash was no longer being mined for reuse. Given market conditions, Ash Pond No. 4 will be closed in conjunction with Ash Pond No. 2 as specified in the Modified Closure Work Plan, as described in the October 2018 Closure Plan Addendum for Ash Pond No. 2 referenced above.

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/s). 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 ponds that are not subject to CCR Rule requirements including the Polishing Pond (located east of the East Ash Pond) and the Leachate Pond (located 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/s. 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/s. 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 Hennepin Power Station 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 sands 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

As allowed by 40 C.F.R. § 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 is bottom ash that was placed as a post-construction freeze-protection measure to protect the leachate collection system and geomembrane liner. The 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 in Ash Pond No. 2 and Underlying the Landfill: 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. The other portions of the pond are currently exposed, and subject to infiltration of precipitation and generation of CCR leachate. The pond is unlined, potentially allowing CCR leachate to percolate to groundwater. A revised closure plan for these portions of the pond, which includes the construction of a cover designed to minimize surface water infiltration and leachate generation, was developed in 2018 and is awaiting approval by IEPA prior to implementation. Boring logs indicate that ash fill underlying the Hennepin Landfill may extend to 454 feet above msl. Groundwater elevation measurements indicate 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 CCR constituent concentrations from these intermittent episodes of ash saturation may be present on a transient basis at some downgradient locations after normal groundwater flow resumes. Similarly, boring logs indicate that the ash fill in the unlined Ash Pond No. 2 may extend to 451 above msl. These deeper ash deposits may 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 and other constituents.
- East Ash Pond: The East Ash Pond is directly upgradient from the Landfill. SSIs were reported in monitoring wells downgradient from the East Ash Pond for the same Appendix III parameters – boron and fluoride – as in monitoring wells downgradient from the Landfill. Elevated Appendix III parameters observed in the Landfill downgradient wells may be impacted by upgradient CCR leachate from the East Ash Pond if percolation to groundwater occurs. Any leachate that may reach groundwater beneath the East Ash Pond would be transported laterally in the direction of groundwater flow towards the Illinois River and beneath the Landfill.

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 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 (Appendix A) 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:

- Barium: 0.116 milligrams per liter (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 0.08-0.17 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.

Bottom ash leachate data was not available for fluoride.

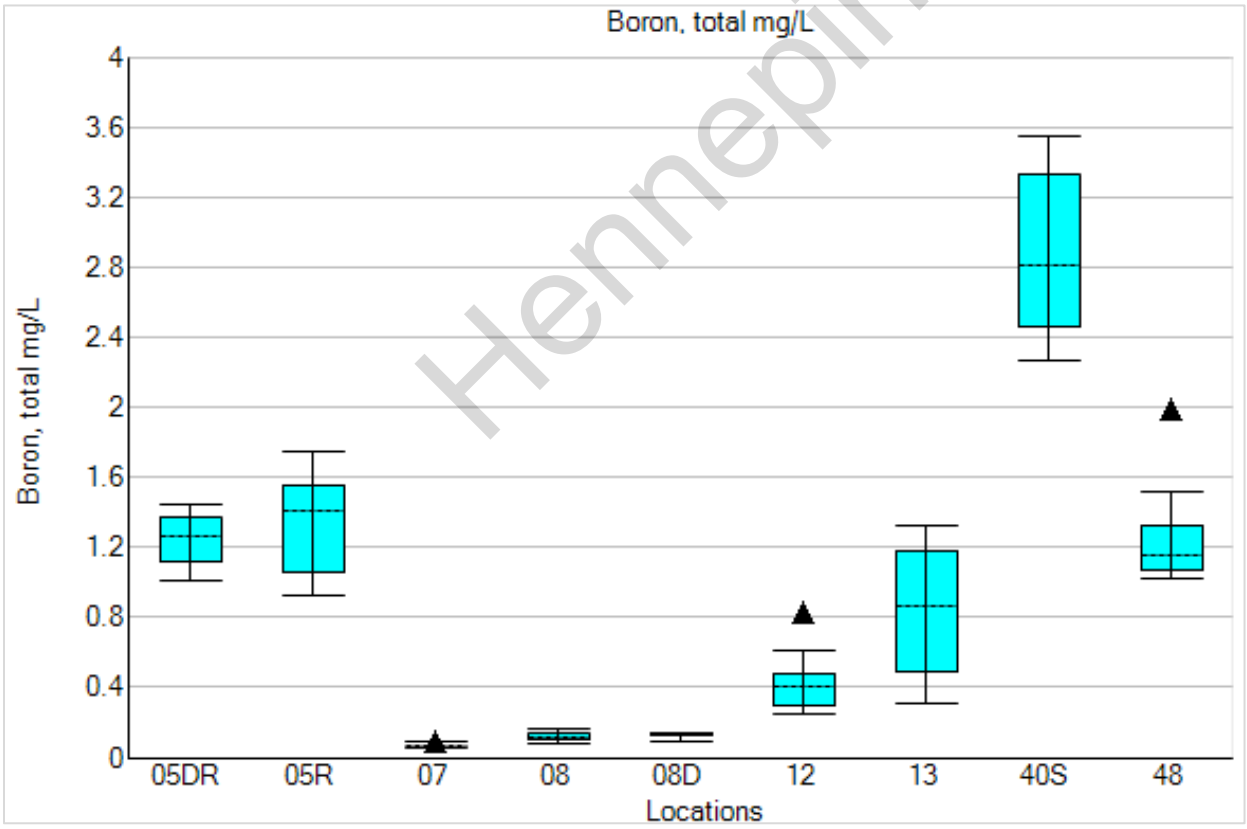


Figure 3. Box-Whisker Plot Showing Distribution of Boron.
Boron concentrations for data collected under the CCR Rule monitoring program for monitoring wells upgradient (07, 08, 08D), between the East Ash Pond and Landfill (12, 13) and downgradient (05R, 05DR, 40S, 48) of the Hennepin Landfill are shown in the figure above.

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

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. The other portions of the pond are currently exposed, and subject to infiltration of precipitation and generation of CCR leachate. Since the pond is unlined, CCR leachate may percolate to groundwater. A revised closure plan for the exposed portions of the pond, which includes the construction of a cover designed to minimize surface water infiltration and leachate generation, was developed in 2018 and is awaiting approval by IEPA prior to implementation.

The hydrogeological assessment submitted with the 2018 revised closure plan for Ash Pond No. 2documents 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 assessment 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 have the potential to become partially saturated for a transient period; and, may result in a temporary change to some CCR constituent concentrations at some downgradient locations after groundwater flow direction returns to normal. Since boron is the primary indicator of coal ash leachate, elevated boron concentrations indicate the potential for increased concentrations of other coal ash constituents 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 and March 26-27 ,2018 sampling events appear to have captured this phenomenon as evidenced by a temporary increase in dissolved boron concentrations at downgradient well 40S, and to a lesser extent well 05R, as shown in Figure 4 below. Following each transient event, the boron concentrations at both monitoring wells returned to their prior long-term trends.

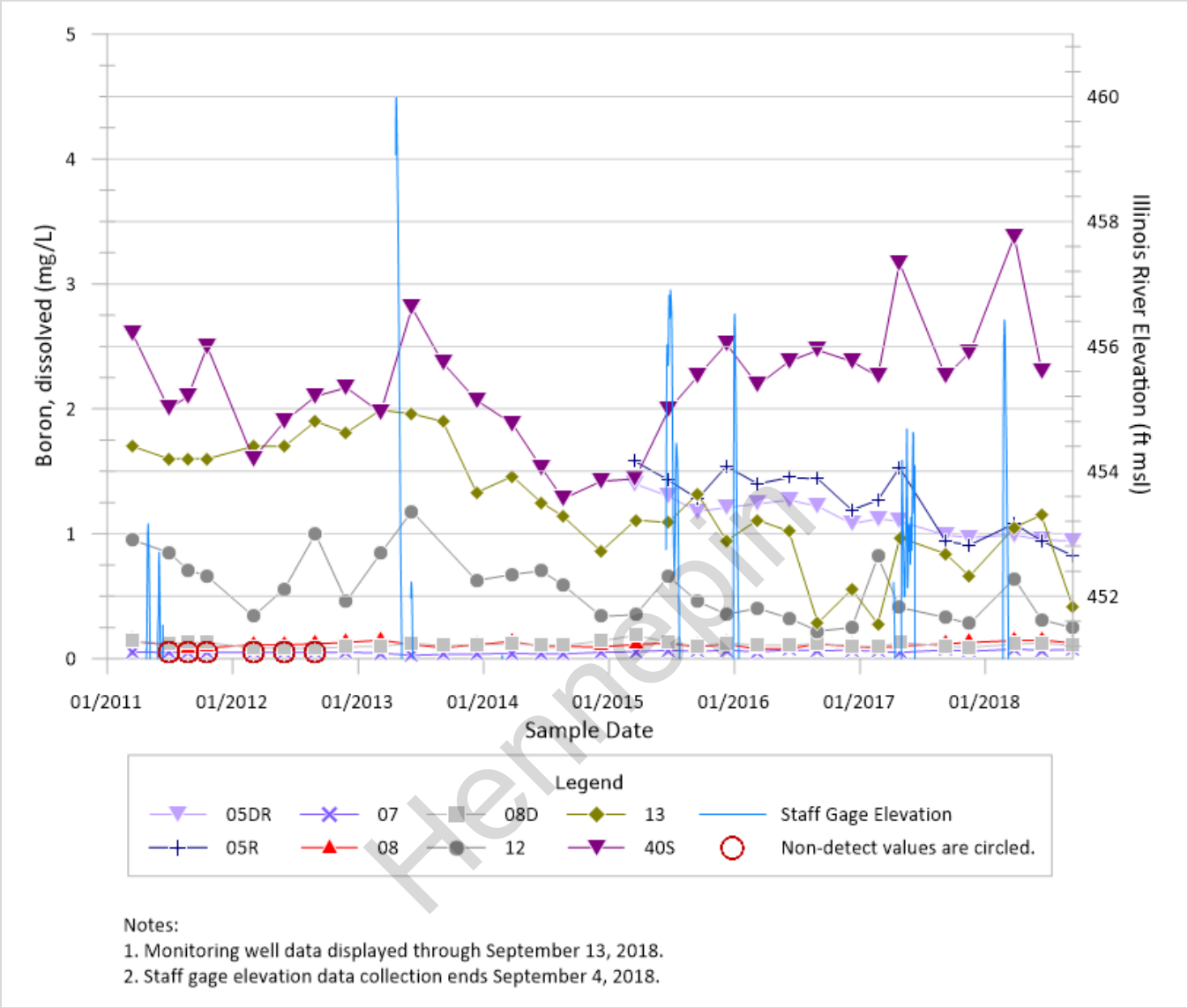


Figure 4. Trends in Dissolved Boron Compared to River Elevations, 2011-2018.
Dissolved boron is shown rather than total boron due to the availability of long-term trend data. Only river elevations exceeding 451 ft msl are shown.

Wells 40S, 05R, and 05DR are located downgradient of the ash fill area under Hennepin Landfill. Monitoring wells 12 and 13 are located upgradient (south) of the landfill, and background wells 07, 08, and 08D, are shown for comparison. Figure 5 also shows elevated total boron concentration at well 40S in the second quarters of 2017 and 2018. Total boron was not analyzed in samples collected March 26-27, 2018.

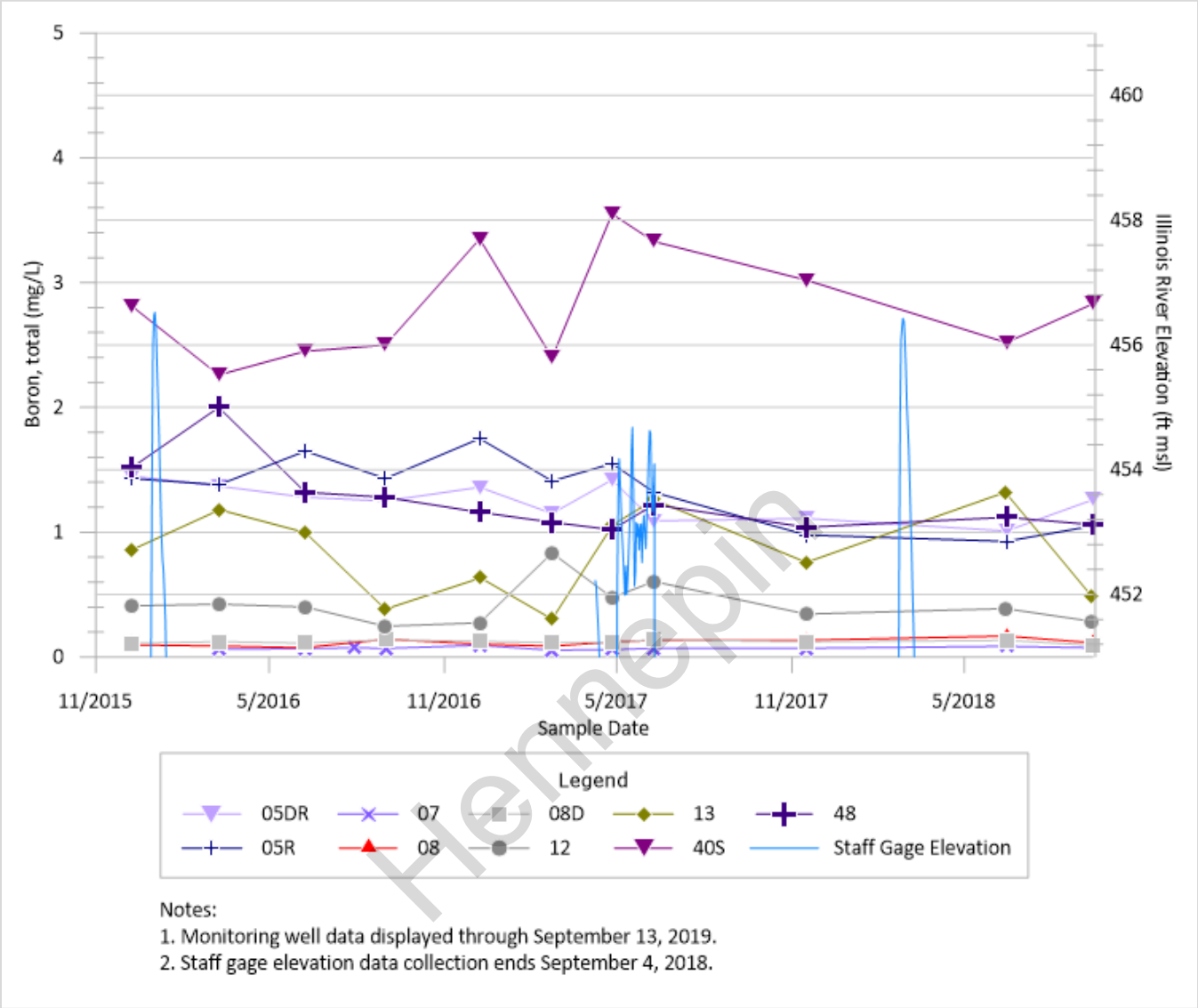


Figure 5. Trends in Total Boron Concentration Compared to River Elevations.
Only river elevations exceeding 451 ft msl are shown.

This demonstrates that low-lying ash deposits, located underneath the Landfill that can occasionally become wetted due to natural variation in river elevation, represent a potential 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 East Ash Pond System 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 6), dated July 25, 2018, 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 6. Photo of Hennepin East and Surrounding Industrial Areas (July 25, 2018).

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, 15, 16, 17, and 46. 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 2015-2018 at these and other monitoring wells at Hennepin East is shown below (Figure 7), Well 46 is not included on Figure 7 due to the lack of dissolved fluoride data at this location. 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.

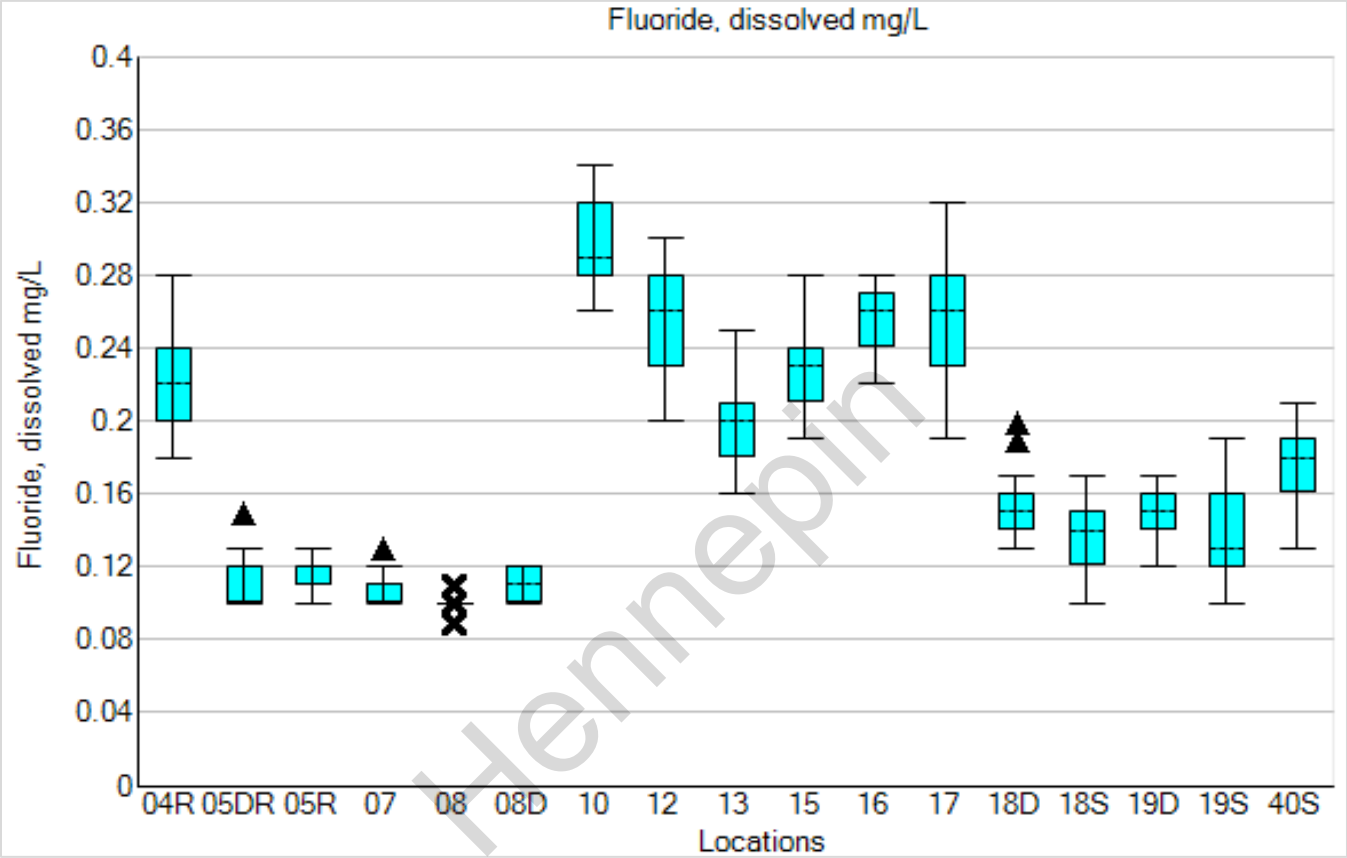


Figure 7. Distribution of Dissolved Fluoride Concentrations at Hennepin East Wells.

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) of the wells in the monitoring system, 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

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 and fluoride) 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 8. The background Upper Prediction Limit (UPL) for boron of 0.1503 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 potentially from the East Ash Pond are a contributing factor to, and alternate source of, the elevated boron concentrations observed in the Landfill monitoring wells.

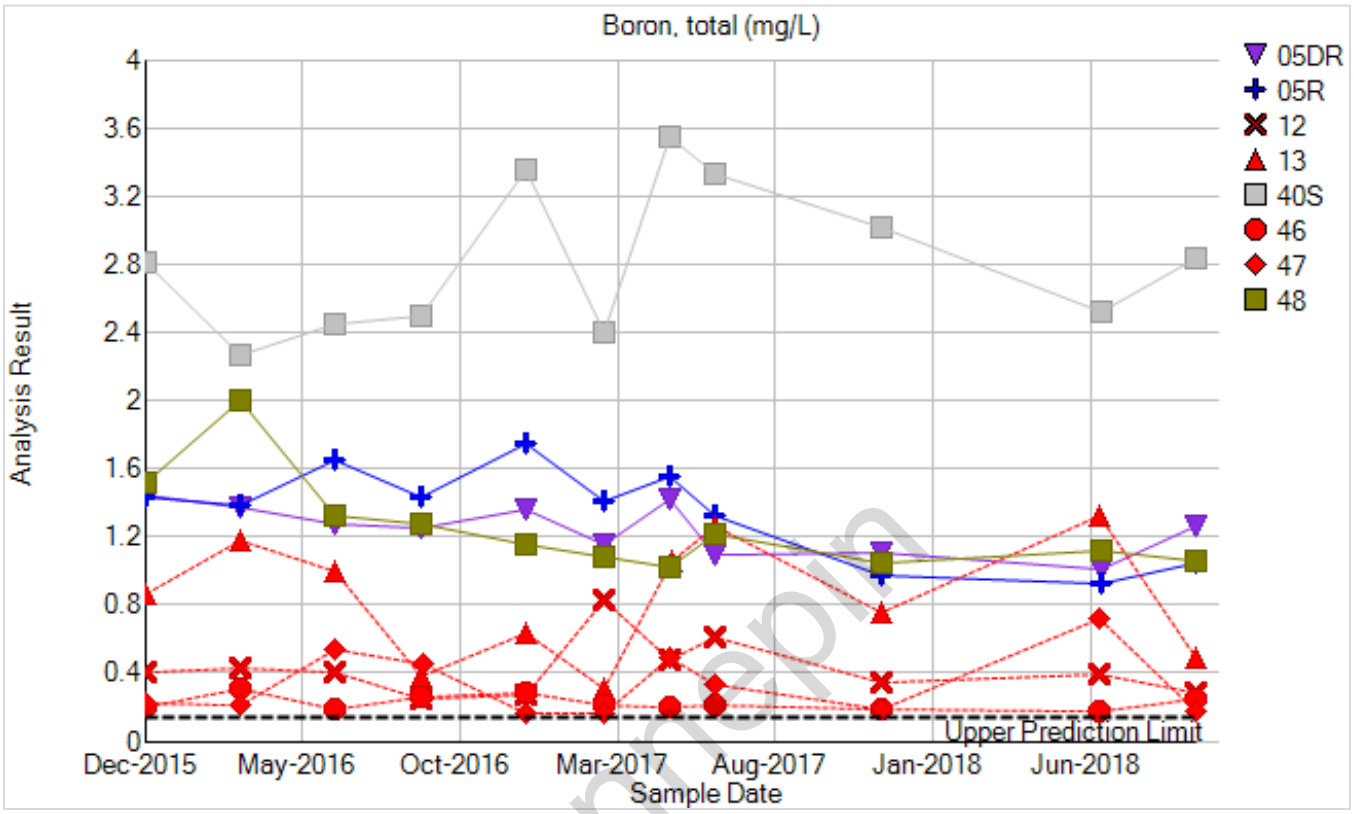


Figure 8. Boron Concentration Time-Series in Wells Downgradient from the East Ash Pond and Landfill.

Fluoride concentrations observed at wells near the East Ash Pond and Landfill are shown on Figure 9. The background UPL for fluoride of 0.12 mg/L was exceeded at all wells except those used to calculate the UPL (07, 08, and 08D). Both total and dissolved fluoride concentrations are shown to facilitate comparison; some wells are only monitored for total fluoride, and some are only monitored for dissolved fluoride. Figure 10 is a box-whisker plot for wells where both total and dissolved fluoride are monitored, and demonstrate good correlation between total and dissolved concentrations.

Unlike boron, the highest observed fluoride concentrations are near the East Ash Pond, both upgradient (wells 16, 17) and downgradient (wells 12, 13, 46, and 47), and the lower concentrations were observed in the Landfill downgradient wells (05R, 05DR, 40S, 48), which supports that elevated concentrations of fluoride are 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 9, wells near 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 <0.10 (non-detect) to 0.24 mg/L. Elevated fluoride concentrations observed upgradient and downgradient of the East Ash Pond decrease beneath the Landfill, which establishes that groundwater beneath the Landfill is not being impacted with fluoride from either the Landfill, the ash beneath the landfill, or the East Ash Pond, and is from another source located upgradient.

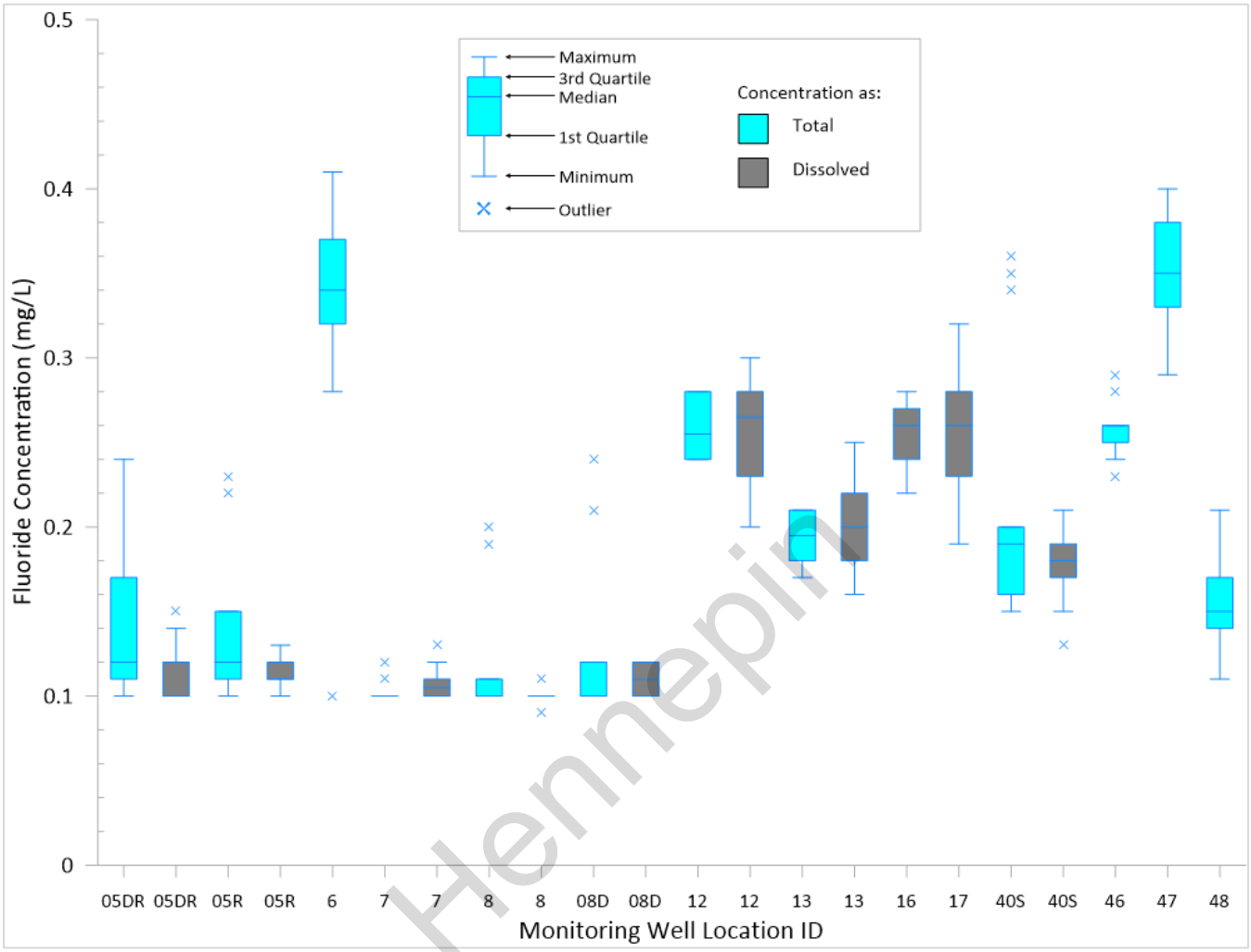


Figure 9. Fluoride Concentration Box-Whisker Plot for Wells Near the East Ash Pond and Landfill.

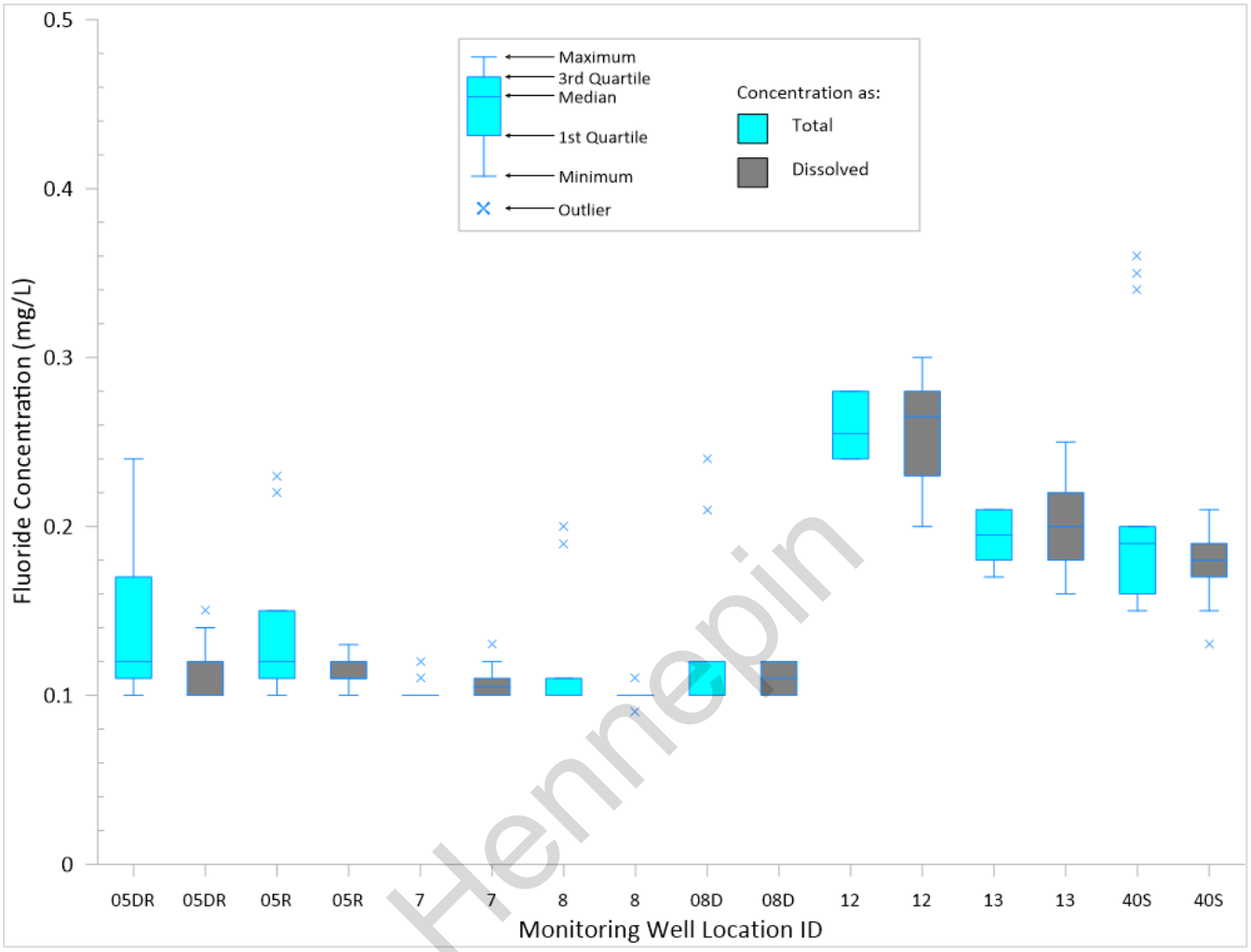


Figure 10 - Box-Whisker Plot Comparing Total and Dissolved Fluoride Concentrations.

3 CONCLUSIONS AND CERTIFICATION

Pursuant to 40 C.F.R. § 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 in Ash Pond No. 2 and Underlying the Landfill
- Surrounding Industrial Activity
- East Ash Pond

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 exposed ash deposits in Ash Pond No. 2 outside the Landfill boundary and potentially from the East Ash Pond with periodic wetting of low-lying ash deposits beneath the Landfill during river flood events which may cause temporary increases in boron concentrations in some downgradient wells. Concentrations return to long-term trends shortly after these events.

- 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. Leachate from the East Ash Pond may also be contributing to fluoride concentrations downgradient of the Landfill.

This information serves as the written alternate source demonstration report prepared in accordance with 40 C.F.R. § 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 near 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., part of Ramboll
Date: January 7, 2019

I, Nicole M. Pagano, a professional geologist in good standing in the State of Illinois, 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.

Nicole M. Pagano
Professional Geologist
196-000750
Illinois
O'Brien & Gere Engineers, Inc., part of Ramboll
Date: January 7, 2019

REFERENCES

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

Kelron, NRT. Initial Facility Report – Hennepin Power Station, New Coal Combustion Waste Landfill. December 10, 2010.

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.

O'Brien & Gere Engineers, Inc. and Civil & Environmental Consultants, Inc. Closure Plan Addendum, Hennepin East Ash Pond No. 2, Hennepin, Illinois. October 25, 2018.

40 C.F.R. 257

Figures

Y:\Mapping\Projects\222285 Hennepin EastMXD\ASD\Figure 1 Groundwater Sampling Well Location Map.mxd

DOWNGRADIENT WELL LOCATION
UPGRADIENT WELL LOCATION
NON-CCR WELL LOCATION
CCR MONITORED UNIT
NON-CCR UNIT

ALTERNATE SOURCE DEMONSTRATION
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

0 175 350 700
Feet

N

GROUNDWATER SAMPLING WELL LOCATION MAP

OBG
Part of Ramboll

Y:\Mapping\Projects\222285 Hennepin East\MXD\ASD\Figure 2 GWS Wellt.oc HenLF.mxd

DOWNGRADIENT WELL LOCATION
UPGRADIENT WELL LOCATION
CCR MONITORED UNIT

ALTERNATE SOURCE DEMONSTRATION
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

0 175 350 700
Feet

N

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

OBG
Part of Ramboll

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

					Requested Tests						
Sample ID	**ClientSampID**	**Matrix**	**Date Collected**	**Bottle**	**D3987/6010B**	**D3987/7000 G**	**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:** 2 Btl (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

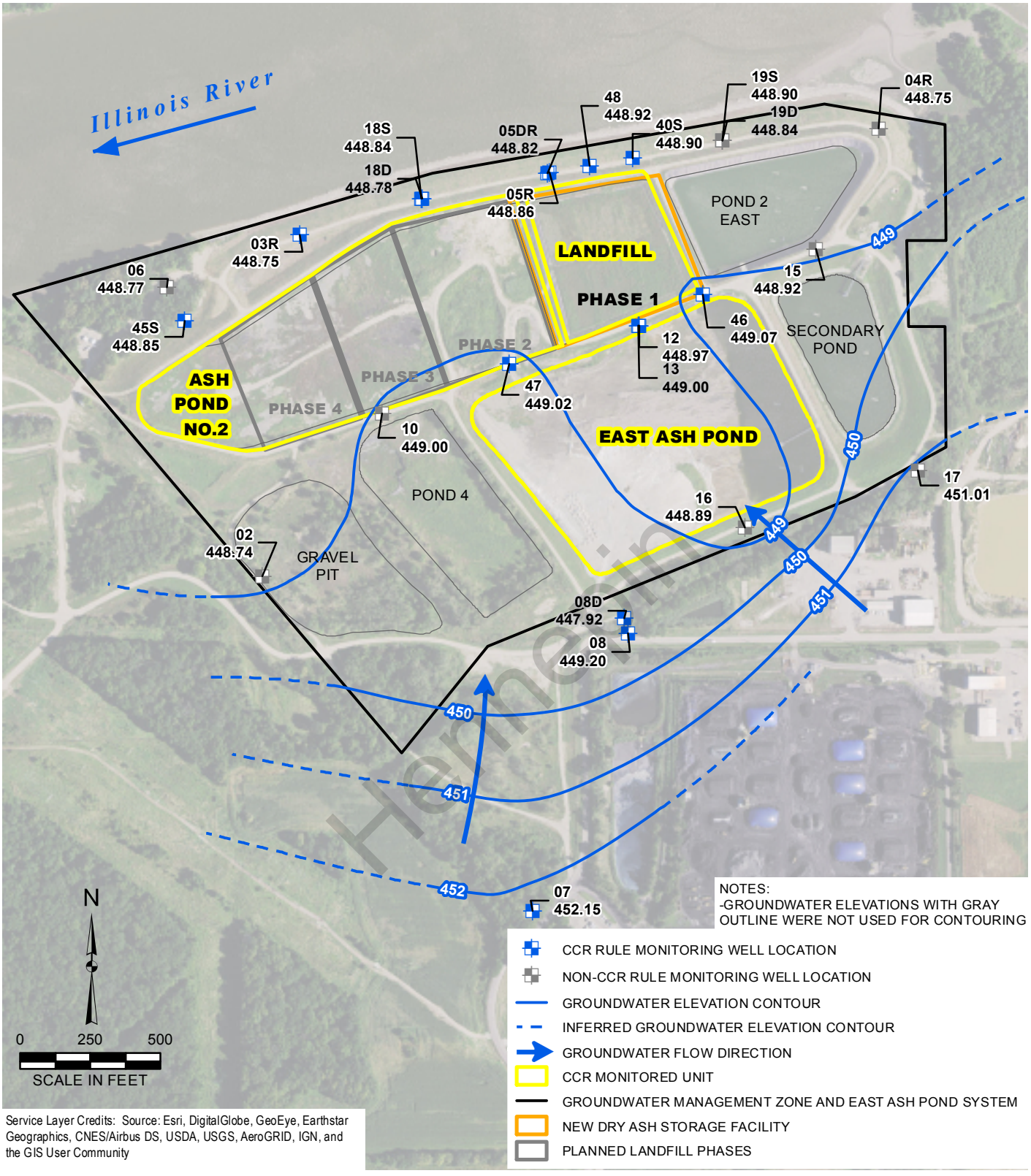
Sample Narrative
ASTM D3987, SW-846 3020A, Metals in Shake Extract by GFAA
TI - Matrix interference present in sample.

22-8 notice
DB 7/24/09

900 ~~FeWS~~
DB 7/24/09

Appendix B

Groundwater Contour Maps, 2015-2018



DRAWN BY/DATE:
SDS 1/25/17
REVIEWED BY/DATE:
TBN 1/26/17
APPROVED BY/DATE:
JJW 2/9/17

HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 1: DECEMBER 8, 2015

DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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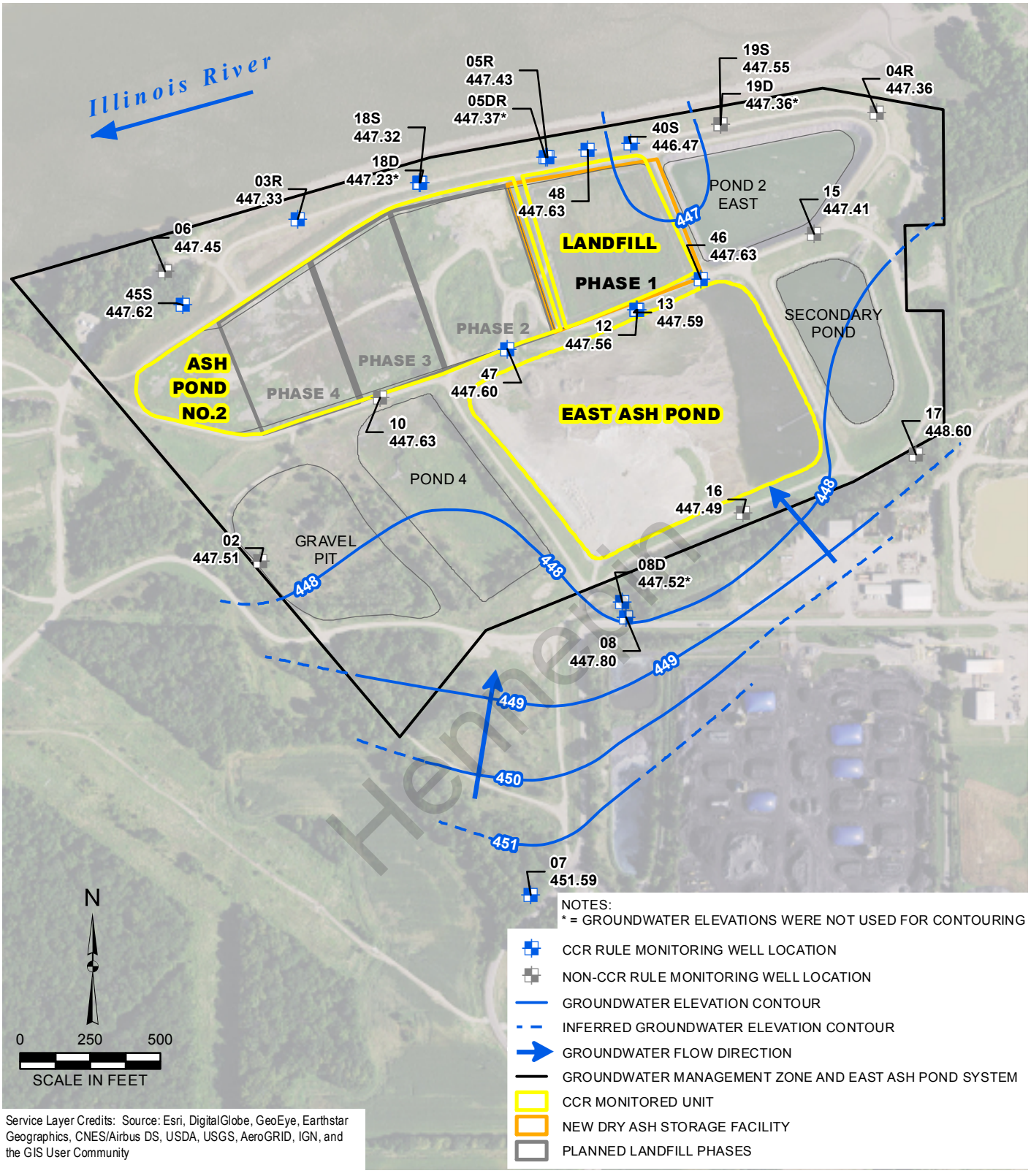

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SDS 1/25/17
REVIEWED BY/DATE:
TBN 1/26/17
APPROVED BY/DATE:
JJW 2/9/17

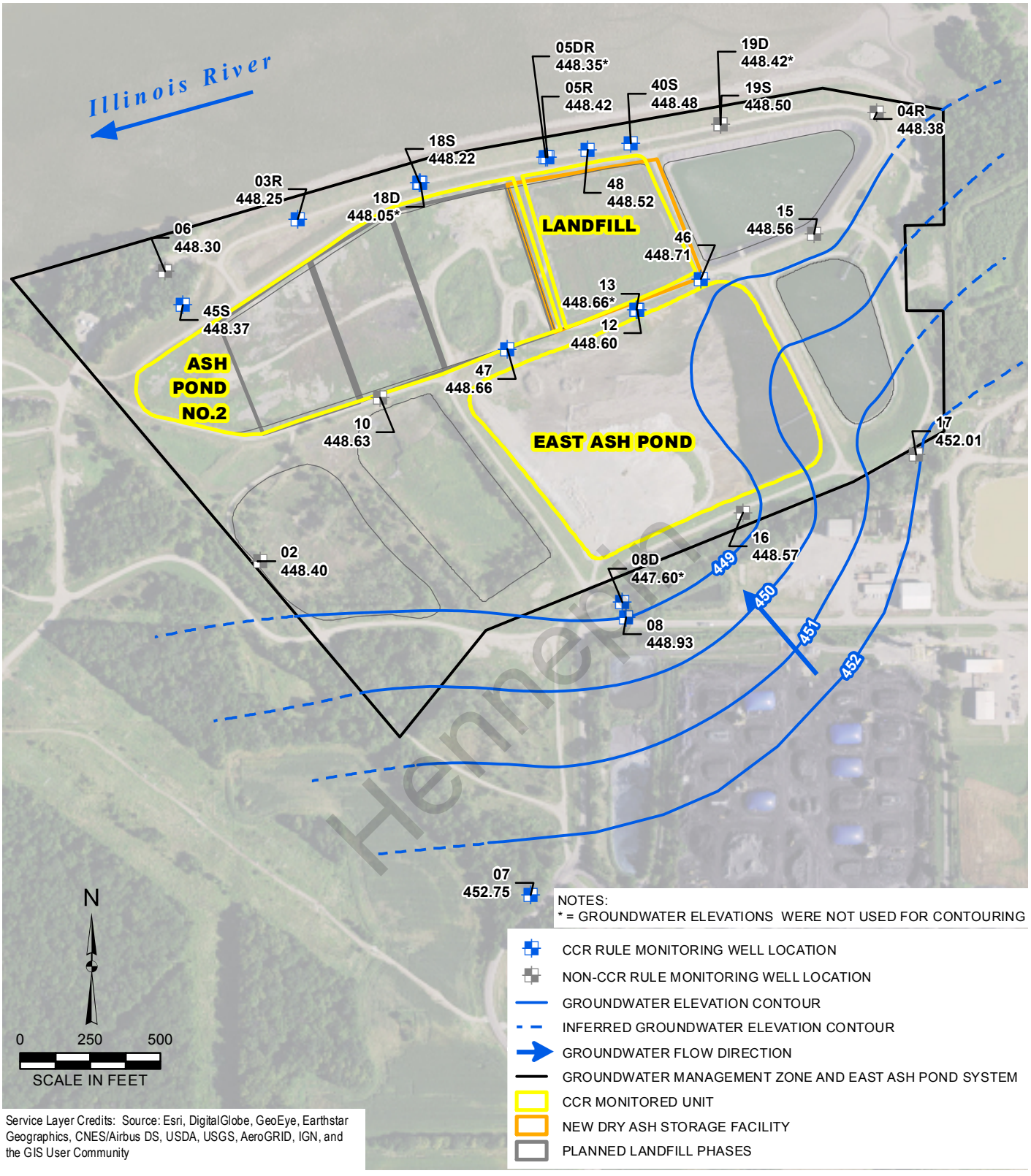
HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 2: MARCH 8, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



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SDS 1/25/17
REVIEWED BY/DATE:
TBN 1/26/17
APPROVED BY/DATE:
JJW 2/9/17

HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 3: JUNE 7, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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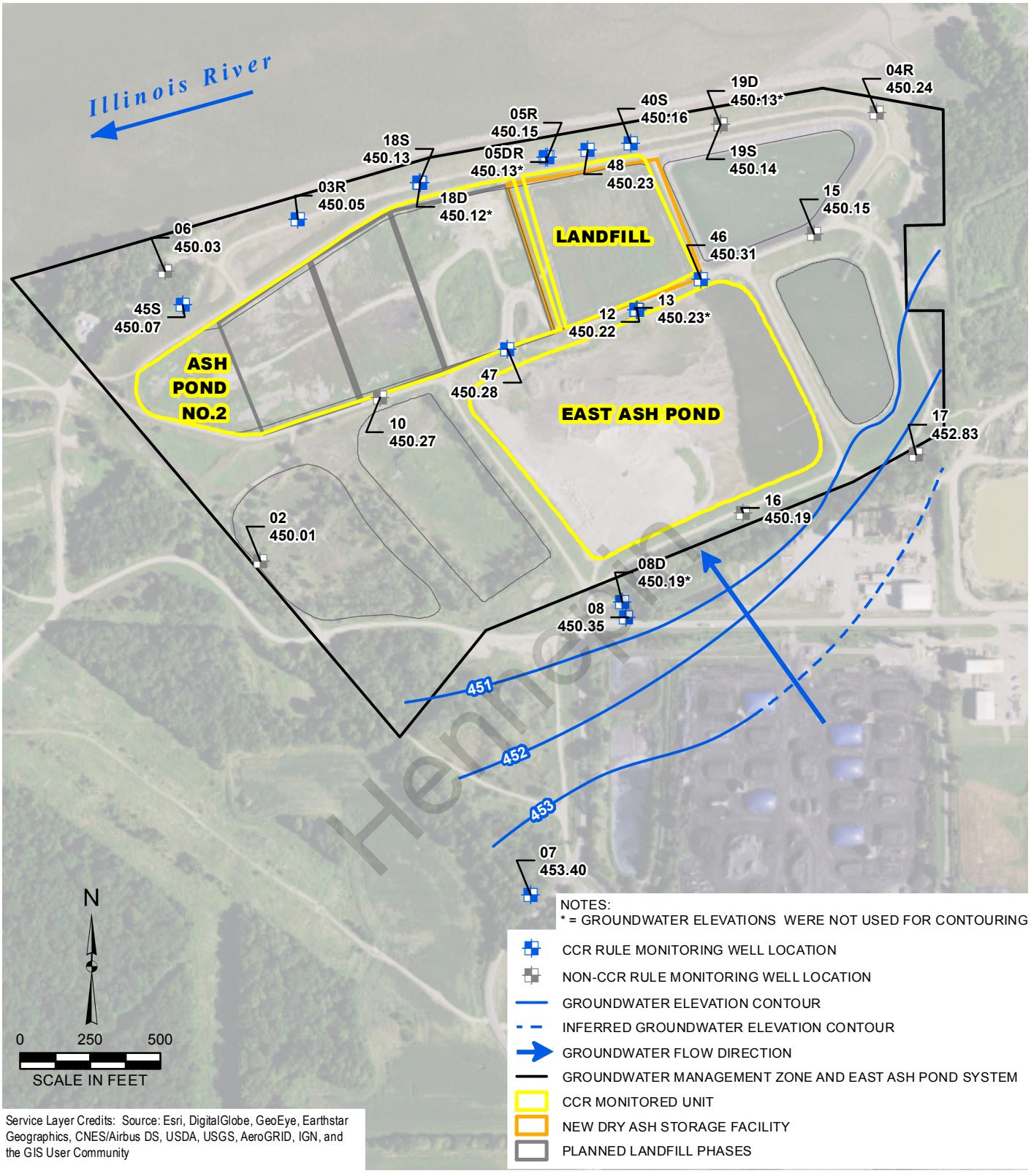

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REVIEWED BY/DATE:
TBN 1/27/17
APPROVED BY/DATE:
JJW 2/7/17

HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 4: SEPTEMBER 9, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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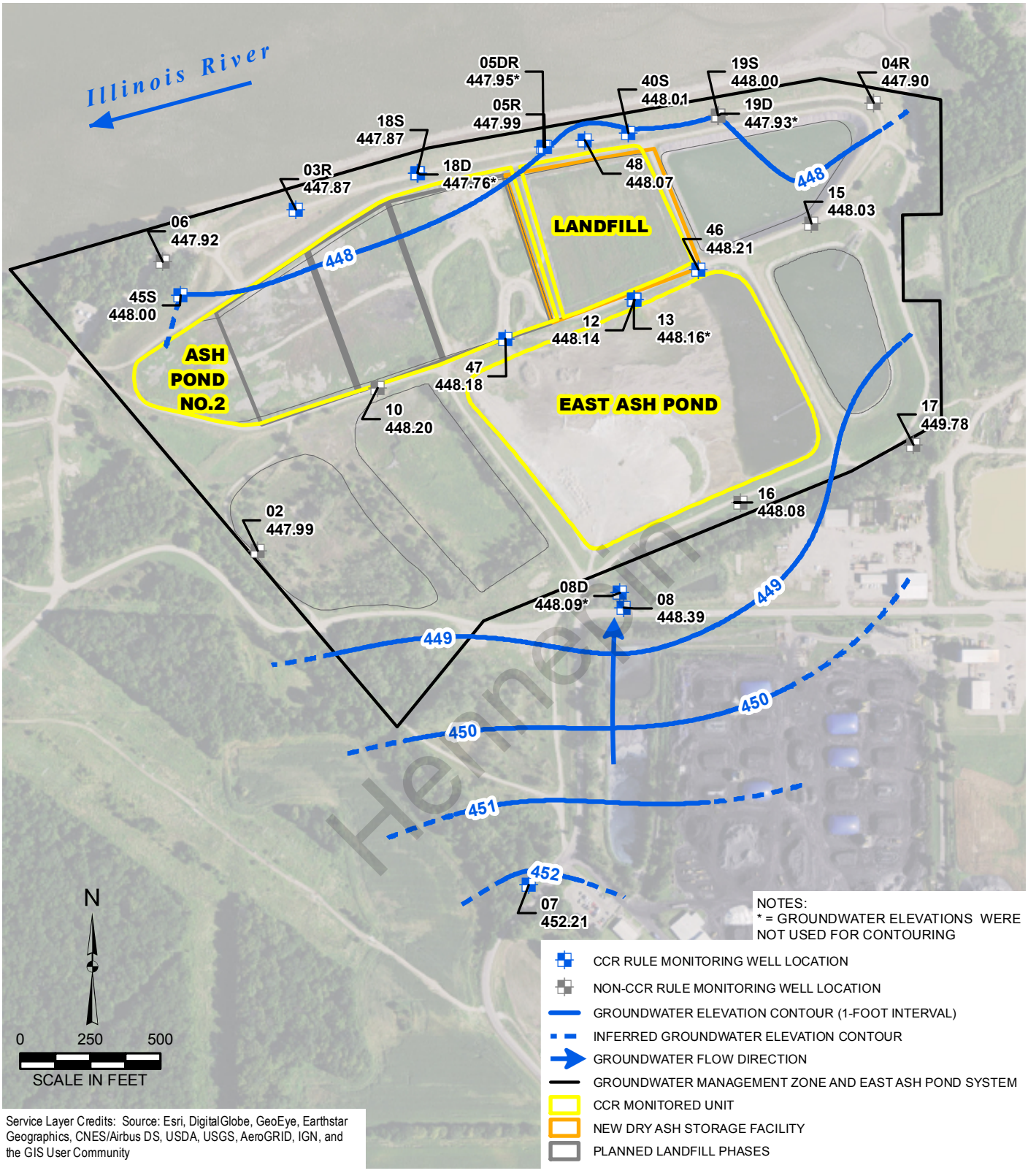

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

DRAWN BY/DATE:
SDS 3/6/17
REVIEWED BY/DATE:
TBN 3/6/17
APPROVED BY/DATE:
JJW 9/1/17

HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 5: DECEMBER 7, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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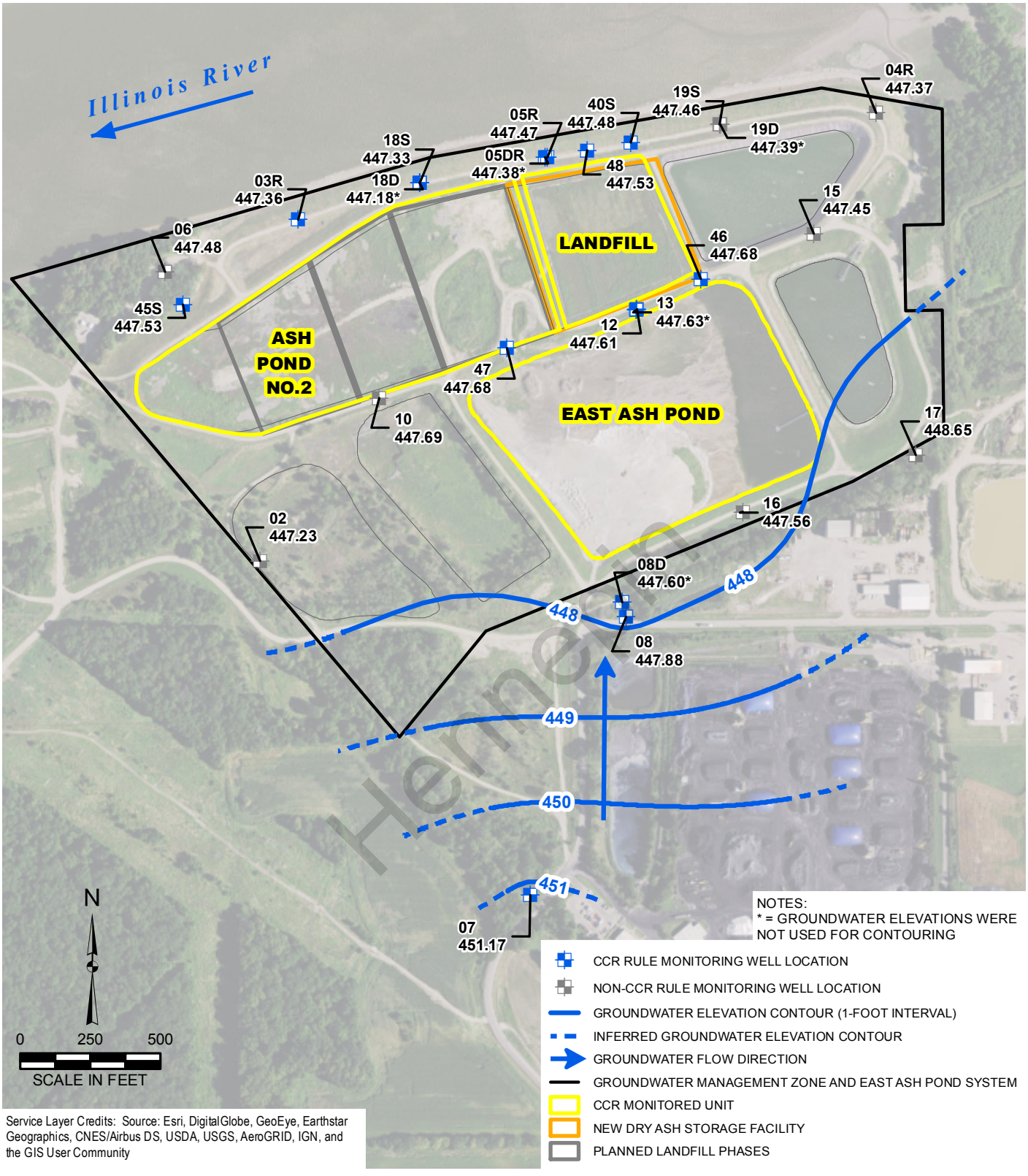

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REVIEWED BY/DATE:
TBN 3/6/17
APPROVED BY/DATE:
JJW 9/1/17

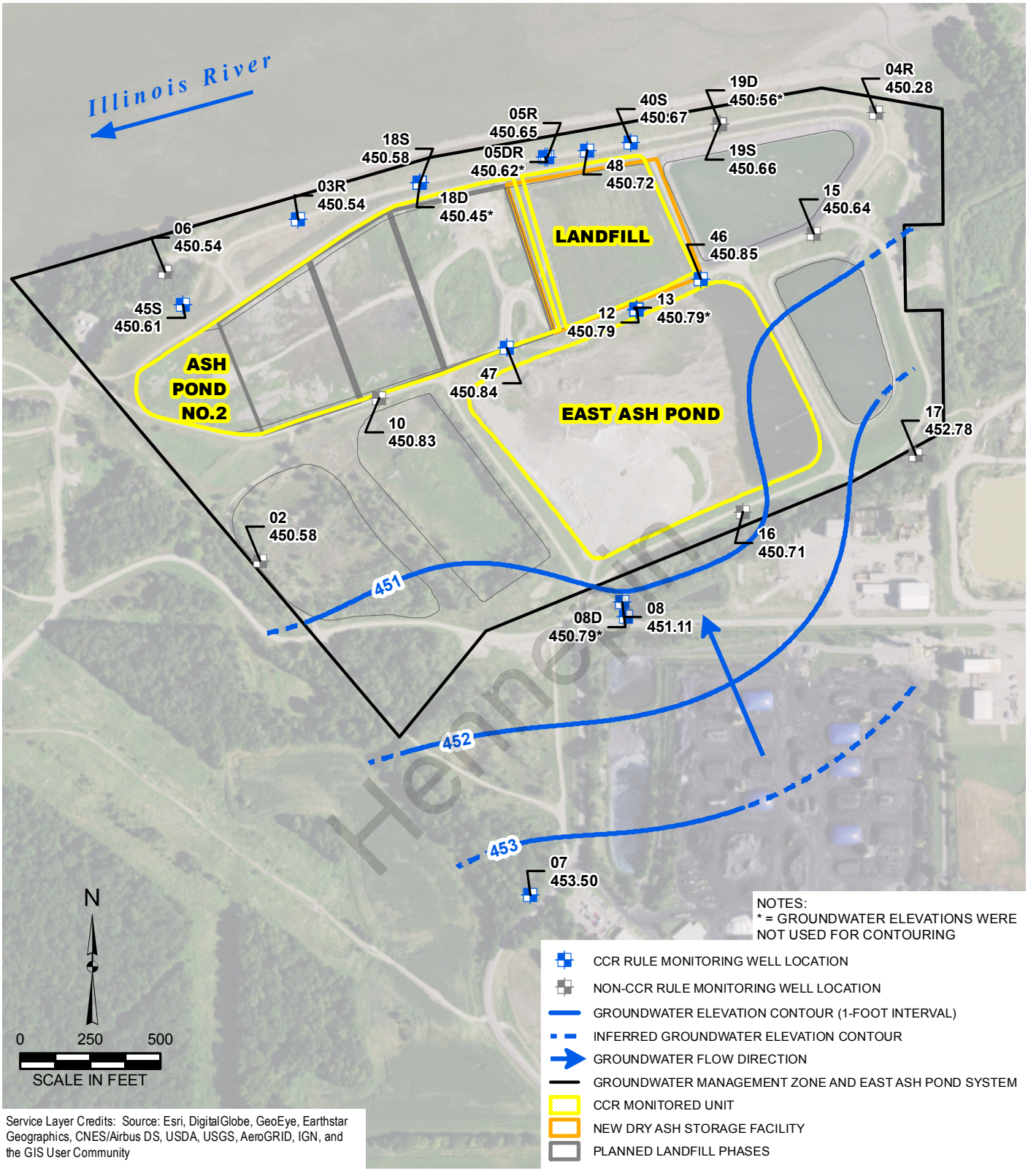
HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 6: FEBRUARY 20, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



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 5/25/17
REVIEWED BY/DATE:
TBN 5/25/17
APPROVED BY/DATE:
JJW 9/1/17

HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 7: APRIL 25, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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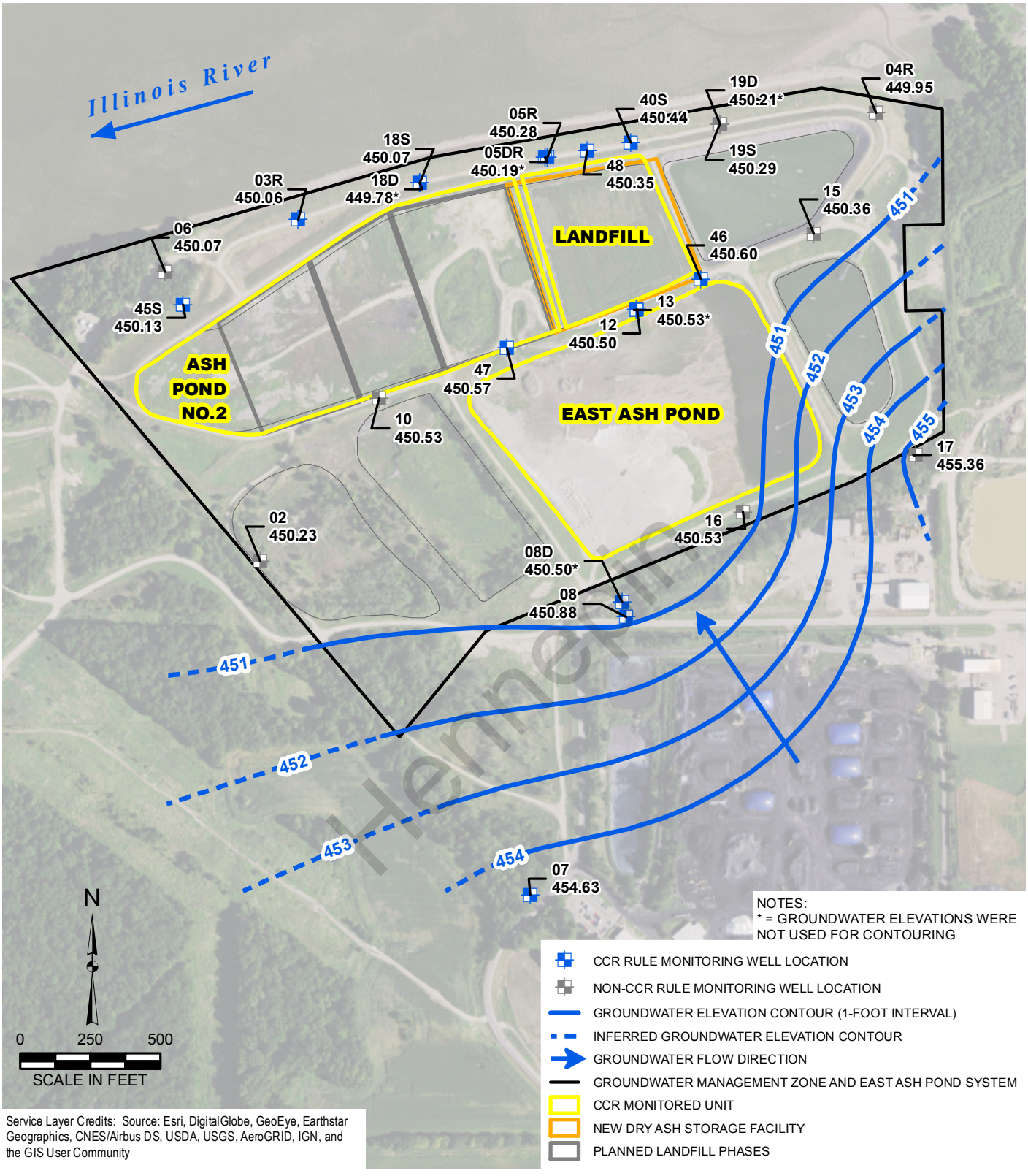

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SDS 7/20/17
REVIEWED BY/DATE:
TBN 7/20/17
APPROVED BY/DATE:
JJW 9/1/17

HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 8: JUNE 8, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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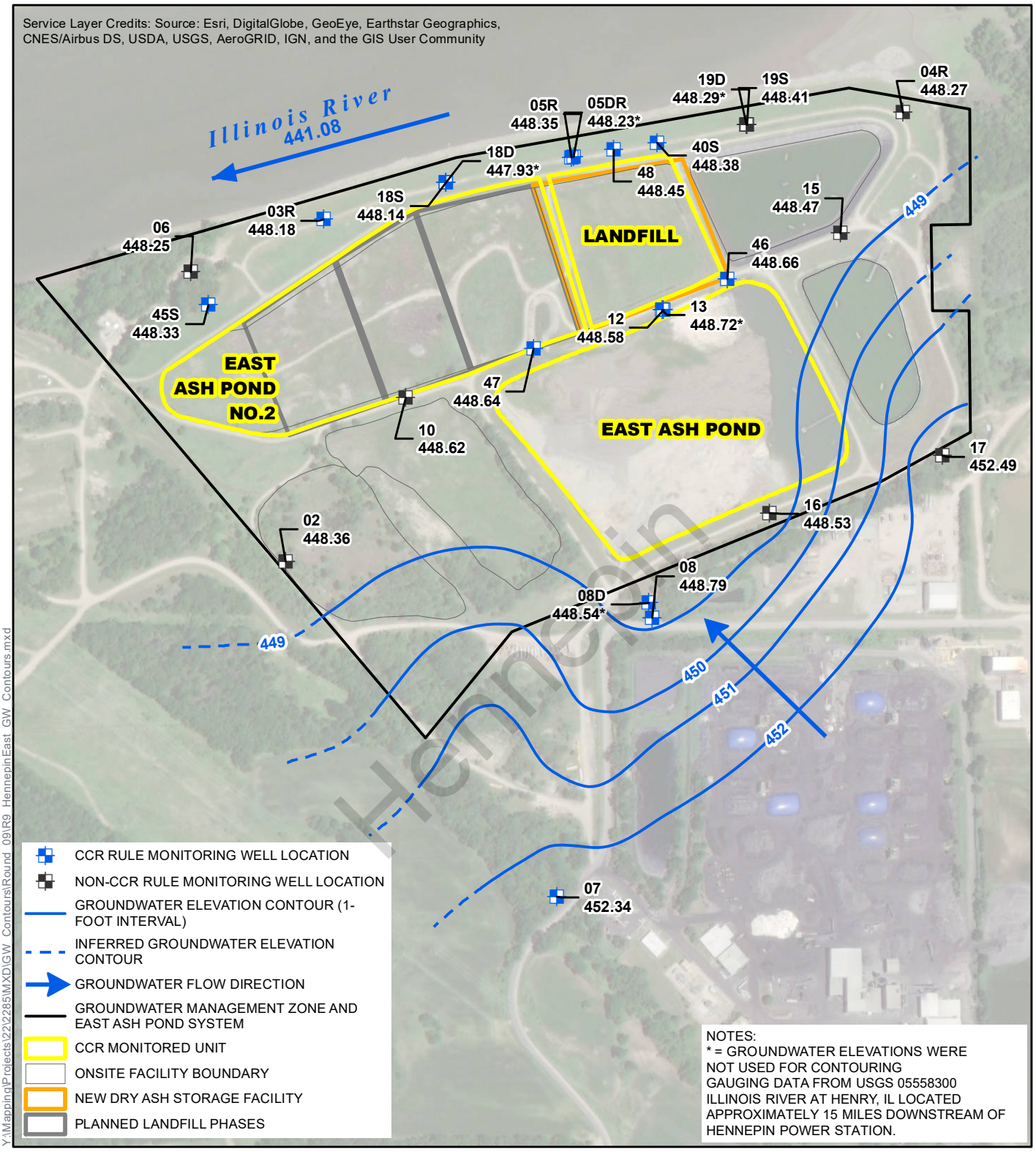


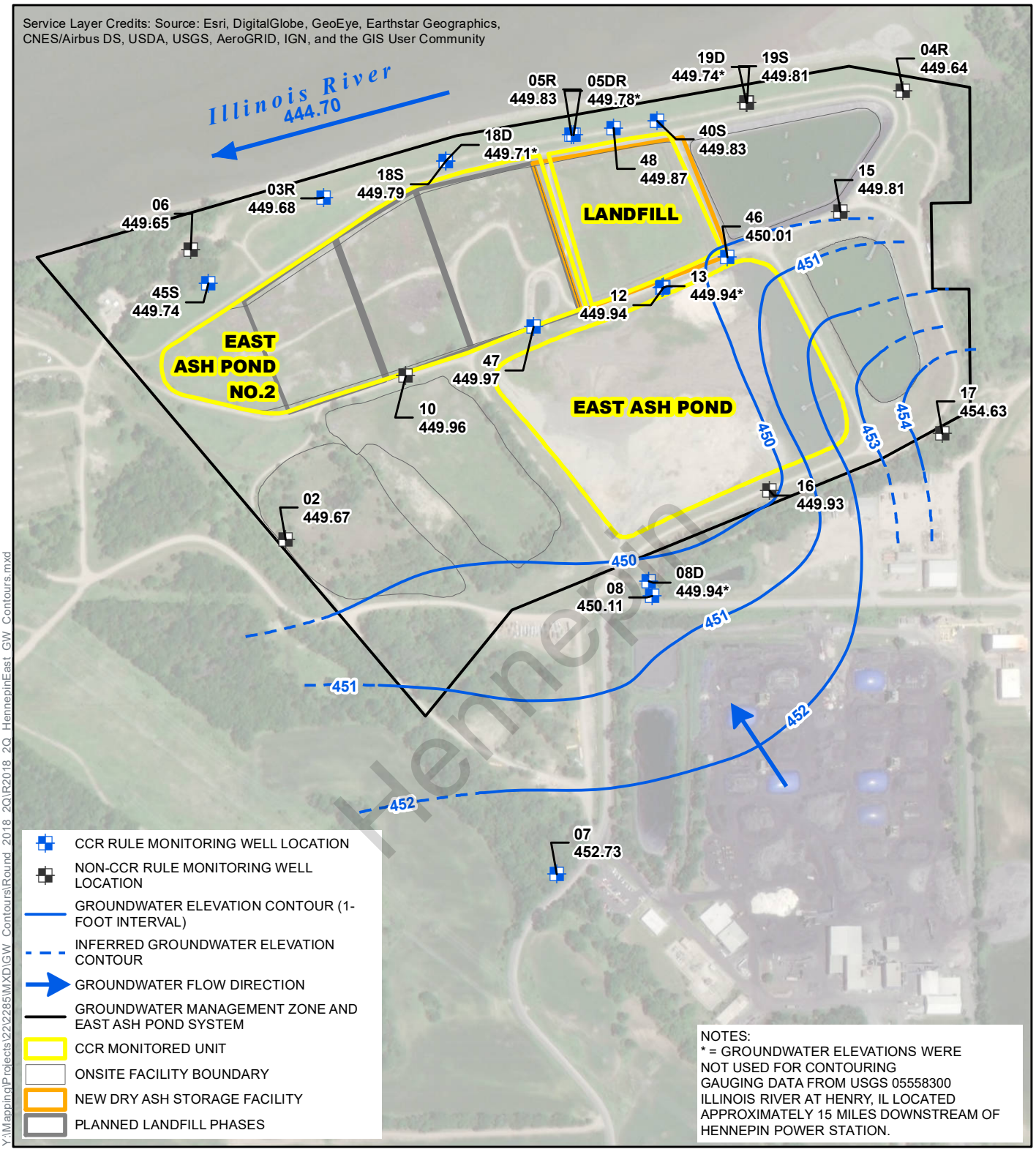
HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
GROUNDWATER ELEVATION CONTOUR MAP
NOVEMBER 15, 2017

CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

N

0 125 250 500
Feet

O'BRIEN & GERE ENGINEERS, INC.



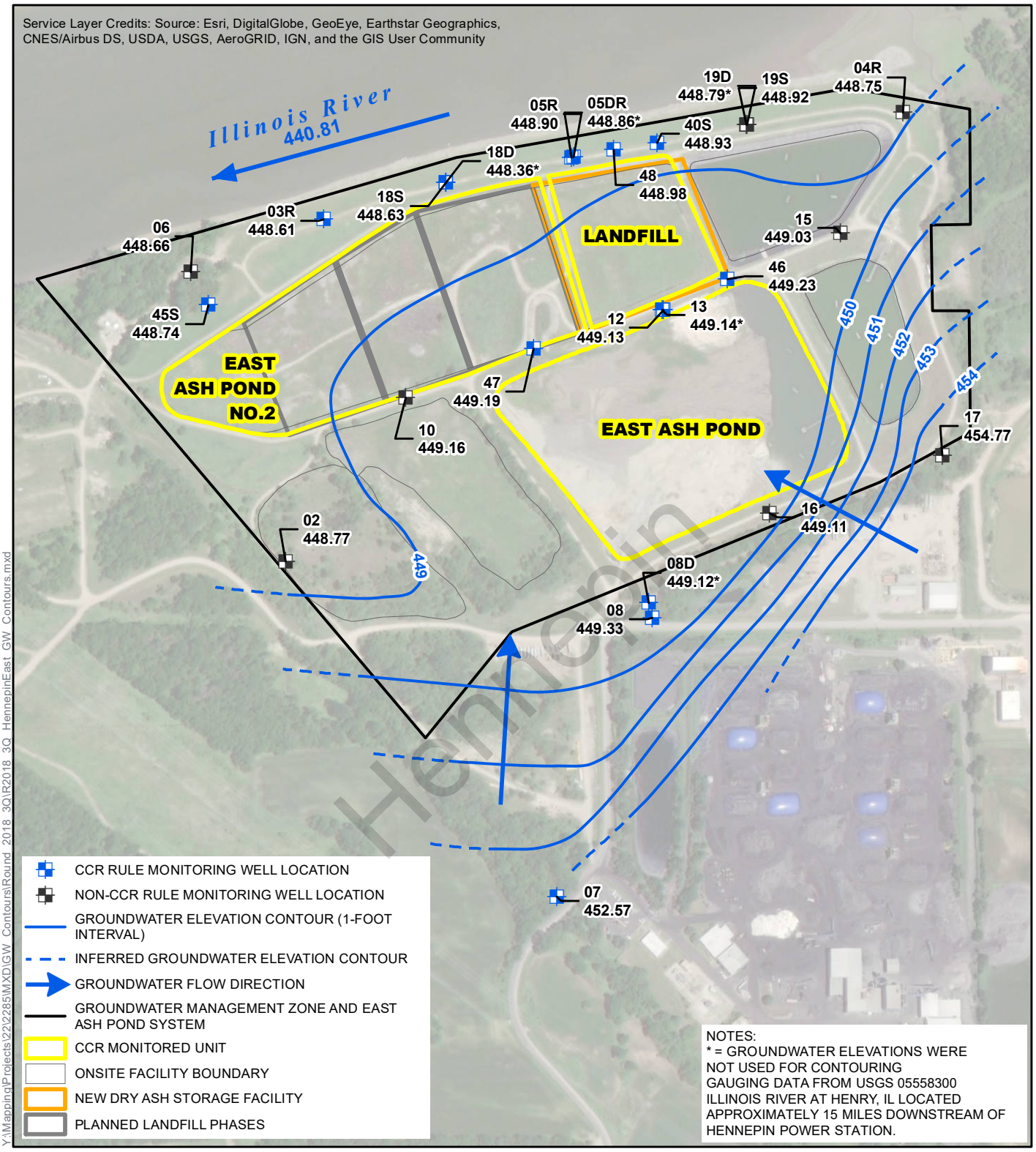
HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
GROUNDWATER ELEVATION CONTOUR MAP
JUNE 13, 2018

CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

0 125 250 500
Feet

N

O'BRIEN & GERE ENGINEERS, INC.



HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
GROUNDWATER ELEVATION CONTOUR MAP
SEPTEMBER 12, 2018

CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

0 125 250 500
Feet

N

O'BRIEN & GERE ENGINEERS, INC.

40 C.F.R. § 257.94(e)(2): ALTERNATE SOURCE DEMONSTRATION
HENNEPIN LANDFILL
JULY 15, 2019

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

Hennepin Power Station
Hennepin, Illinois

Dynegy Midwest Generation, LLC

July 15, 2019

OBG
Part of Ramboll

JULY 15, 2019 | PROJECT #72756

40 C.F.R. § 257.94(e)(2): Alternate Source Demonstration Hennepin Landfill

Hennepin Power Station
Hennepin, Illinois

Prepared for:
Dynegy Midwest Generation, LLC

KRISTEN L. THEESFELD
Hydrogeologist

ERIC J. TLACHAC
Managing Engineer

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figures 1 and 2 are attached, Figures 3-12 are included in the text.

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

ASD	Alternate Source Demonstration
Ash Pond No. 2	Hennepin Ash Pond No. 2
CCR	Coal Combustion Residuals
CCR Rule	40 C.F.R. Part 257
CEC	Civil & Environmental Consultants, Inc.
40 C.F.R.	Title 40 of the Code of Federal Regulations
cm/s	centimeters per second
East Ash Pond	Hennepin East Ash Pond
HDPE	High-density Polyethylene
IEPA	Illinois Environmental Protection Agency
Landfill	Hennepin Landfill
mg/L	milligrams per liter
msl	mean sea level
NPDES	National Pollutant Discharge Elimination System
NRT/OBG	Natural Resource Technology, an OBG Company
OBG	O'Brien & Gere Engineers, Inc., Part of Ramboll
Site	Hennepin Power Station
SSI	Statistically Significant Increase
STD	Standard Units
UPL	Upper Prediction Limit

1 INTRODUCTION

1.1 OVERVIEW

Title 40 Code of Federal Regulations (40 C.F.R.) Section 257.94(e)(2) allows the owner or operator of a Coal Combustion Residuals (CCR) unit 90 days from the date of determination of Statistically Significant Increases (SSIs) over background for groundwater constituents listed in Appendix III of 40 C.F.R. Part 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSI(s), or that the SSI(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (Alternate Source Demonstration [ASD]).

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

The third semi-annual detection monitoring samples (Detection Monitoring Round 3 [D3]) were collected on December 12-13, 2018 and analytical data were received on January 14, 2019. In accordance with 40 C.F.R. § 257.93(h)(2), statistical analysis of the data to identify SSIs of 40 C.F.R. Part 257 Appendix III parameters over background concentrations was completed by April 14, 2019, within 90 days of receipt of the analytical data. The statistical determination identified the following SSIs at downgradient monitoring wells:

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

Because Detection Monitoring Round 4 (D4) was completed on March 13-14, 2019, prior to the SSIs referenced above being determined (April 15, 2019), results from D4 were used to verify the D3 SSIs in accordance with the Statistical Analysis Plan (NRT/OBG, 2017a). Following evaluation of analytical data from D4, the following SSIs were confirmed:

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

Pursuant to 40 C.F.R. § 257.94(e)(2), the following demonstrates that sources other than the Hennepin Landfill were the cause of the SSIs listed above. This ASD was completed by July 15, 2019, within 90 days of determination of the SSIs as required by 40 C.F.R. § 257.94(e)(2).

1.2 LOCATION

The Hennepin Power Station (Site) 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 regulated under 40 C.F.R. 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 Landfill (Landfill), 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, 2017b) prepared for the Landfill. Statistical evaluation of analytical data is performed in accordance with the Statistical Analysis Plan.

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 1).

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.
2014	North Embankment tree removal, grading, and vegetation re-establishment adjacent to Ash Pond No. 2.

Table 1. 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), and an addendum to this plan was submitted in October 2018 (OBG/CEC; 2018) to provide closure and post-closure care information for Ash Pond No. 4.

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 high-density polyethylene (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.

Ash Pond No. 4: A former unlined impoundment, now dry, is classified as a non-CCR Rule pond (capped or otherwise maintained). Based on review of aerial photographs and other site information, ash was placed in a former sand and gravel quarry between 1978 and 1984.

A Modified Closure Work Plan submitted and approved in 2010 indicated Ash Pond No. 4 would remain uncovered until such time that ash was no longer being mined for reuse. Given market conditions, Ash Pond No. 4 will be closed in conjunction with Ash Pond No. 2 as specified in the Modified Closure Work Plan, as described in the October 2018 Closure Plan Addendum for Ash Pond No. 2 referenced above.

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/s). 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 x 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 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 x 10^{-7} cm/s. 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 x 10^{-7} cm/s. 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 sands 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

As allowed by 40 C.F.R. § 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 is 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 in Ash Pond No. 2 and Underlying the Landfill: 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. The other portions of the pond are currently exposed, and subject to infiltration of precipitation and generation of CCR leachate. The pond is unlined, potentially allowing CCR leachate to percolate to groundwater. A revised closure plan for these portions of the pond, which includes the construction of a cover designed to minimize surface water infiltration and leachate generation, was developed in 2018 and is awaiting approval by IEPA prior to implementation. Boring logs indicate that ash fill underlying the Hennepin Landfill may extend to 454 feet above msl. Groundwater elevation measurements indicate 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 CCR constituent concentrations from these intermittent episodes of ash saturation may be present on a transient basis at some downgradient locations after normal groundwater flow resumes. Similarly, boring logs indicate that the ash fill in the unlined Ash Pond No. 2 may extend to 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 monitoring wells downgradient from the East Ash Pond for the same Appendix III parameters – boron, fluoride and pH – as in monitoring wells downgradient from the Landfill. Elevated Appendix III parameters observed in the Landfill downgradient wells may be impacted by upgradient CCR leachate from the East Ash Pond if percolation to groundwater occurs. Any leachate that may reach groundwater beneath the East Ash Pond would be transported laterally in the direction of groundwater flow towards the Illinois River and beneath the Landfill.

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 (Appendix A) 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:

- Barium: 0.116 milligrams per liter (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 0.08-0.17 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.

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

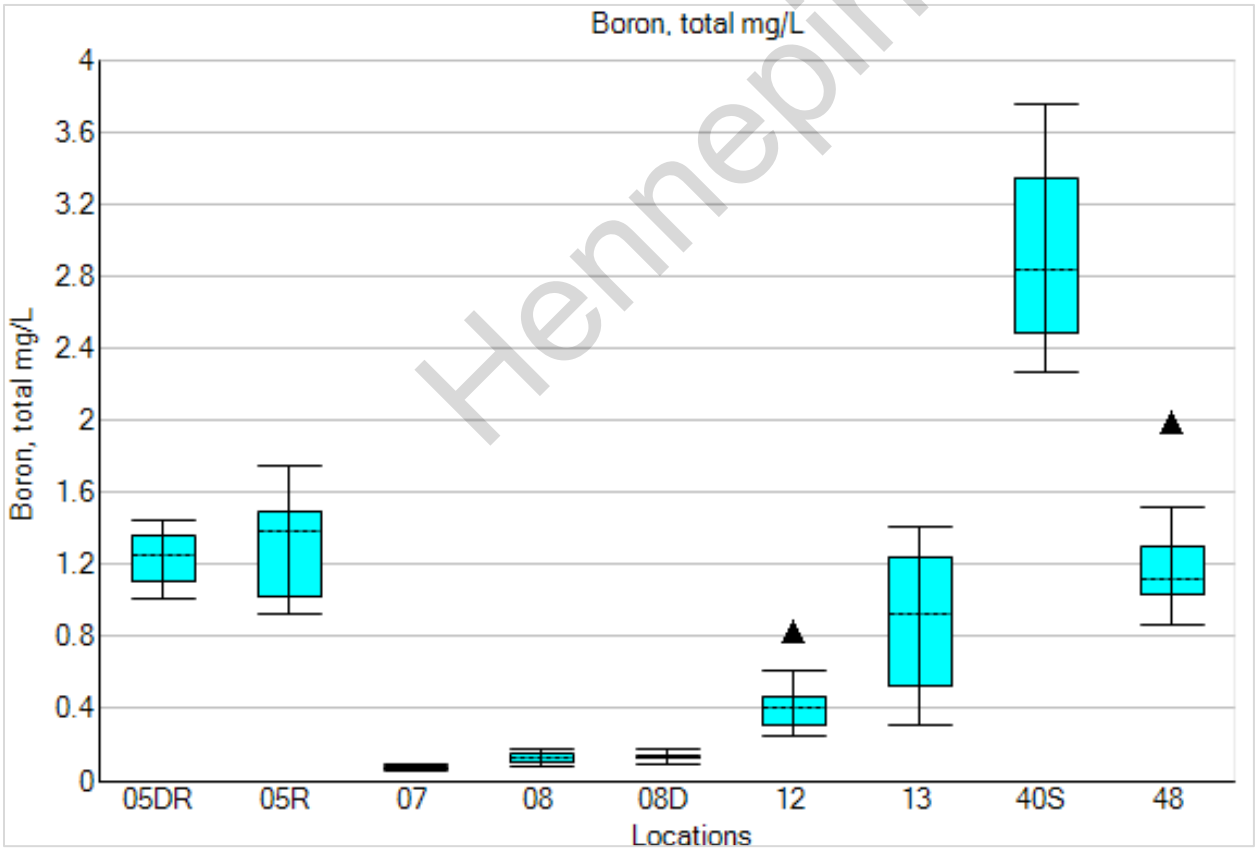


Figure 3. Box-Whisker Plot Showing Distribution of Boron.
Boron concentrations for data collected under the CCR Rule monitoring program for monitoring wells upgradient (07, 08, 08D), between the East Ash Pond and Landfill (12, 13) and downgradient (05R, 05DR, 40S, 48) of the Hennepin Landfill.

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

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. The other portions of the pond are currently exposed, and subject to infiltration of precipitation and generation of CCR leachate. The pond is unlined, allowing CCR leachate to percolate to groundwater. A revised closure plan for the exposed portions of the pond, which includes the construction of a cover designed to minimize surface water infiltration and leachate generation, was developed in 2018 and is awaiting approval by IEPA prior to implementation.

The hydrogeological assessment submitted with the 2018 revised closure plan for Ash Pond No. 2documents 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 have the potential to become partially saturated for a transient period; and, may result in a temporary change to some CCR constituent concentrations at some downgradient locations after groundwater flow direction returns to normal. Since boron is the primary indicator of coal ash leachate, elevated boron concentrations indicate the potential for increased concentrations of other coal ash constituents 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 and March 26-27 ,2018 sampling events appear to have captured this phenomenon as evidenced by a temporary increase in dissolved boron concentrations at downgradient well 40S, and to a lesser extent well 05R, as shown in Figure 4 below. Following each transient event, the boron concentrations at both monitoring wells returned to their prior long-term trends.

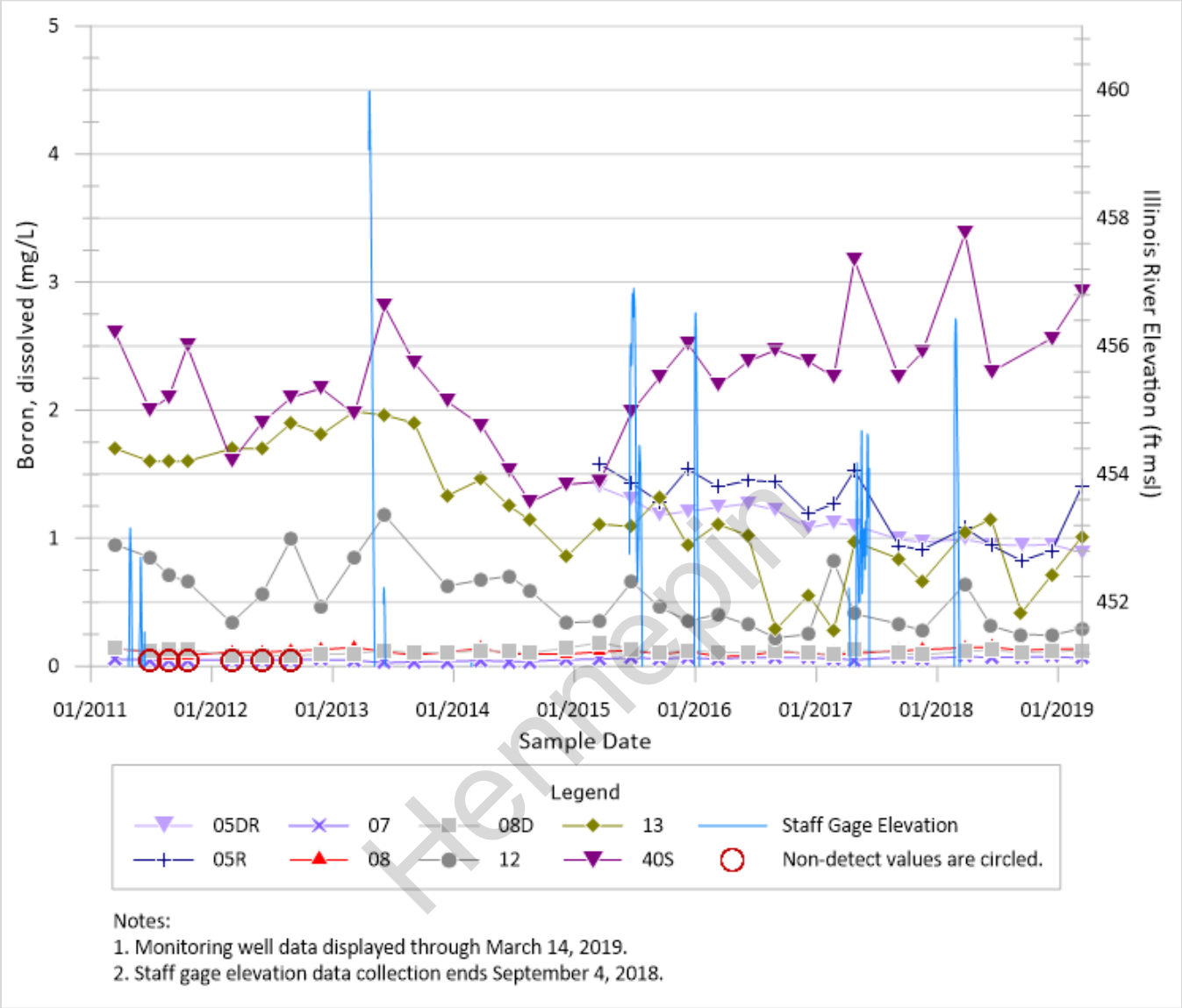


Figure 4. Trends in Dissolved Boron Compared to River Elevations, 2011-2019.
Dissolved boron is shown rather than total boron due to the availability of long-term trend data. Only river elevations exceeding 451 ft msl are shown.

Wells 40S, 05R, and 05DR are located downgradient of the ash fill area under Hennepin Landfill. Monitoring wells 12 and 13 are located upgradient (south) of the landfill, and background wells 07, 08, and 08D are shown for comparison. Figure 5 also shows elevated total boron concentration at well 40S in the second quarters 2017 and 2018. Total boron was not analyzed in samples collected March 26-27, 2018.

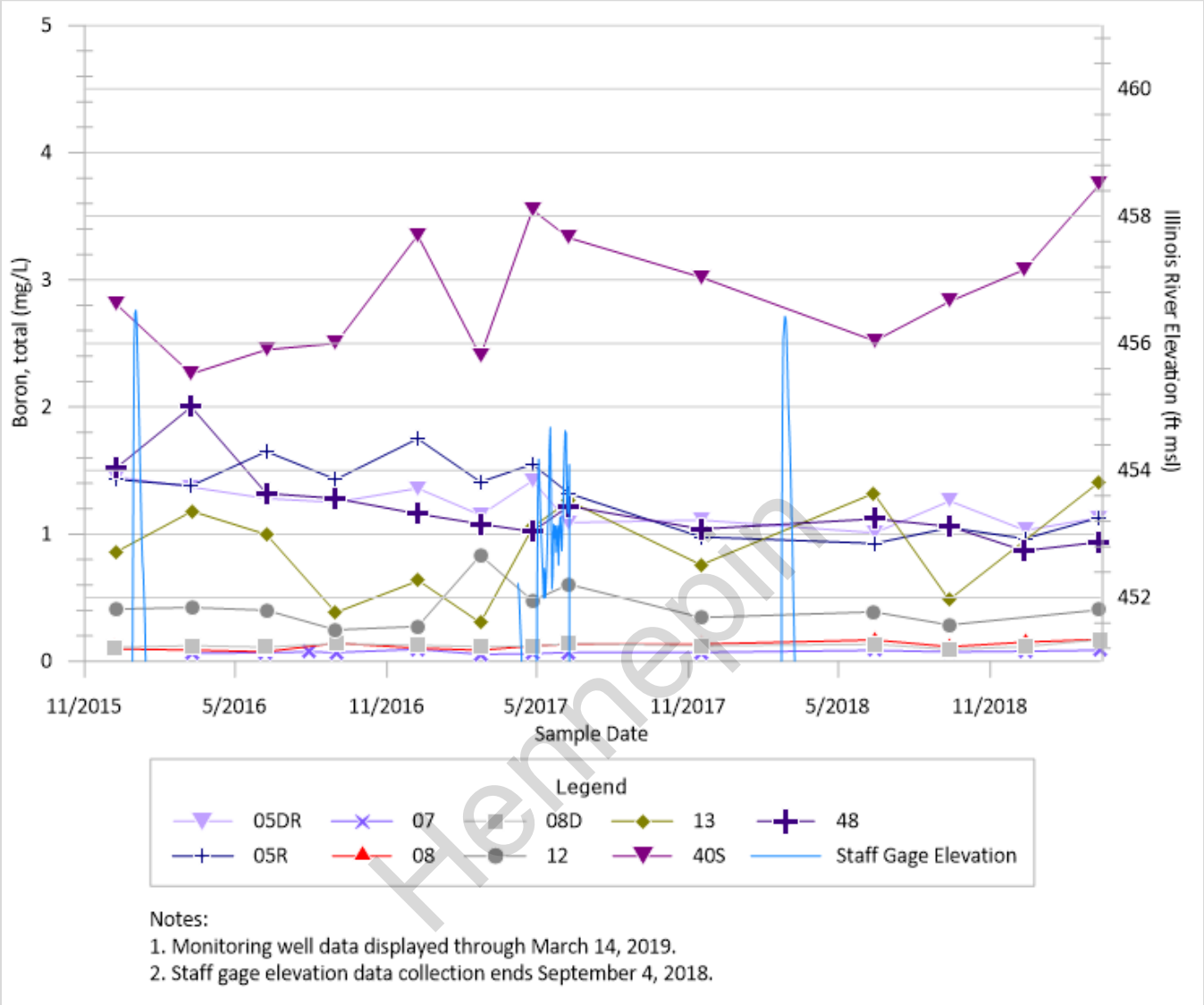


Figure 5. Trends in Total Boron Concentration Compared to River Elevations.
Only river elevations exceeding 451 ft msl are shown.

This demonstrates that low-lying ash deposits located underneath the Landfill that can occasionally become wetted due to natural variation in river elevation represent a potential 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 6), dated July 25, 2018, 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 6. Photo of Hennepin East and Surrounding Industrial Areas (July 25, 2018).

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 2015-2019 at these and other monitoring wells at Hennepin East is shown below (Figure 7), Well 46 is not included on Figure 7 due to the lack

of dissolved fluoride data at this location. 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.

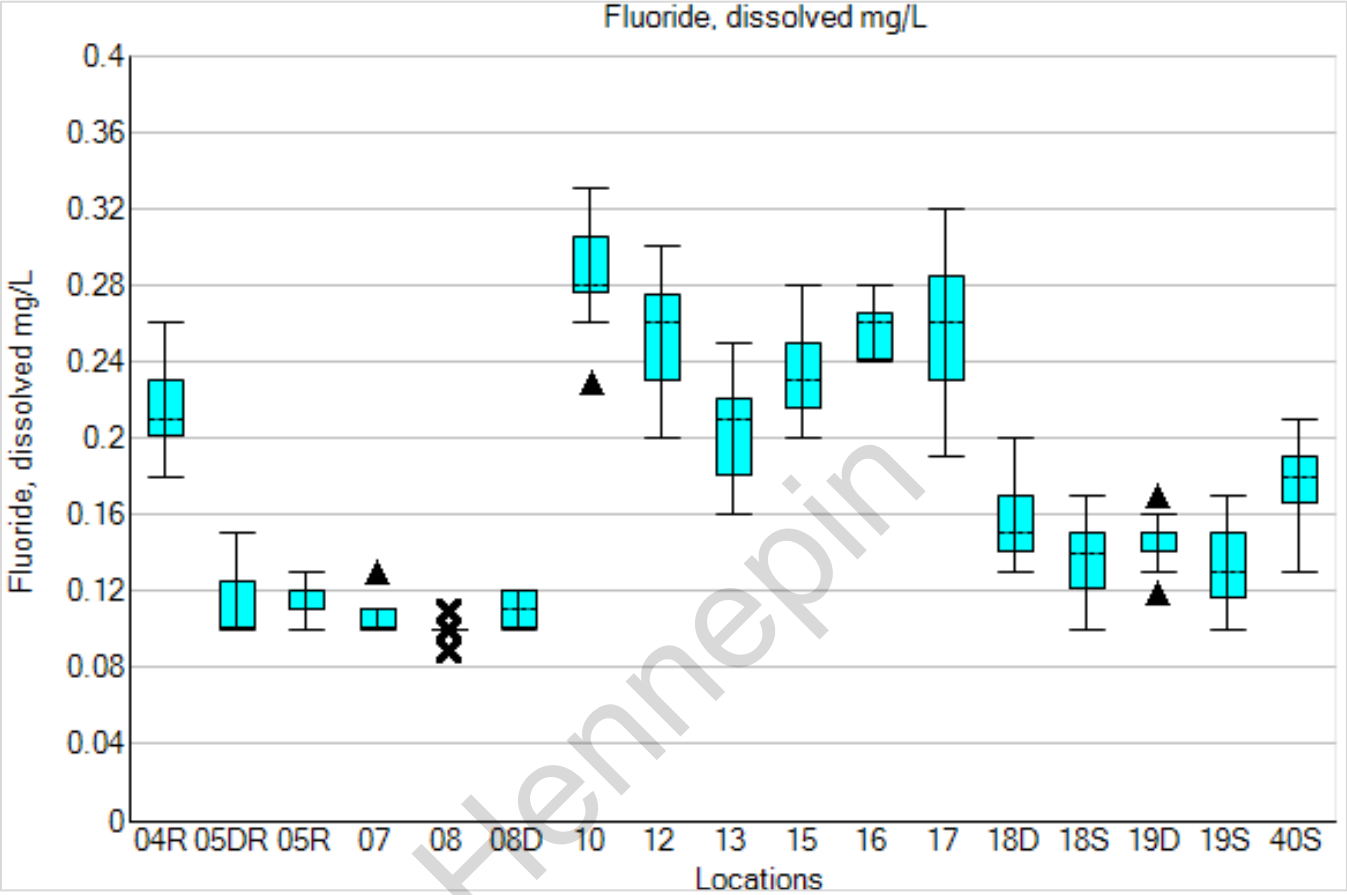


Figure 7. Distribution of Dissolved Fluoride Concentrations at Hennepin East Wells.

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.

Figure 8 below compares pH across most of the Hennepin East upgradient, intermediate, and downgradient wells .

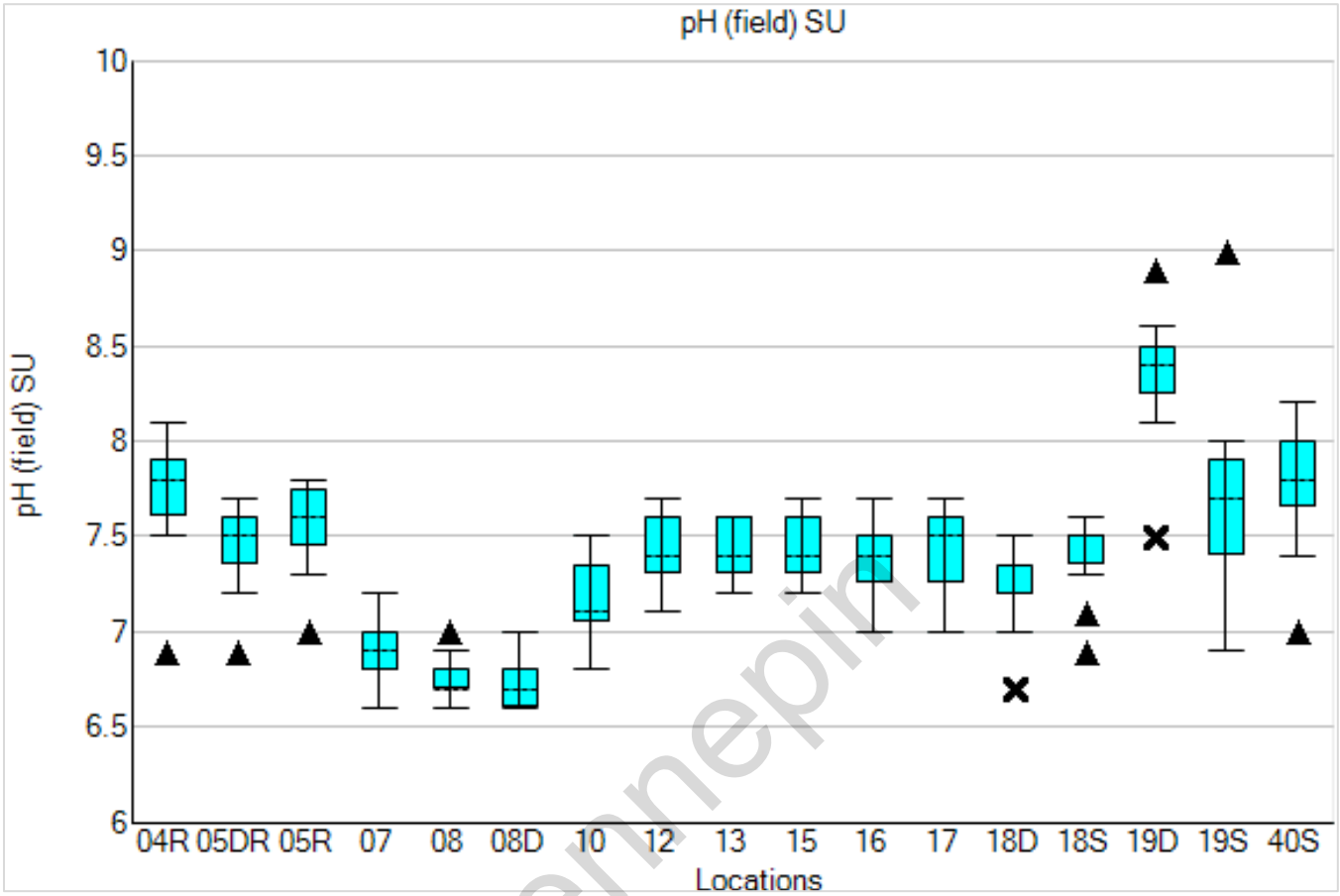


Figure 8. Box-Whisker Plot Showing the Distribution of pH.

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 at intermediate wells 12, 13, and 15, as well as downgradient wells 05R, 05DR, and 18S. Given that pH values observed in wells upgradient of the Landfill and downgradient of neighboring industrial activity are similar to pH values observed in wells downgradient of the Landfill, those industrial activities may be an alternate source of pH values observed in the wells downgradient of the Landfill.

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) of the wells in the monitoring system, 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

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 and Landfill are shown on Figure 9. The Upper Prediction Limit (UPL) for boron of 0.1503 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 potentially from the East Ash Pond are a contributing factor to, and alternate source of, the elevated boron concentrations observed in the Landfill monitoring wells.

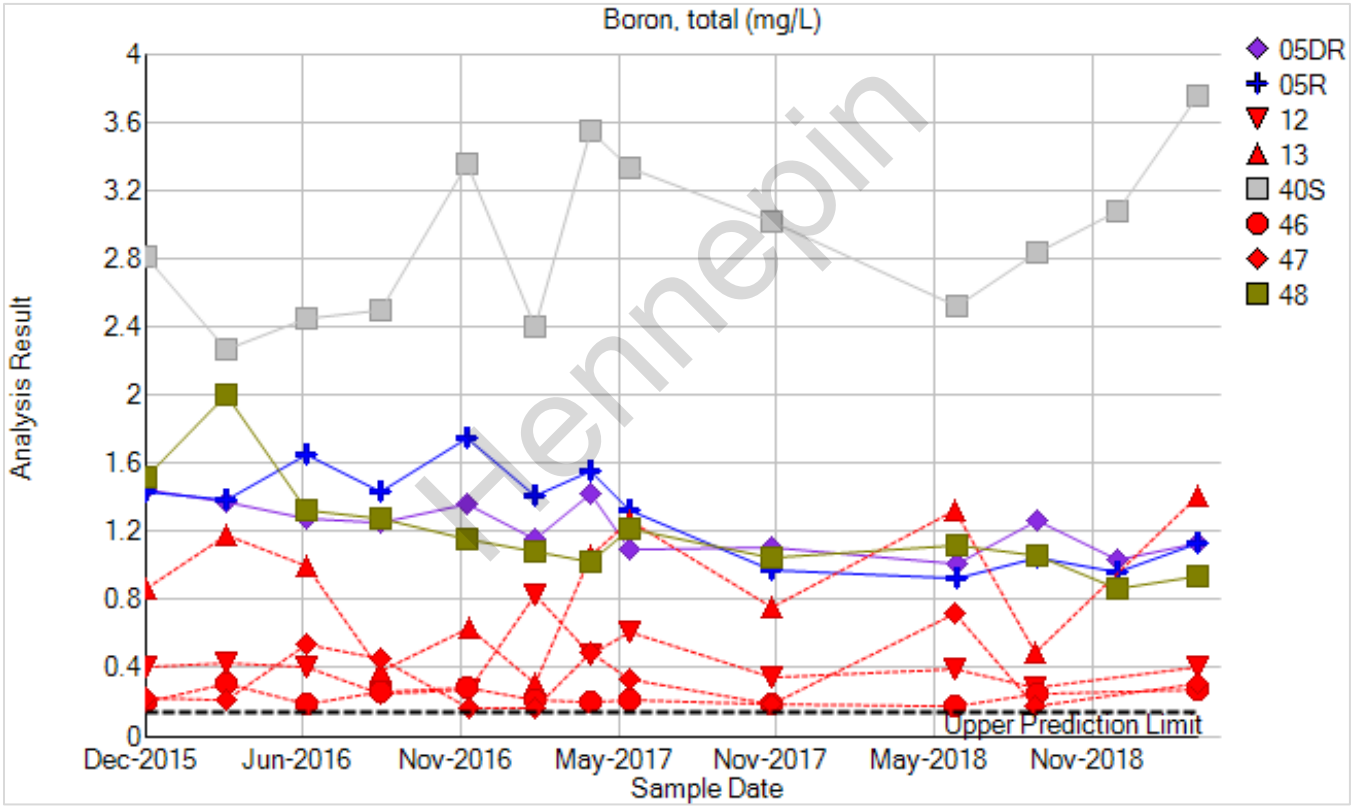


Figure 9. Boron Concentration Time-Series in Wells Downgradient from the East Ash Pond and Landfill.

Fluoride concentrations observed at wells near the East Ash Pond and Landfill are shown on Figure 10. The UPL for fluoride of 0.12 mg/L was exceeded at all wells except those used to calculate the UPL (07, 08, and 08D). Both total and dissolved fluoride concentrations are shown to facilitate comparison; some wells are only monitored for total fluoride, and some are only monitored for dissolved fluoride. Figure 11 is a box-whisker plot for wells where both total and dissolved fluoride are monitored, and demonstrate good correlation between total and dissolved concentrations.

Unlike boron, the highest observed fluoride concentrations are near the East Ash Pond, both upgradient (wells 16, 17) and downgradient (wells 12, 13, 46, and 47), and the lower concentrations were observed in the Landfill downgradient wells (05R, 05DR, 40S, 48), which supports that for the elevated concentrations of fluoride are 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 near the 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 <0.10 to 0.24 mg/L. Elevated fluoride concentrations observed upgradient and downgradient of the East Ash Pond decrease beneath the Landfill, which establishes that groundwater beneath the Landfill is not being impacted with fluoride from either the Landfill, the ash beneath the Landfill, or the East Ash Pond, and is from another source located upgradient.

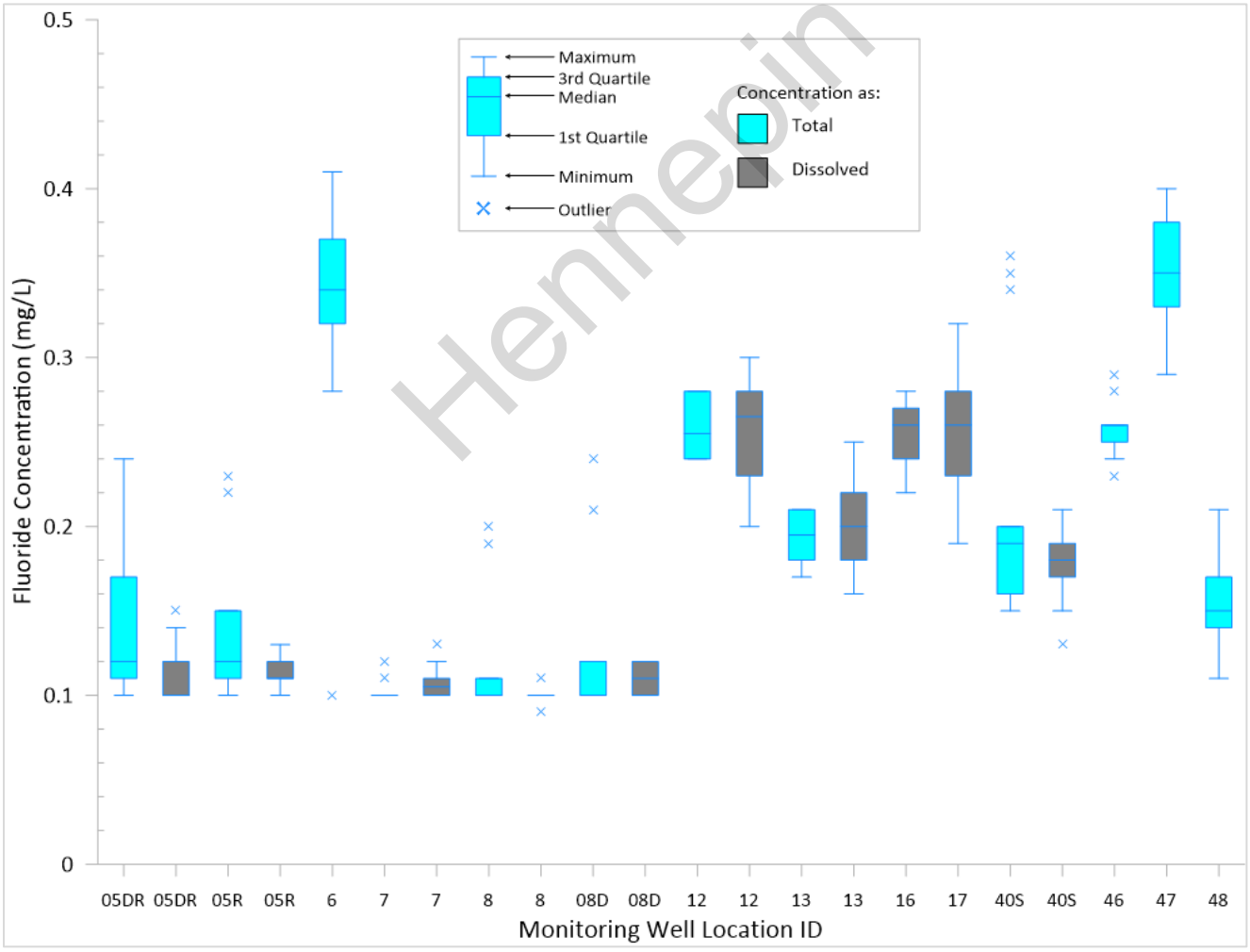


Figure 10. Fluoride Concentration Box-Whisker Plot for Wells Near the East Ash Pond and Landfill.

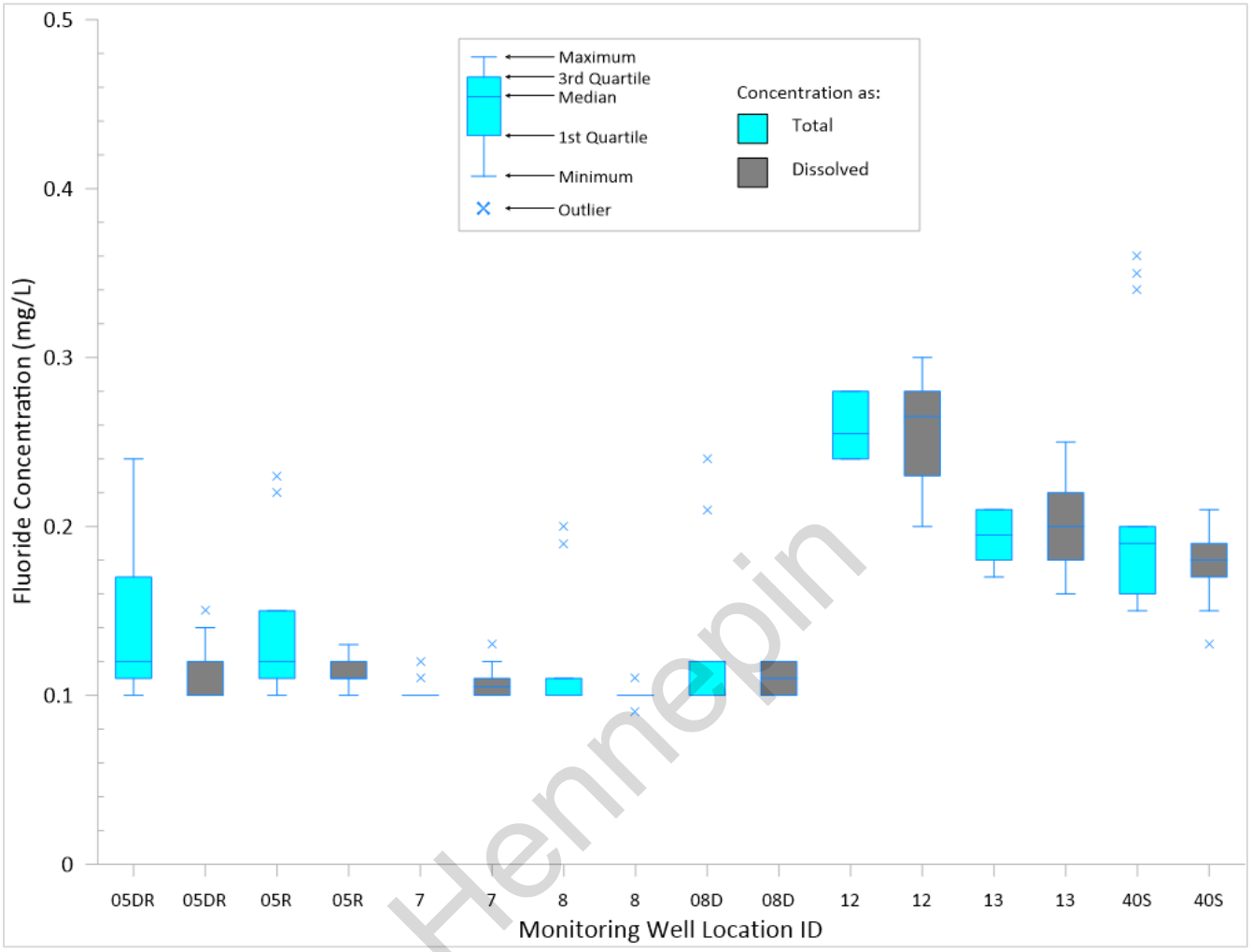


Figure 11 – Box-Whisker Plot Comparing Total and Dissolved Fluoride Concentrations.

Figure 12 shows pH values observed at wells near the East Ash Pond and Landfill. Wells 16 and 17 are located upgradient of the East Ash Pond. Wells 12, 13, 46, and 47 are located downgradient of the East Ash Pond, but upgradient of the Landfill. Wells 05R, 05DR, 40S, and 48 are located downgradient of the Landfill. Values for pH at wells 16 and 17 are near the UPL for pH of 7.5 Standard Units (SU), which supports that off-site anthropogenic activity may be contributing to elevated pH values, as discussed in Section 2.2.3. Values for pH downgradient Landfill are slightly higher than upgradient, indicating that pH increases slightly as groundwater moves beneath the Landfill, and ash underlying the Landfill. For the period of November 2015 to March 2019 (Figure 12), the observed pH at wells upgradient from the East Ash Pond ranges from 7.0 to 7.7 SU. Wells downgradient from the East Ash Pond range from 6.7 to 7.7 SU. Wells downgradient from the Landfill range from 7.0 to 8.2 SU. The maximum measured pH of groundwater downgradient from the Landfill is 0.5 SU greater than the maximum pH measured upgradient and downgradient from the East Ash Pond. The pH of groundwater is already elevated upgradient of the East Ash Pond and Landfill, and only increases slightly as it moves further downgradient to the East Ash Pond and Landfill wells, but enough to trigger SSIs. Elevated pH values upgradient from the East Ash Pond and Landfill demonstrate that an off-site anthropogenic source located upgradient is contributing to pH SSIs observed downgradient of the East Ash Pond and Landfill.

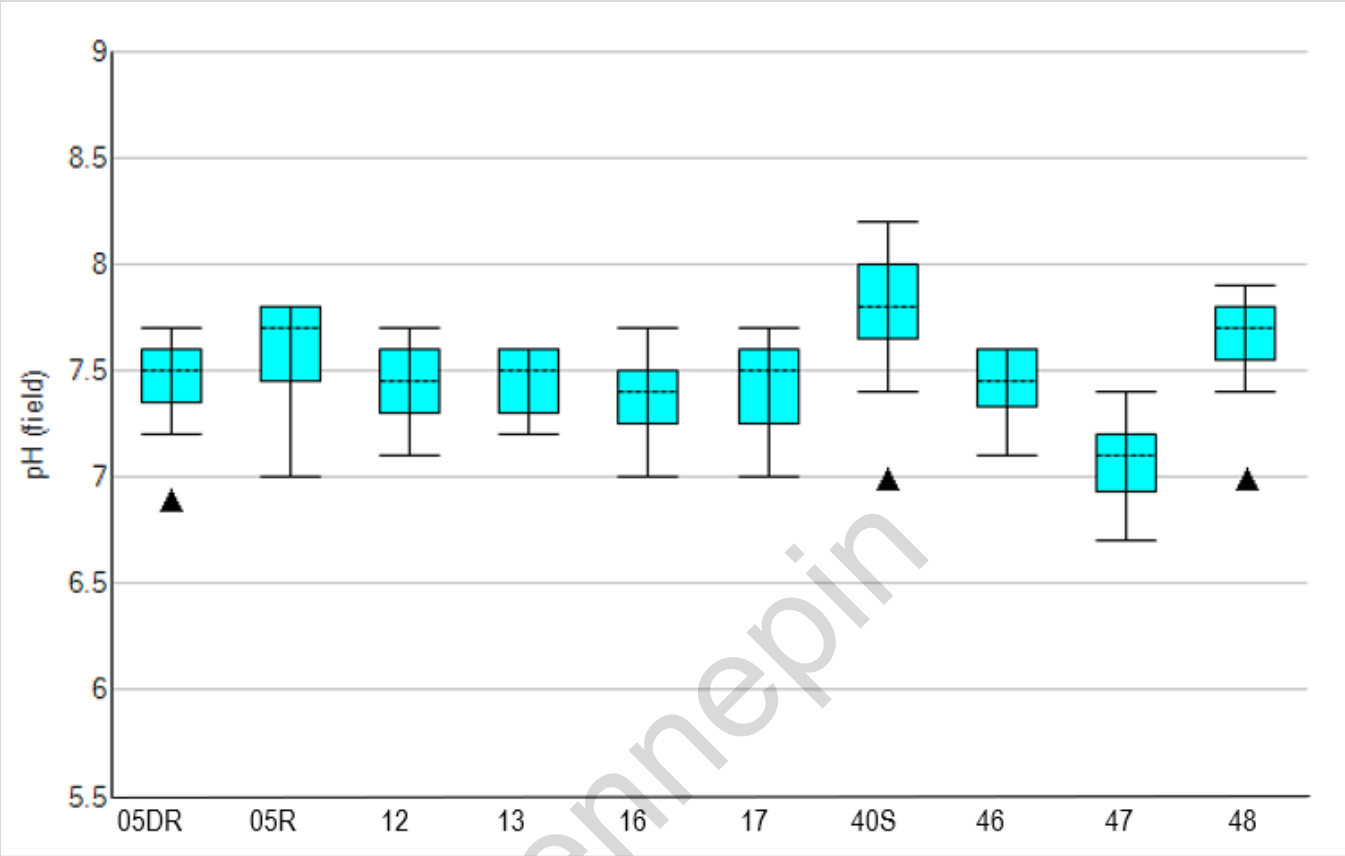


Figure 12. Box-Whisker Plot of pH in Wells Near the East Ash Pond and Landfill.

3 CONCLUSIONS AND CERTIFICATION

Pursuant to 40 C.F.R. § 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 in Ash Pond No. 2 and Underlying the Landfill
- Surrounding Industrial Activity
- East Ash Pond

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 exposed ash deposits in Ash Pond No. 2 outside the Landfill boundary and potentially from the East Ash Pond, with periodic wetting of low lying ash deposits beneath the Landfill during river flood events which may cause temporary increases in boron concentrations in some downgradient wells. Concentrations return to long-term trends shortly after these events.
- 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.
- 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 groundwater beneath the Landfill is likely influenced by an off-site anthropogenic source.

This information serves as the written ASD prepared in accordance with 40 C.F.R. § 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 near 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., a Ramboll Company
Date: July 15, 2019

I, Nicole M. Pagano, a professional geologist in good standing in the State of Illinois, 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.

Nicole M. Pagano
Professional Geologist
196-000750
Illinois
O'Brien & Gere Engineers, Inc., a Ramboll Company
Date: July 15, 2019

Figures

Y:\Mapping\Projects\222285 Hennepin EastMXD\ASD\Figure 1 Groundwater Sampling Well Location Map.mxd

DOWNGRADIENT WELL LOCATION
UPGRADIENT WELL LOCATION
NON-CCR WELL LOCATION
CCR MONITORED UNIT
NON-CCR UNIT

ALTERNATE SOURCE DEMONSTRATION
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

0 175 350 700
Feet

N

GROUNDWATER SAMPLING WELL LOCATION MAP

OBG
Part of Ramboll

Y:\Mapping\Projects\222285 Hennepin East\MXD\ASD\Figure 2 GWS Wellt.oc HenLF.mxd

DOWNGRADIENT WELL LOCATION
UPGRADIENT WELL LOCATION
CCR MONITORED UNIT

ALTERNATE SOURCE DEMONSTRATION
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

0 175 350 700
Feet

N

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

OBG
Part of Ramboll

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

					Requested Tests						
Sample ID	**ClientSampID**	**Matrix**	**Date Collected**	**Bottle**	**D3987/6010B**	**D3987/7000 G**	**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:** Dan Botly (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

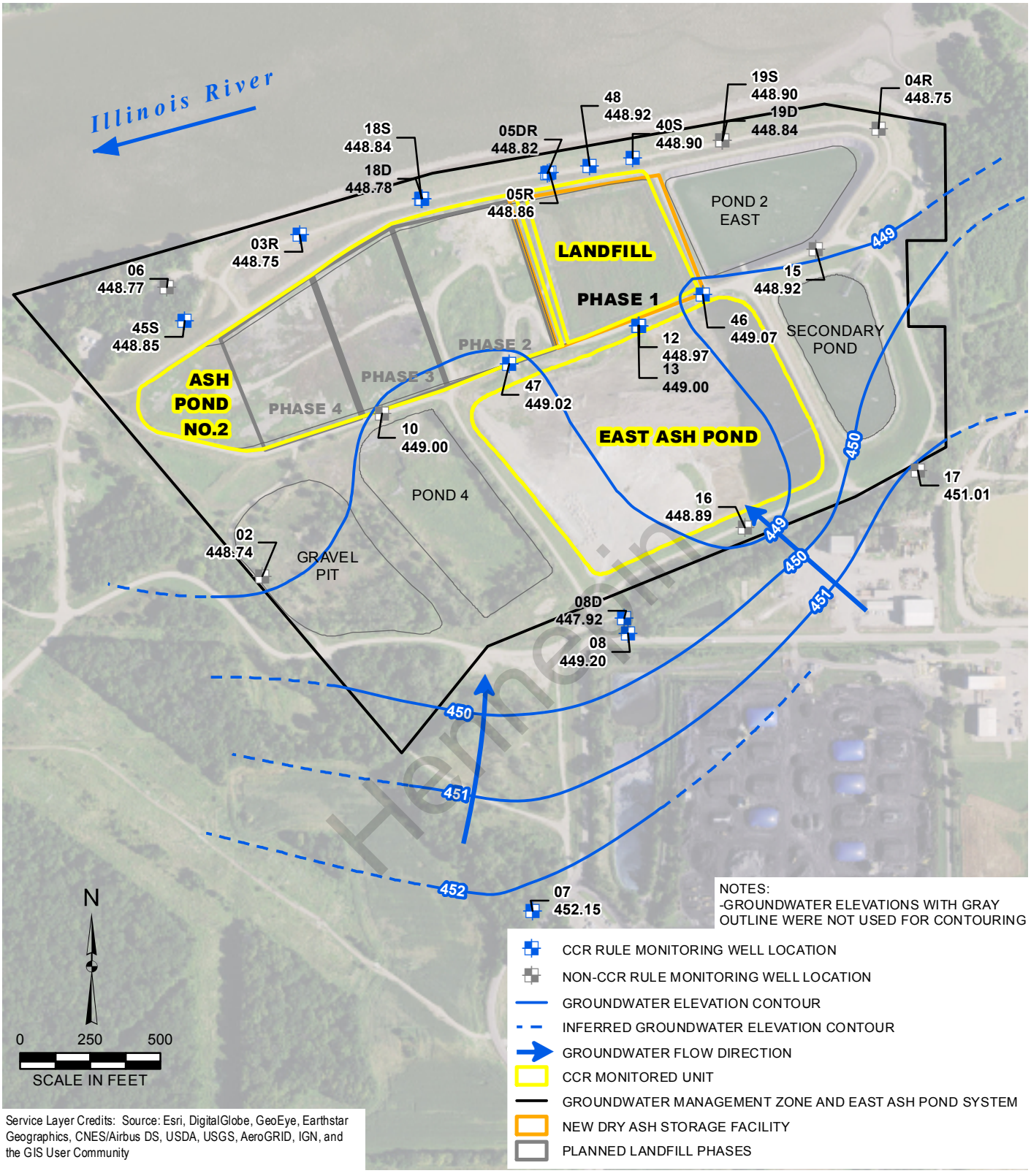
Sample Narrative
ASTM D3987, SW-846 3020A, Metals in Shake Extract by GFAA
TI - Matrix interference present in sample.

22-8 notice
DB 7/24/09

900 ~~FeWS~~
DB 7/24/09

Appendix B

Groundwater Contour Maps, 2015-2019



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SDS 1/25/17
REVIEWED BY/DATE:
TBN 1/26/17
APPROVED BY/DATE:
JJW 2/9/17

HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 1: DECEMBER 8, 2015

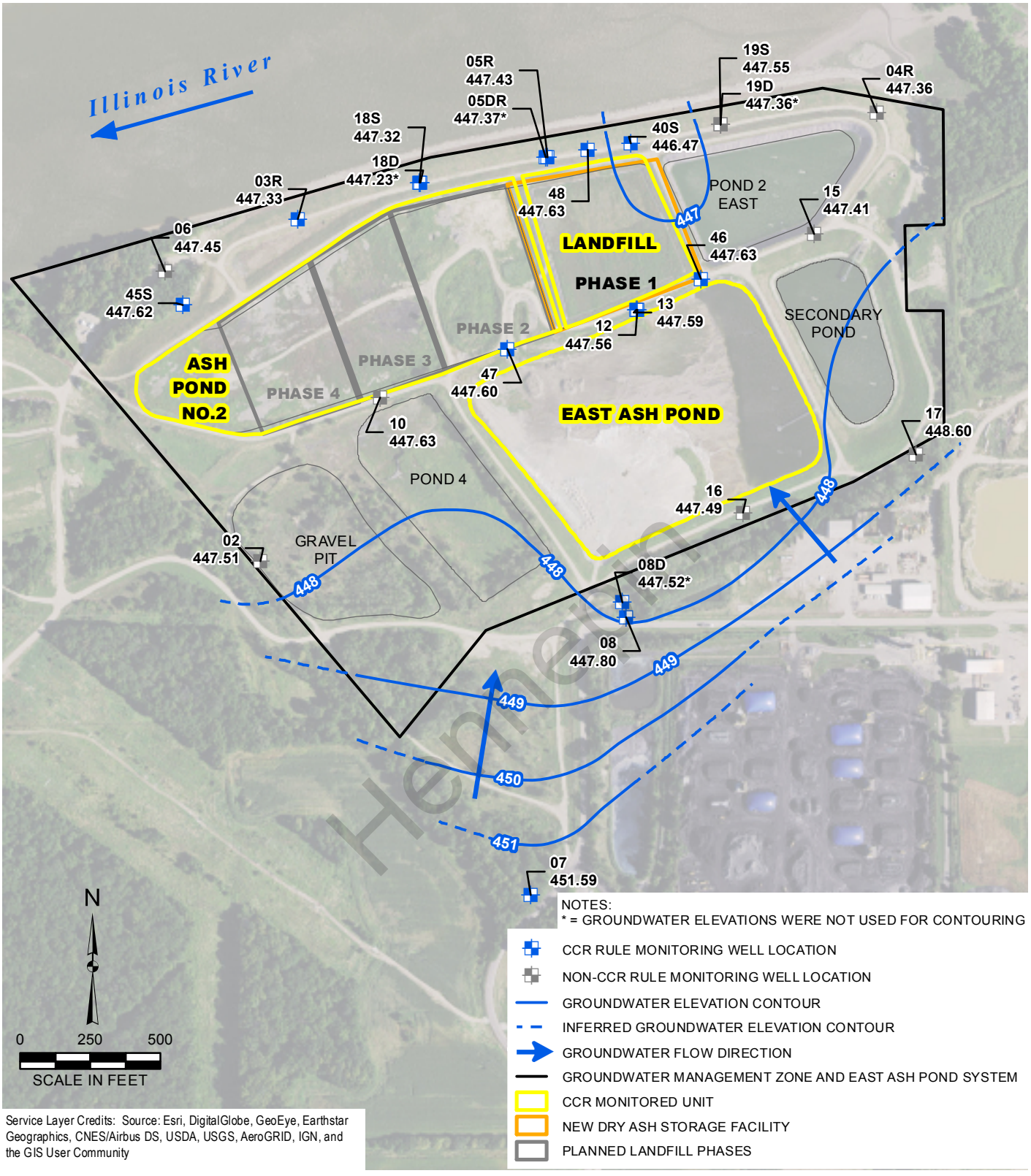
DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

Y:\Mapping\Projects\22\2285MXD\GW_Contours\Round_01\R1_HennepinEast_GW_Contours.mxd Author: sstolz Date/Time: 3/2/2017, 2:55:08 PM



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SDS 1/25/17
REVIEWED BY/DATE:
TBN 1/26/17
APPROVED BY/DATE:
JJW 2/9/17

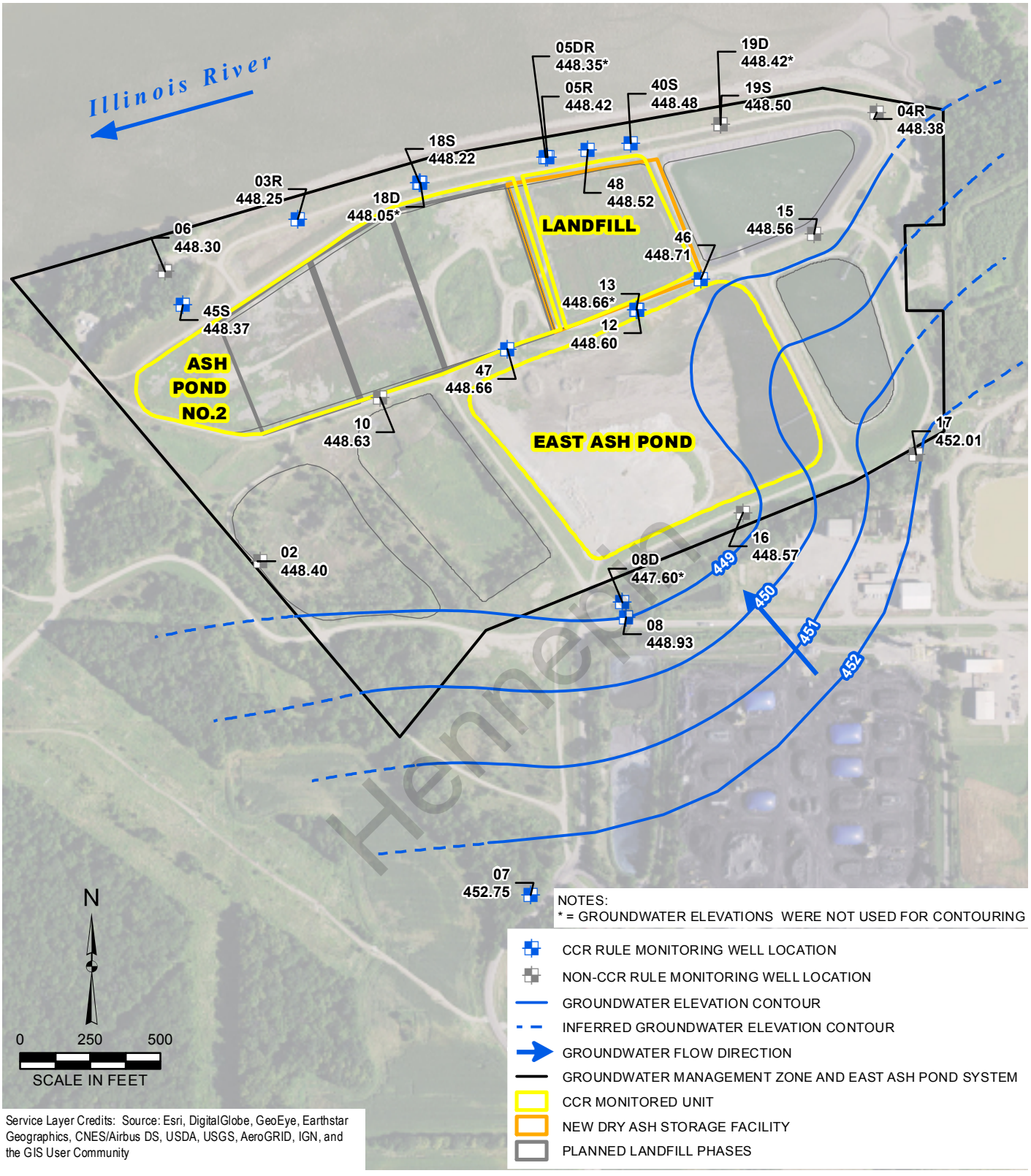
HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 2: MARCH 8, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



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SDS 1/25/17
REVIEWED BY/DATE:
TBN 1/26/17
APPROVED BY/DATE:
JJW 2/9/17

HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 3: JUNE 7, 2016

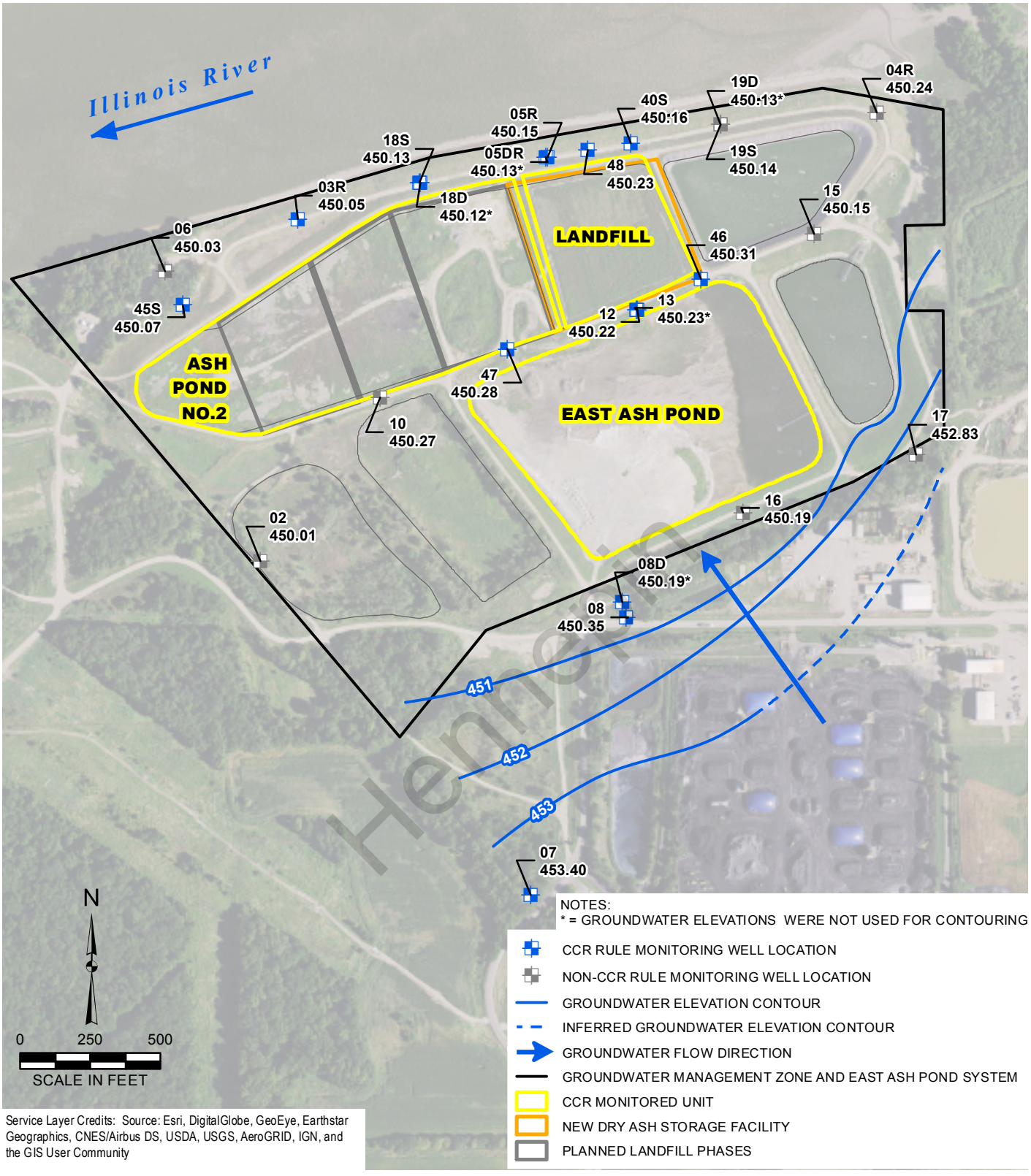
DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

Y:\Mapping\Projects\22\2285MXD\GW_Contours\Round_03\R3_HennepinEast_GW_Contours.mxd Author: stolzsd: Date/Time: 4/11/2017, 6:08:24 PM



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SDS 1/25/17
REVIEWED BY/DATE:
TBN 1/27/17
APPROVED BY/DATE:
JJW 2/7/17

HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 4: SEPTEMBER 9, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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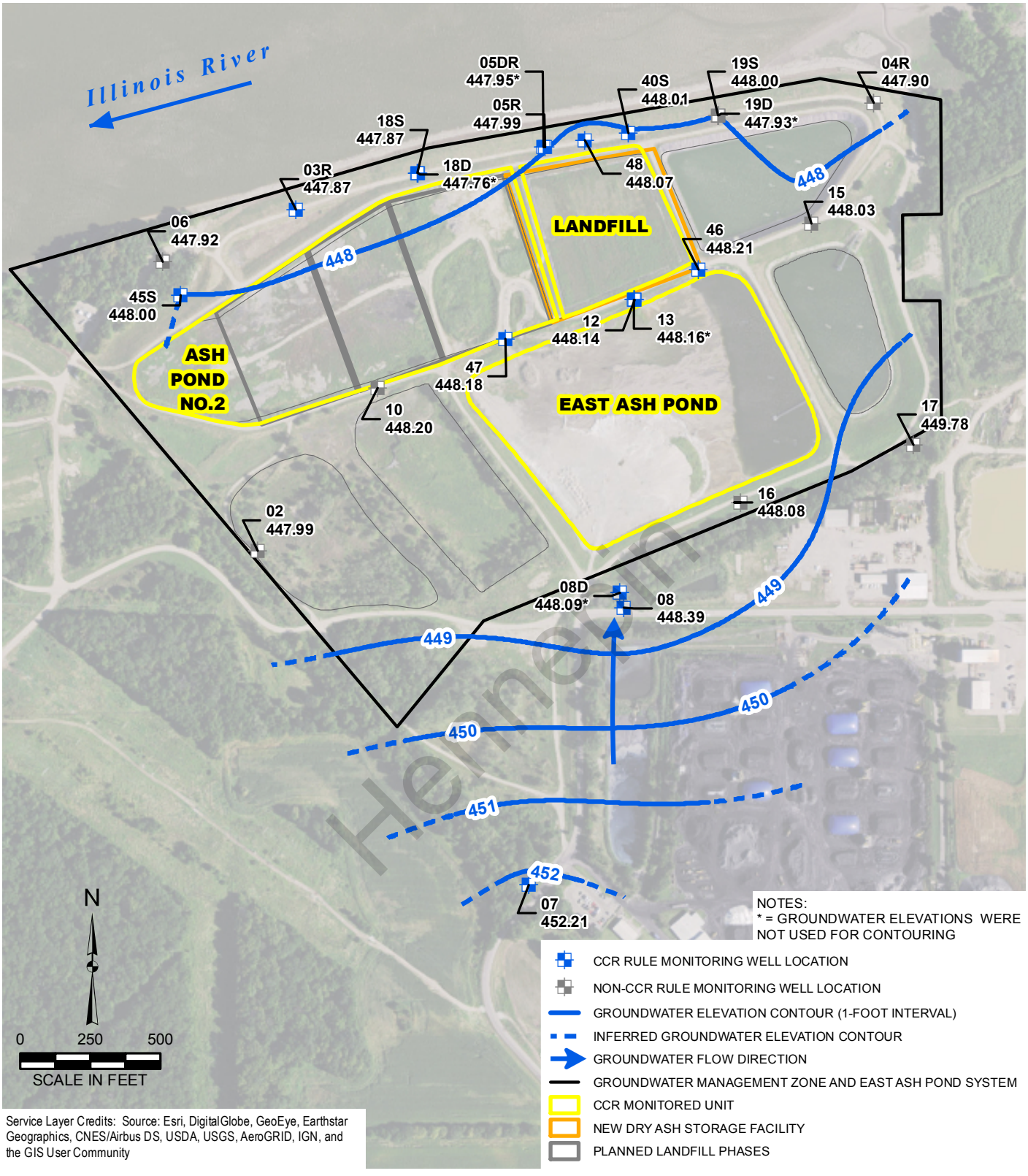

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

DRAWN BY/DATE:
SDS 3/6/17
REVIEWED BY/DATE:
TBN 3/6/17
APPROVED BY/DATE:
JJW 9/1/17

HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 5: DECEMBER 7, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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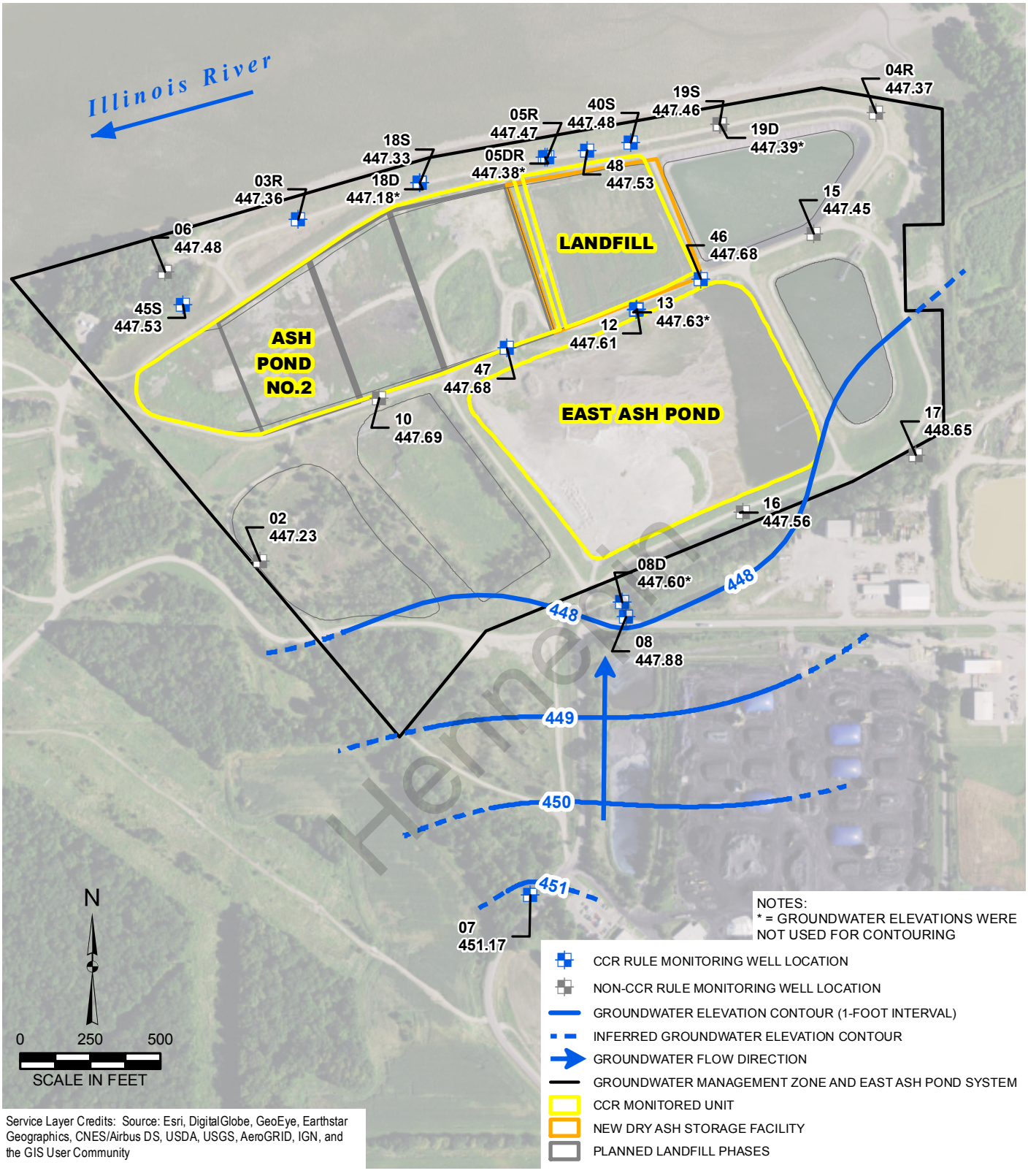

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SDS 3/6/17
REVIEWED BY/DATE:
TBN 3/6/17
APPROVED BY/DATE:
JJW 9/1/17

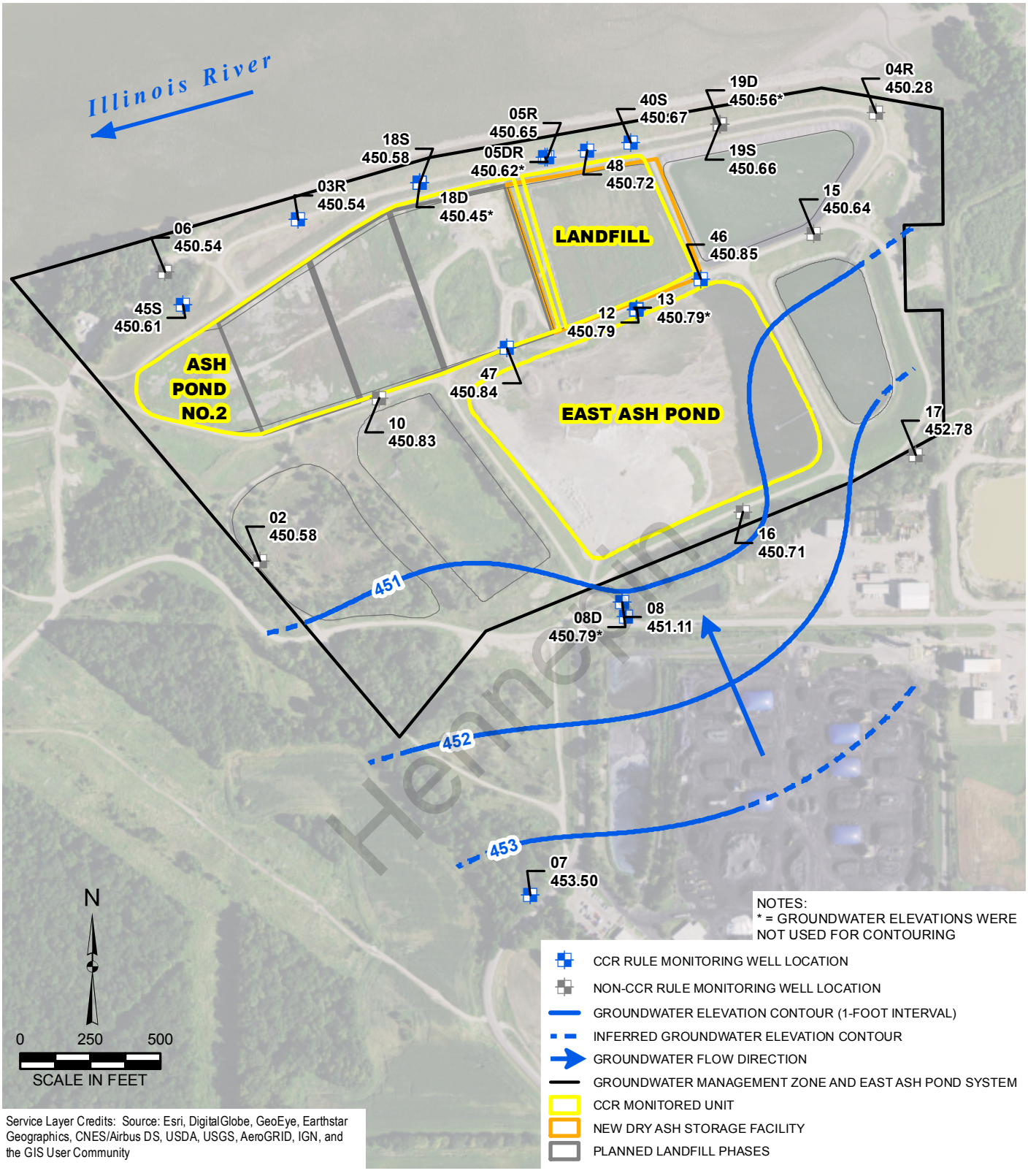
HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 6: FEBRUARY 20, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



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 5/25/17
REVIEWED BY/DATE:
TBN 5/25/17
APPROVED BY/DATE:
JJW 9/1/17

HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 7: APRIL 25, 2017

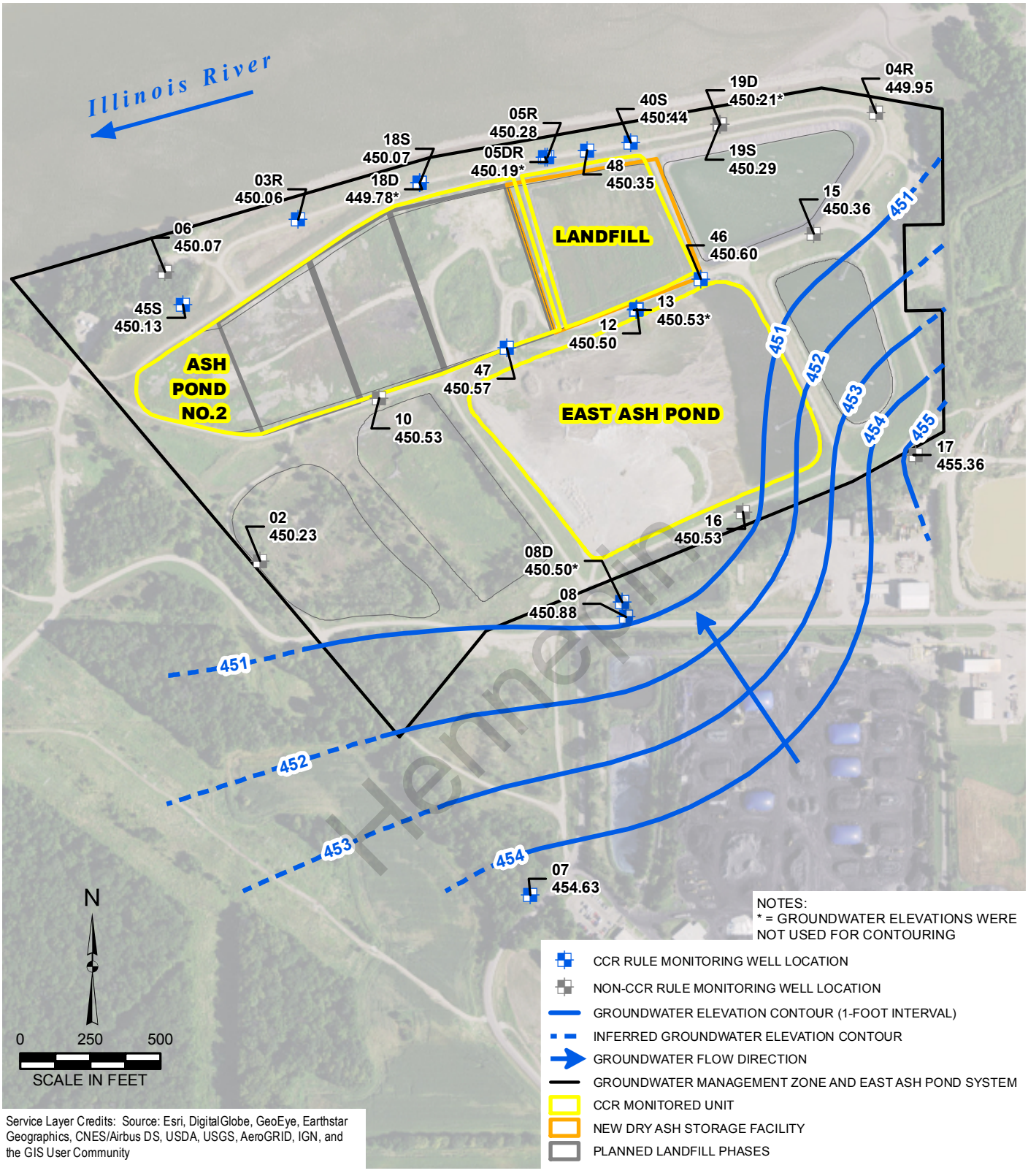
DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

Y:\Mapping\Projects\2285\MXD\GW_Contours\Round_07\R7_HennepinEast_GW_Contours.mxd Author: stolzsd; Date/Time: 9/8/2017, 4:33:47 PM



DRAWN BY/DATE:
SDS 7/20/17
REVIEWED BY/DATE:
TBN 7/20/17
APPROVED BY/DATE:
JJW 9/1/17

HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 8: JUNE 8, 2017

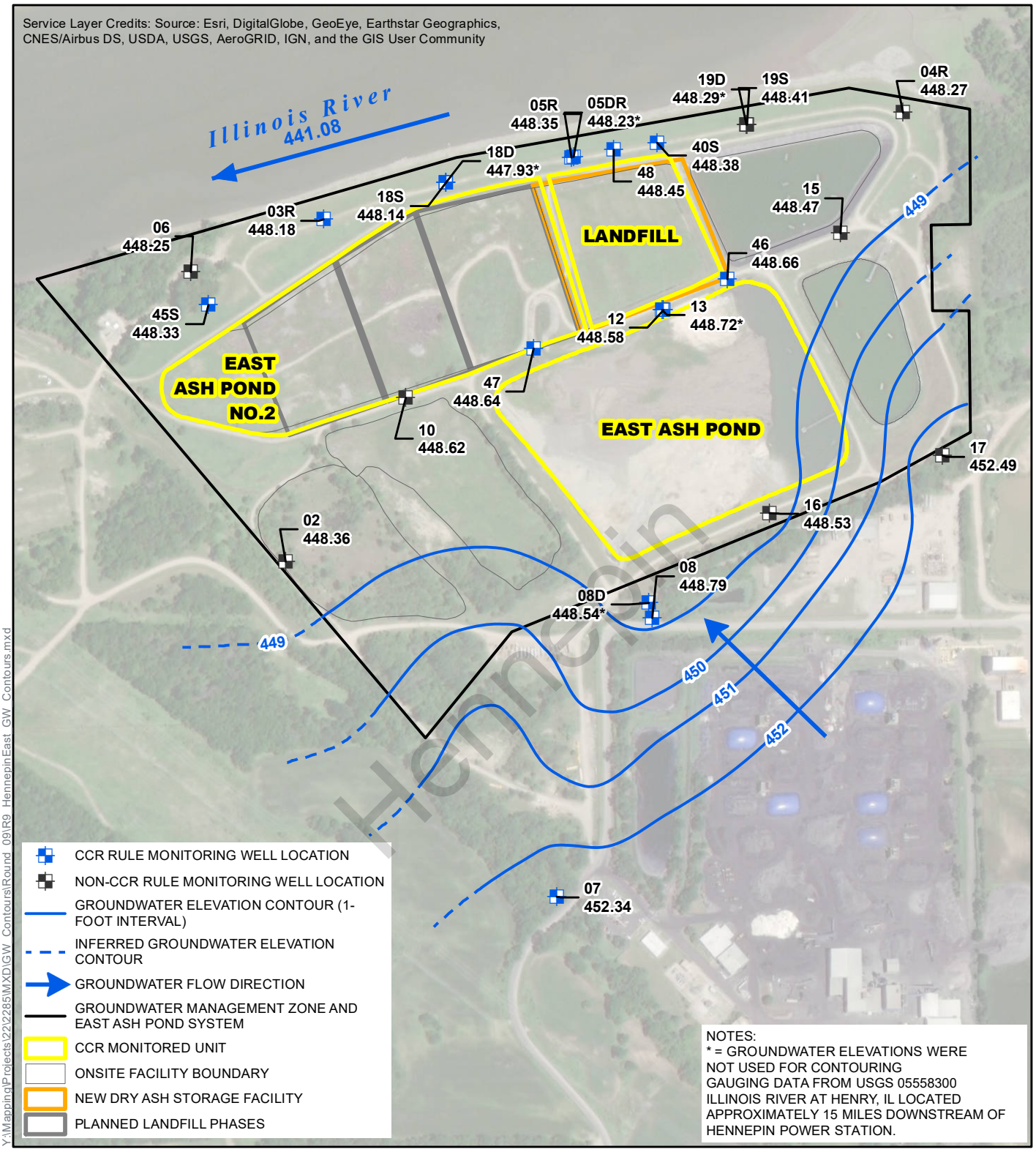
DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

Y:\Mapping\Projects\2285\MXD\GW_Contours\Round_08\R8_HennepinEast_GW_Contours.mxd Author: stolzsd; Date/Time: 9/8/2017, 4:31:23 PM



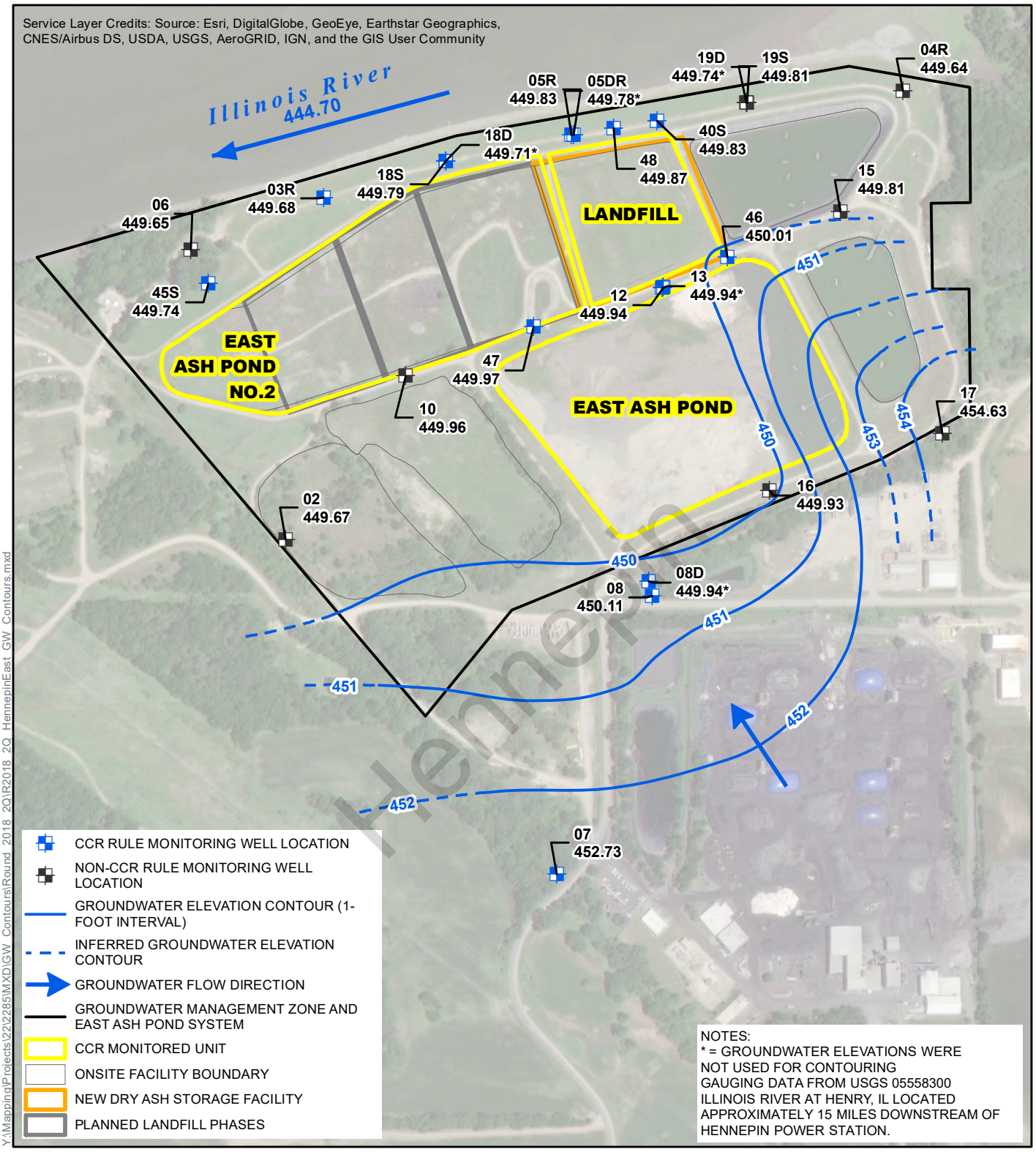
HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
GROUNDWATER ELEVATION CONTOUR MAP
NOVEMBER 15, 2017

CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

N

0 125 250 500
Feet

O'BRIEN & GERE ENGINEERS, INC.



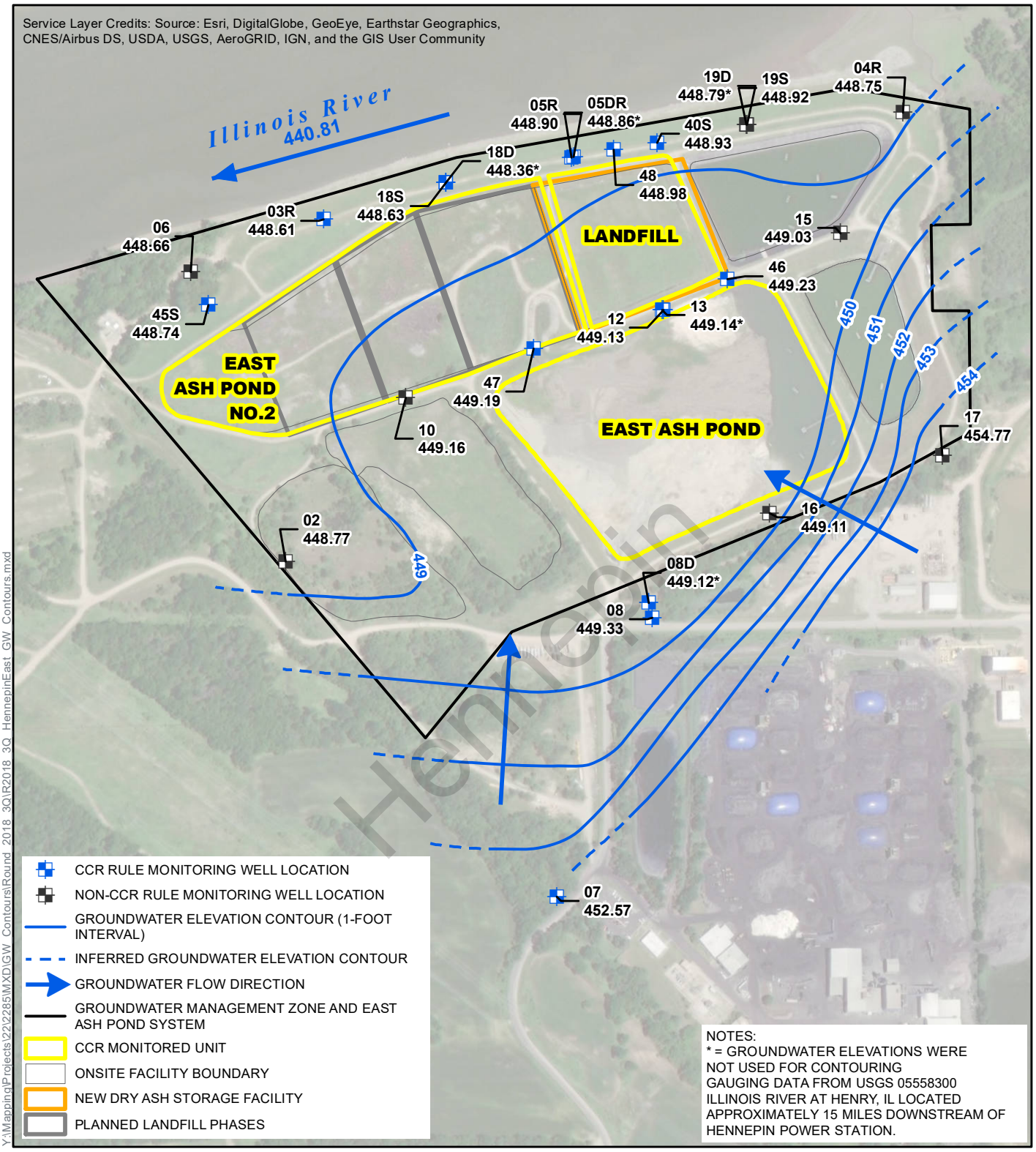
HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
GROUNDWATER ELEVATION CONTOUR MAP
JUNE 13, 2018

CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

0 125 250 500
Feet

N

O'BRIEN & GERE ENGINEERS, INC.



HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
GROUNDWATER ELEVATION CONTOUR MAP
SEPTEMBER 12, 2018

CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

0 125 250 500
Feet

N

O'BRIEN & GERE ENGINEERS, INC.

40 C.F.R. § 257.94(e)(2): ALTERNATE SOURCE DEMONSTRATION
HENNEPIN LANDFILL
OCTOBER 14, 2019

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

Hennepin Power Station
Hennepin, Illinois

Dynegy Midwest Generation, LLC

October 14, 2019

OBG
Part of Ramboll

OCTOBER 14, 2019 | PROJECT #72756

40 C.F.R. § 257.94(e)(2): Alternate Source Demonstration Hennepin Landfill

Hennepin Power Station
Hennepin, Illinois

Prepared for:
Dynegy Midwest Generation, LLC

KRISTEN L. THEESFELD
Hydrogeologist

ERIC J. TLACHAC
Managing Engineer

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Figures 1 and 2 are attached, Figures 3-12 are included in the text.

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

ASD	Alternate Source Demonstration
Ash Pond No. 2	Hennepin Ash Pond No. 2
CCR	Coal Combustion Residuals
CCR Rule	40 C.F.R. Part 257
CEC	Civil & Environmental Consultants, Inc.
40 C.F.R.	Title 40, Code of Federal Regulations
cm/s	centimeters per second
East Ash Pond	Hennepin East Ash Pond
HDPE	High-density Polyethylene
IEPA	Illinois Environmental Protection Agency
Landfill	Hennepin Landfill
mg/L	milligrams per liter
msl	mean sea level
NPDES	National Pollutant Discharge Elimination System
NRT/OBG	Natural Resource Technology, an OBG Company
OBG	O'Brien & Gere Engineers, Inc., Part of Ramboll
Site	Hennepin Power Station
SSI	Statistically Significant Increase
STD	Standard Units
UPL	Upper Prediction Limit

1 INTRODUCTION

1.1 OVERVIEW

Title 40 Code of Federal Regulations (40 C.F.R.) Section 257.94(e)(2) allows the owner or operator of a Coal Combustion Residuals (CCR) unit 90 days from the date of determination of Statistically Significant Increases (SSIs) over background for groundwater constituents listed in Appendix III of 40 C.F.R. Part 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSI(s), or that the SSI(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (Alternate Source Demonstration [ASD]).

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

The fourth semi-annual detection monitoring samples (Detection Monitoring Round 4 [D4]) were collected on March 13-14, 2019 and analytical data were received on April 15, 2019. In accordance with 40 C.F.R. § 257.93(h)(2), statistical analysis of the data to identify SSIs of 40 C.F.R. Part 257 Appendix III parameters over background concentrations was completed by July 15, 2019, within 90 days of receipt of the analytical data. The statistical determination 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

Pursuant to 40 C.F.R. § 257.94(e)(2), the following demonstrates that sources other than the Hennepin Landfill were the cause of the SSIs listed above. This ASD was completed by October 14, 2019, within 90 days of determination of the SSIs as required by 40 C.F.R. § 257.94(e)(2).

1.2 LOCATION

The Hennepin Power Station (Site) 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 regulated under 40 C.F.R. 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 Landfill (Landfill), 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. 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 1).

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.
2014	North Embankment tree removal, grading, and vegetation re-establishment adjacent to Ash Pond No. 2.

Table 1. 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), and an

addendum to this plan was submitted in October 2018 (OBG/CEC; 2018) to provide closure and post-closure care information for Ash Pond No. 4.

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 high-density polyethylene (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.

Ash Pond No. 4: A former unlined impoundment, now dry, is classified as a non-CCR Rule pond (capped or otherwise maintained). Based on review of aerial photographs and other site information, ash was placed in a former sand and gravel quarry between 1978 and 1984.

A Modified Closure Work Plan submitted and approved in 2010 indicated Ash Pond No. 4 would remain uncovered until such time that ash was no longer being mined for reuse. Given market conditions, Ash Pond No. 4 will be closed in conjunction with Ash Pond No. 2 as specified in the Modified Closure Work Plan, as described in the October 2018 Closure Plan Addendum for Ash Pond No. 2 referenced above.

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/s). 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 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/s. 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/s. 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 sands 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

As allowed by 40 C.F.R. § 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 is 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 in Ash Pond No. 2 and Underlying the Landfill: 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. The other portions of the pond are currently exposed, and subject to infiltration of precipitation and generation of CCR leachate. The pond is unlined, potentially allowing CCR leachate to percolate to groundwater. A revised closure plan for these portions of the pond, which includes the construction of a cover designed to minimize surface water infiltration and leachate generation, was developed in 2018 and is awaiting approval by IEPA prior to implementation. Boring logs indicate that ash fill underlying the Hennepin Landfill may extend to 454 feet above msl. Groundwater elevation measurements indicate 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 CCR constituent concentrations from these intermittent episodes of ash saturation may be present on a transient basis at downgradient locations after normal groundwater flow resumes. Similarly, boring logs indicate that the ash fill in the unlined Ash Pond No. 2 may extend to 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 monitoring wells downgradient from the East Ash Pond for the same Appendix III parameters – boron, fluoride and pH – as in monitoring wells downgradient from the Landfill. Elevated Appendix III parameters observed in the Landfill downgradient wells may be impacted by upgradient CCR leachate from the East Ash Pond if percolation to groundwater occurs. Any leachate that may reach groundwater beneath the East Ash Pond would be transported laterally in the direction of groundwater flow towards the Illinois River and beneath the Landfill.

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 (Appendix A) 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:

- Barium: 0.116 milligrams per liter (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 0.08-0.17 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.

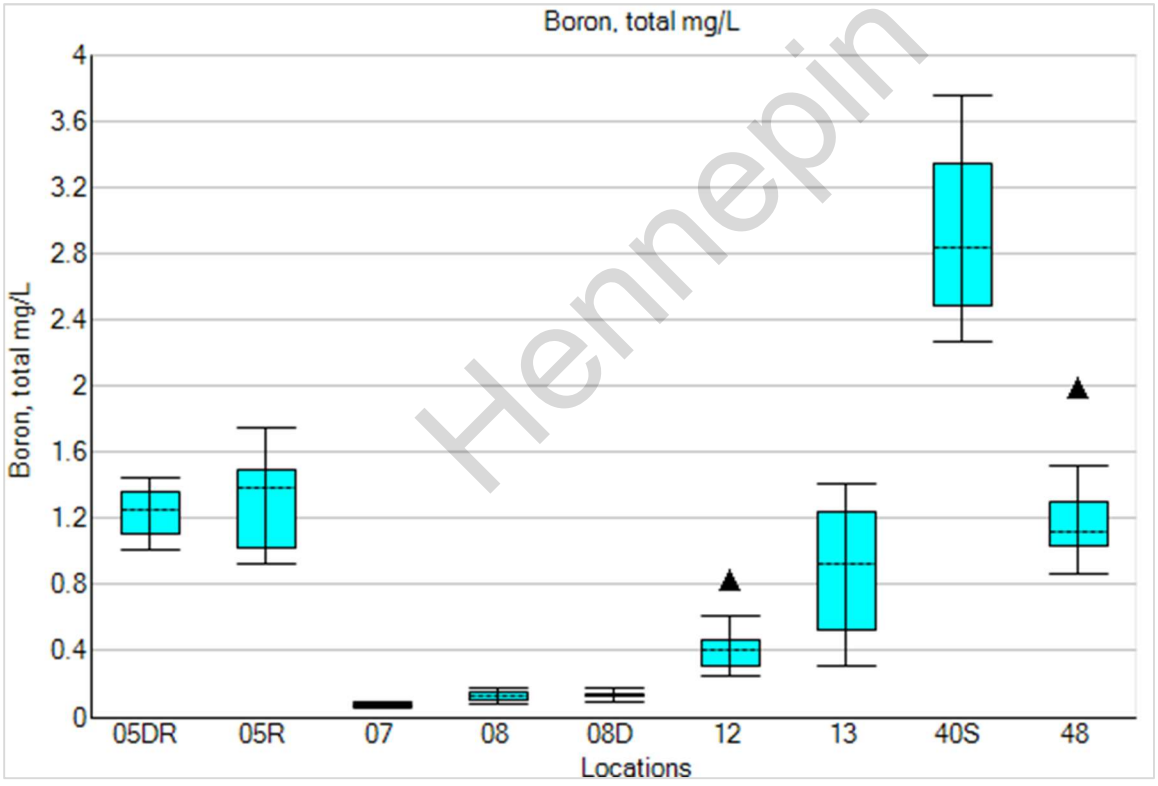


Figure 3. Box-Whisker Plot Showing Distribution of Boron.
Boron concentrations for data collected under the CCR Rule monitoring program for monitoring wells upgradient (07, 08, 08D), between the East Ash Pond and Landfill (12, 13) and downgradient (05R, 05DR, 40S, 48) of the Hennepin Landfill are shown in the figure above.

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

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

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. The other portions of the pond are currently exposed, and subject to infiltration of precipitation and generation of CCR leachate. The pond is unlined, allowing CCR leachate to percolate to

groundwater. A revised closure plan for the exposed portions of the pond, which includes the construction of a cover designed to minimize surface water infiltration and leachate generation, was developed in 2018 and is awaiting approval by IEPA prior to implementation.

The hydrogeological assessment submitted with the 2018 revised closure plan for Ash Pond No. 2 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 have the potential to become partially saturated for a transient period; and, may result in a temporary change to some CCR constituent concentrations at some downgradient locations after groundwater flow direction returns to normal. Since boron is the primary indicator of coal ash leachate, elevated boron concentrations indicate the potential for increased concentrations of other coal ash constituents 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 and March 26-27 ,2018 sampling events appear to have captured this phenomenon as evidenced by a temporary increase in dissolved boron concentrations at downgradient well 40S, and to a lesser extent well 05R, as shown in Figure 4 below. Following each transient event, the boron concentrations at both monitoring wells returned to their prior long-term trends.

Wells 40S, 05R, and 05DR are located downgradient of the ash fill area under Hennepin Landfill. Monitoring wells 12 and 13 are located upgradient (south) of the landfill, and background wells 07, 08, and 08D are shown for comparison. Figure 5 also shows elevated total boron concentration at well 40S since second quarter 2017. Total boron was not analyzed in samples collected March 26-27, 2018.

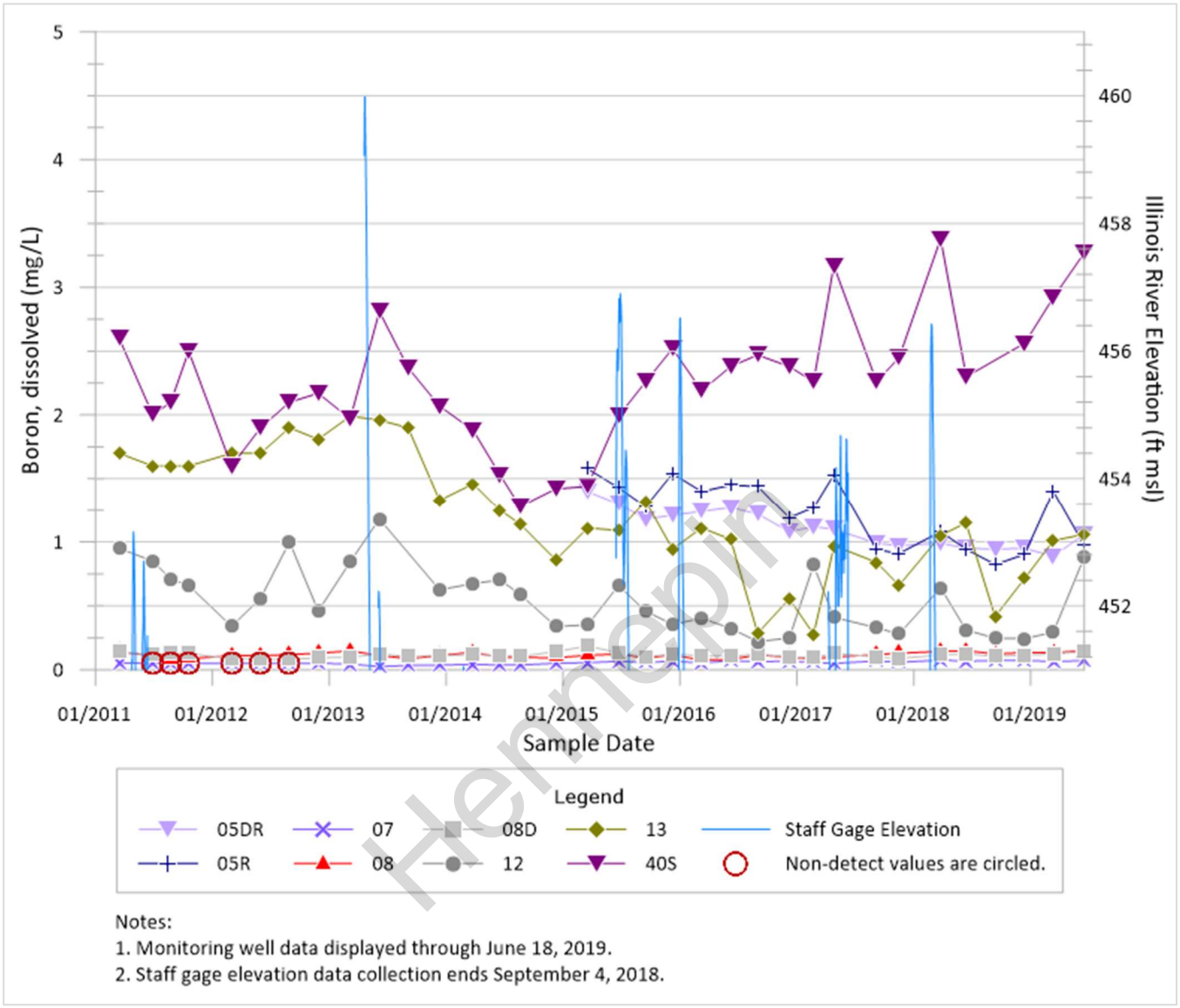


Figure 4. Trends in Dissolved Boron Compared to River Elevations, 2011-2019.
Dissolved boron is shown rather than total boron due to the availability of long-term trend data.
Only river elevations exceeding 451 ft msl are shown.

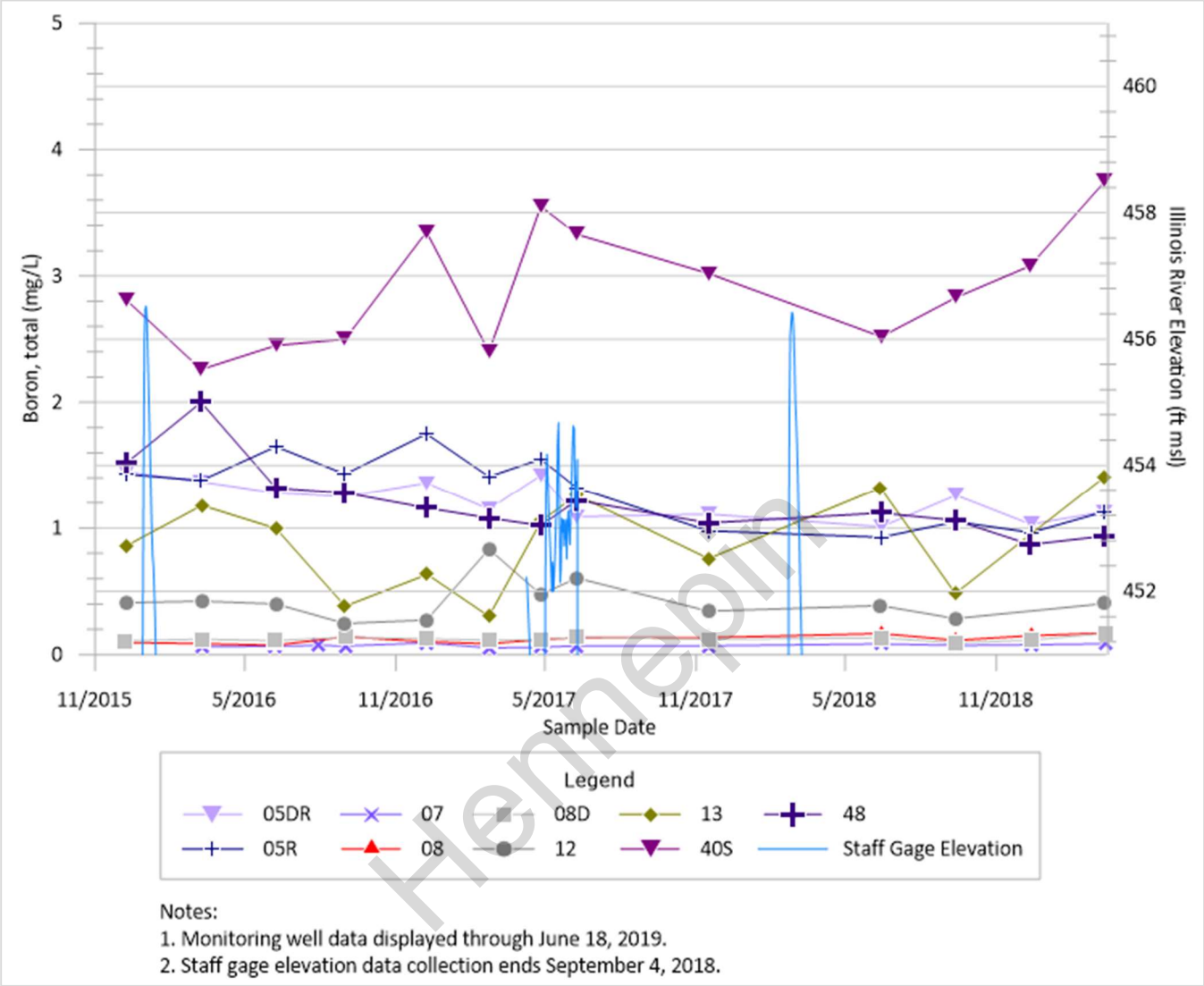


Figure 5. Trends in Total Boron Concentration Compared to River Elevations.
Only river elevations exceeding 451 ft msl are shown.

This demonstrates that low-lying ash deposits located underneath the Landfill that can occasionally become wetted due to natural variation in river elevation represent a potential 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 6), dated July 25, 2018, 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).

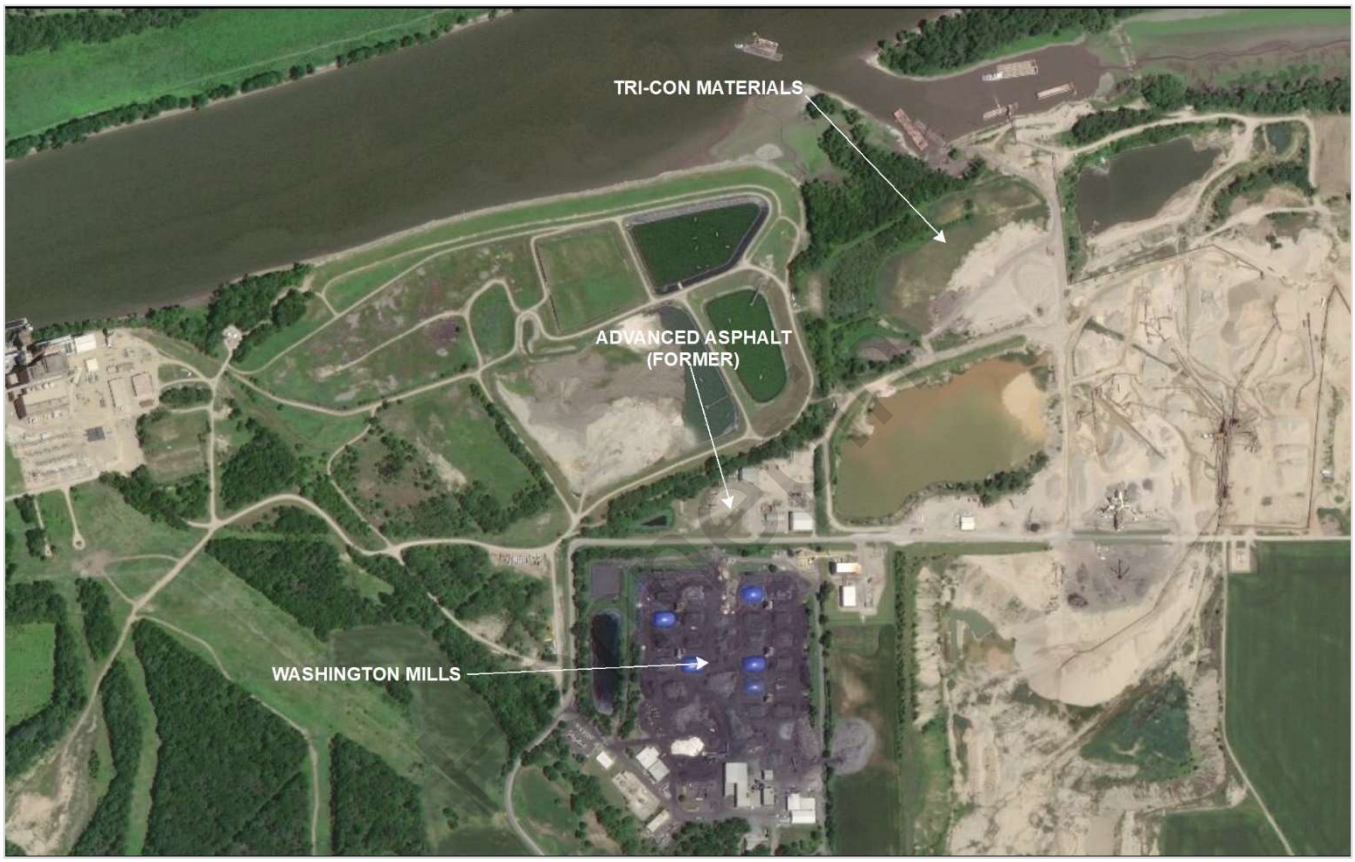


Figure 6. Photo of Hennepin East and Surrounding Industrial Areas (July 25, 2018).

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 2015-2019 at these and other monitoring wells at Hennepin East is shown below (Figure 7), Well 46 is not included on Figure 8 due to the lack

of dissolved fluoride data at this location. 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.

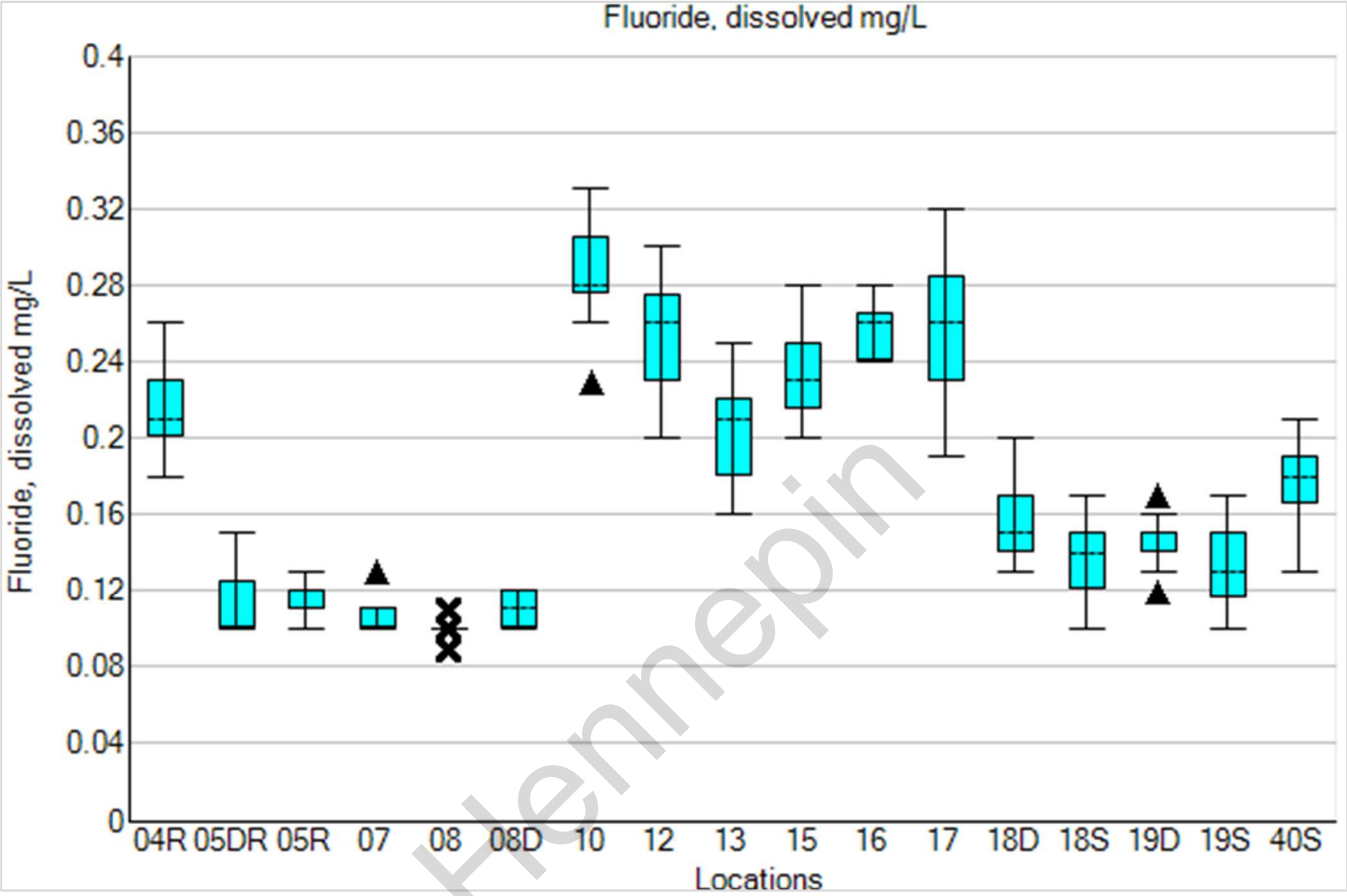


Figure 7. Distribution of Dissolved Fluoride Concentrations at Hennepin East Wells.

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.

Figure 8 below compares pH across most of the upgradient, intermediate, and downgradient wells surrounding the Landfill.

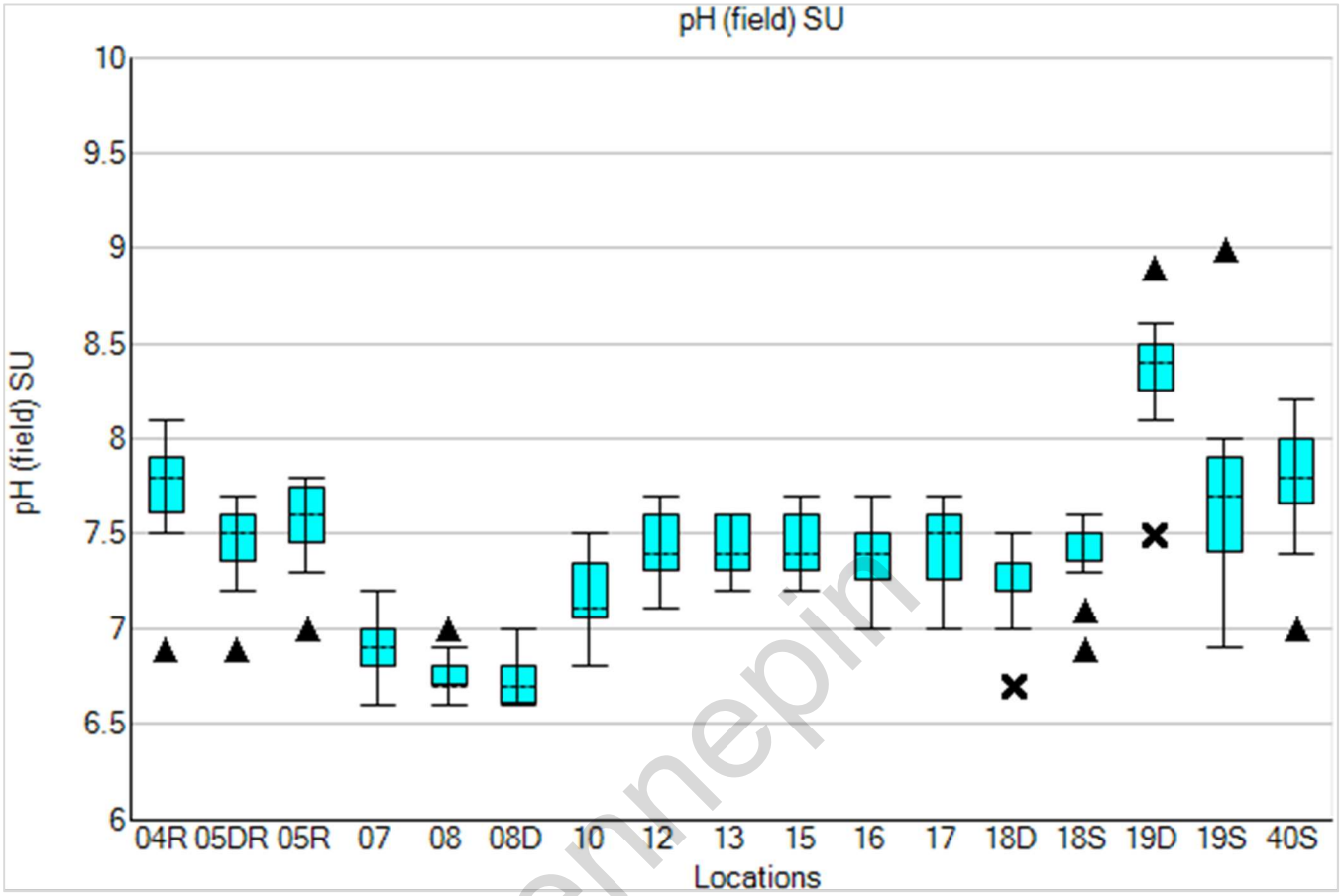


Figure 8. Box-Whisker Plot Showing Distribution of pH

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 at intermediate wells 12, 13, and 15, as well as downgradient wells 05R, 05DR, and 18S. Given that pH values observed in wells upgradient of the Landfill and downgradient of neighboring industrial activity are similar to pH values observed in wells downgradient of the Landfill, those industrial activities may be an alternate source of pH values observed in the wells downgradient of the Landfill.

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) of the wells in the monitoring system, 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

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 and Landfill are shown on Figure 8. The Upper Prediction Limit (UPL) for boron of 0.1503 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 potentially from the East Ash Pond are a contributing factor to, and alternate source of, the elevated boron concentrations observed in the Landfill monitoring wells.

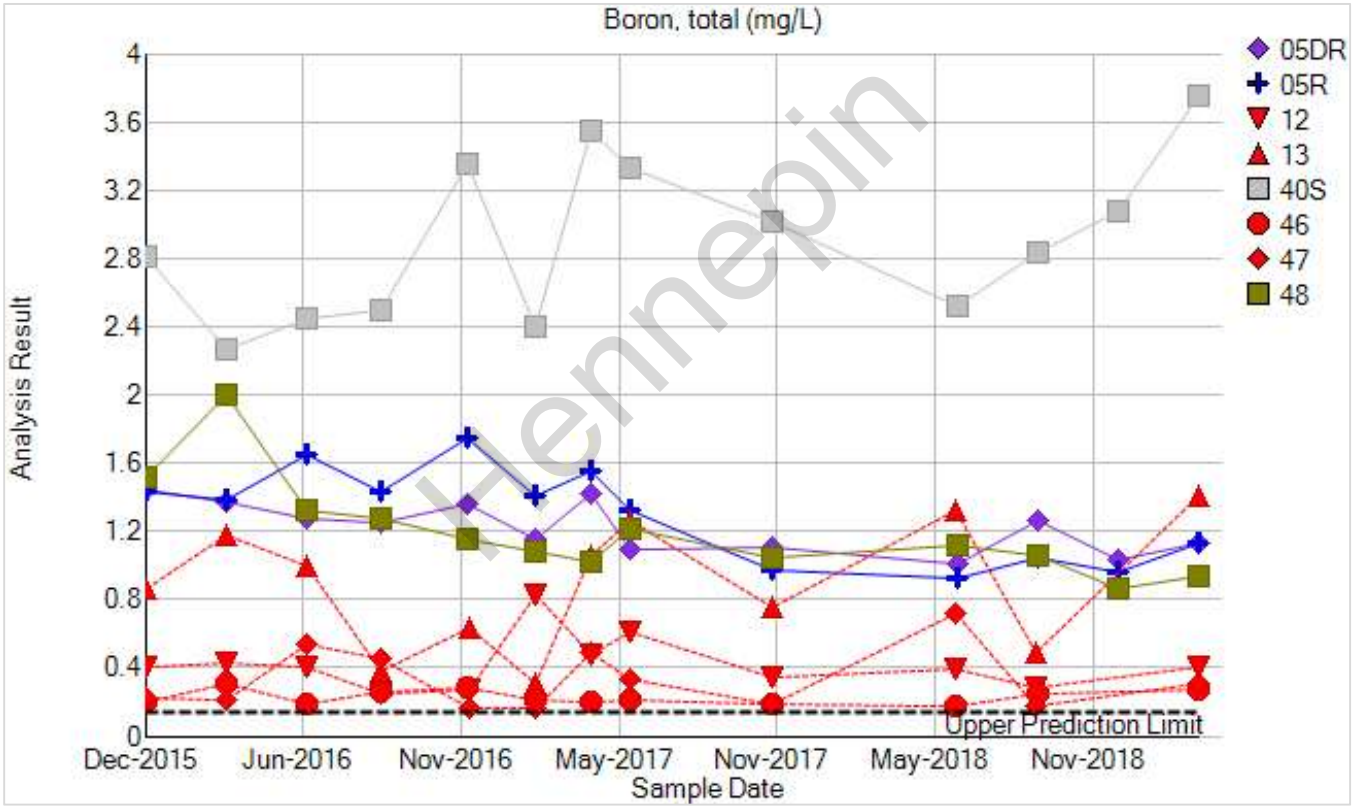


Figure 9. Boron concentration time-series in wells downgradient from the East Ash Pond and Landfill.

Fluoride concentrations observed at wells near the East Ash Pond and Landfill are shown on Figure 10. The UPL for fluoride of 0.12 mg/L was exceeded at all wells except those used to calculate the UPL (07, 08, and 08D). Both total and dissolved fluoride concentrations are shown to facilitate comparison; some wells are only monitored for total fluoride, and some are only monitored for dissolved fluoride. Figure 11 is a box-whisker plot for wells where both total and dissolved fluoride are monitored, and demonstrate good correlation between total and dissolved concentrations.

Unlike boron, the highest observed fluoride concentrations are near the East Ash Pond, both upgradient (wells 16, 17) and downgradient (wells 12, 13, 46, and 47), and the lower concentrations were observed in the Landfill downgradient wells (05R, 05DR, 40S, 48), which supports that elevated concentrations for fluoride are 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 near the 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 <0.10 to 0.24 mg/L. Elevated fluoride concentrations observed upgradient and downgradient of the East Ash Pond decrease beneath the Landfill, which establishes that groundwater beneath the Landfill is not being impacted with fluoride from either the Landfill, the ash beneath the Landfill, or the East Ash Pond, and is being impacted from another source located upgradient.

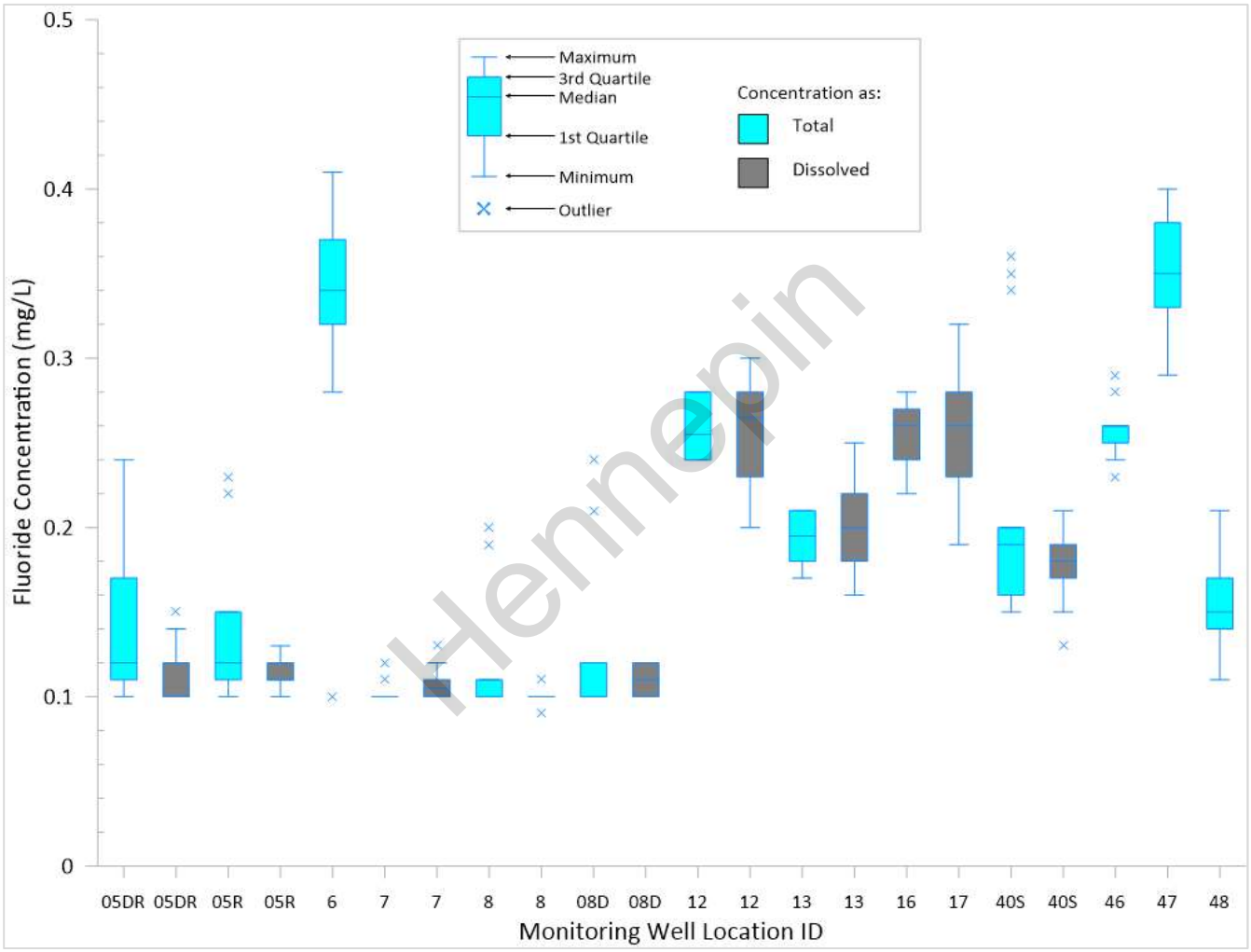


Figure 10. Fluoride Concentration Box-Whisker Plot for Wells Near the East Ash Pond and Landfill.

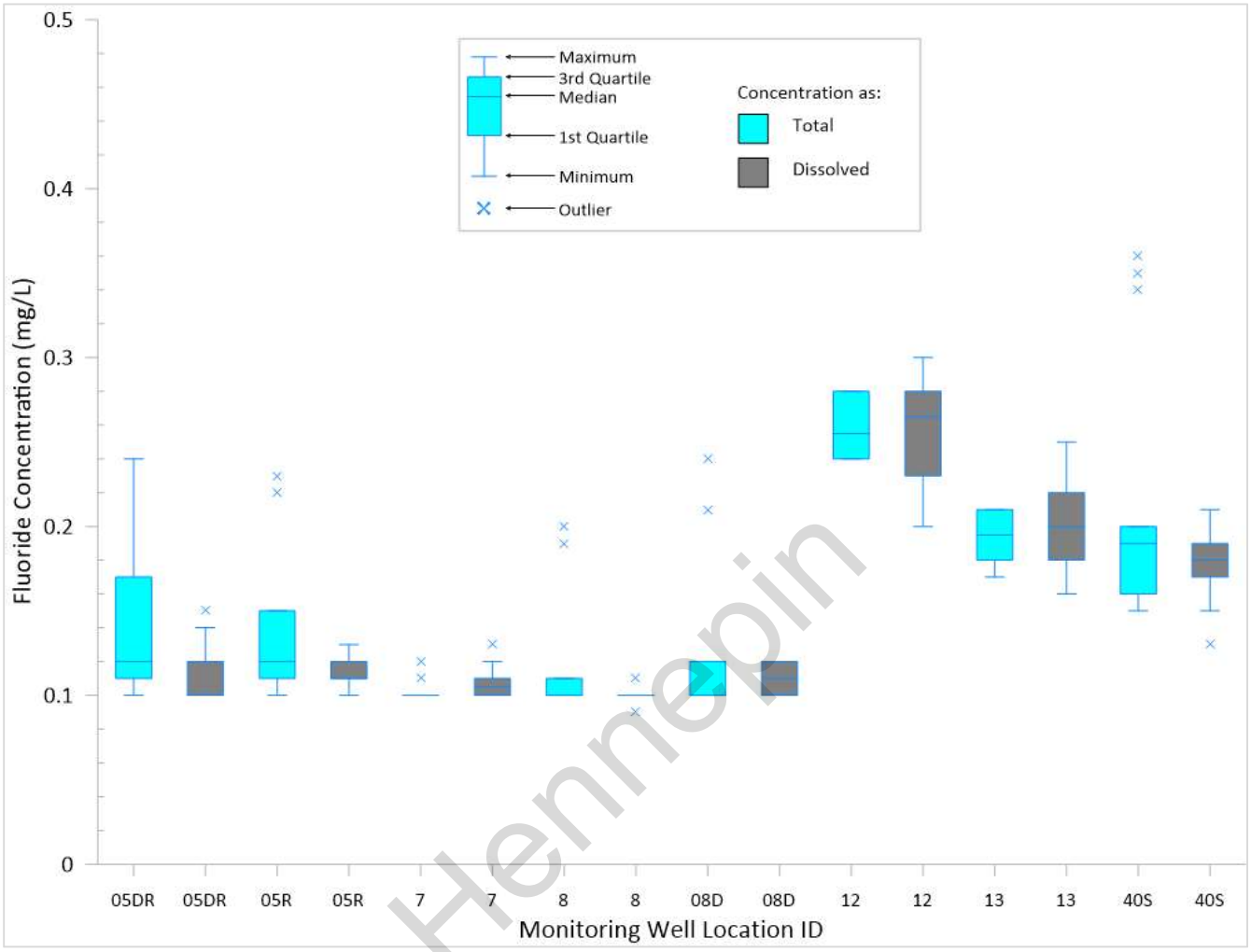


Figure 11 - Box-Whisker Plot Comparing Total and Dissolved Fluoride Concentrations.

Figure 12 shows pH values observed at wells near the East Ash Pond and Landfill. Wells 16 and 17 are located upgradient of the East Ash Pond. Wells 12, 13, 46, and 47 are located downgradient of the East Ash Pond, but upgradient of the Landfill. Wells 05R, 05DR, 40S, and 48 are located downgradient of the Landfill. Values for pH at wells 16 and 17 are near the UPL for pH of 7.5 Standard Units (SU), which supports that off-site anthropogenic activity may be contributing to elevated pH values, as discussed in Section 2.2.3. Values for pH downgradient of the Landfill are slightly higher than upgradient, indicating that pH increases slightly as groundwater moves beneath the Landfill and ash underlying the Landfill. For the period of November 2015 to March 2019 (Figure 12), the observed pH at wells upgradient from the East Ash Pond ranges from 7.0 to 7.7 SU. Wells downgradient from the East Ash Pond range from 6.7 to 7.7 SU. Wells downgradient from the Landfill range from 7.0 to 8.2 SU. The maximum measured pH of groundwater downgradient from the Landfill is 0.5 SU greater than the maximum pH measured upgradient and downgradient from the East Ash Pond. The pH of groundwater is already elevated upgradient of the East Ash Pond and Landfill, and only increases slightly as it moves further downgradient to the East Ash Pond and Landfill wells, but enough to trigger SSIs. Elevated pH values upgradient from the East Ash Pond and Landfill demonstrate that an off-site anthropogenic source located upgradient is contributing to pH SSIs observed downgradient of the East Ash Pond and Landfill.

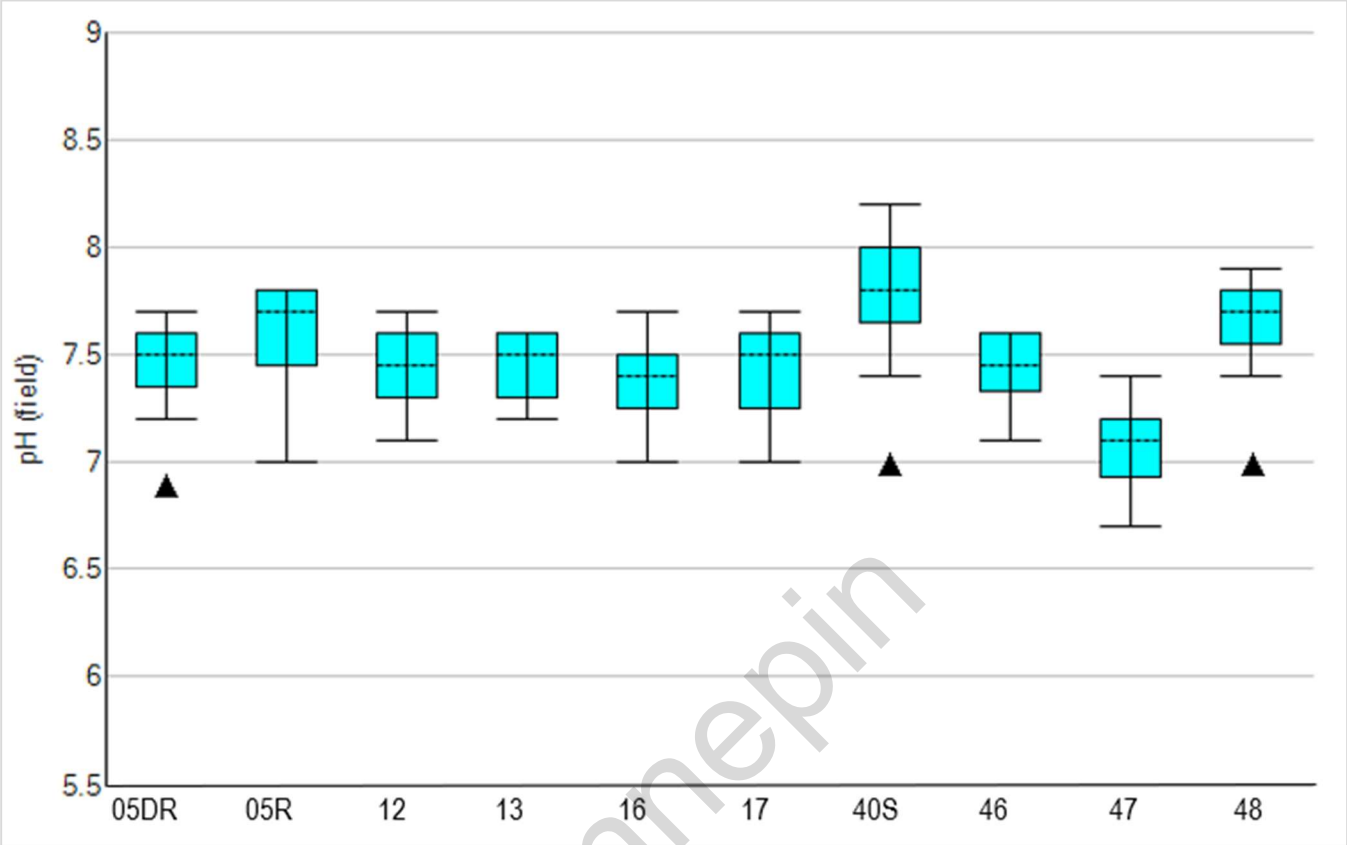


Figure 12. Box-Whisker Plots of pH in Wells Near the East Ash Pond and Landfill.

3 CONCLUSIONS AND CERTIFICATION

Pursuant to 40 C.F.R. § 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 in Ash Pond No. 2 and Underlying the Landfill
- Surrounding Industrial Activity
- East Ash Pond

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 exposed ash deposits in Ash Pond No. 2 outside the Landfill boundary and potentially from the East Ash Pond, with periodic wetting of low lying ash deposits beneath the Landfill during river flood events which may cause temporary increases in boron concentrations in some downgradient wells. Concentrations return to long-term trends shortly after these events.
- 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.
- 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 groundwater beneath the Landfill is likely influenced by an off-site anthropogenic source.

This information serves as the written alternate source demonstration report prepared in accordance with 40 C.F.R. § 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 near 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., a Ramboll Company
Date: October 14, 2019

I, Nicole M. Pagano, a professional geologist in good standing in the State of Illinois, 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.

Nicole M. Pagano
Professional Geologist
196-000750
Illinois
O'Brien & Gere Engineers, Inc., a Ramboll Company
Date: October 14, 2019

REFERENCES

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

Kelron, NRT. Initial Facility Report – Hennepin Power Station, New Coal Combustion Waste Landfill. December 10, 2010.

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

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

O'Brien & Gere Engineers, Inc. and Civil & Environmental Consultants, Inc. Closure Plan Addendum, Hennepin East Ash Pond No. 2, Hennepin, Illinois. October 25, 2018.

40 C.F.R. 257

Figures

Y:\Mapping\Projects\222285 Hennepin EastMXD\ASD\Figure 1 Groundwater Sampling Well Location Map.mxd

DOWNGRADIENT WELL LOCATION
UPGRADIENT WELL LOCATION
NON-CCR WELL LOCATION
CCR MONITORED UNIT
NON-CCR UNIT

ALTERNATE SOURCE DEMONSTRATION
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

0 175 350 700
Feet

N

GROUNDWATER SAMPLING WELL LOCATION MAP

OBG
Part of Ramboll

Y:\Mapping\Projects\222285 Hennepin East\MXD\ASD\Figure 2 GWS Wellt.oc HenLF.mxd

DOWNGRADIENT WELL LOCATION
UPGRADIENT WELL LOCATION
CCR MONITORED UNIT

ALTERNATE SOURCE DEMONSTRATION
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

0 175 350 700
Feet

N

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

OBG
Part of Ramboll

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

					Requested Tests						
Sample ID	**ClientSampID**	**Matrix**	**Date Collected**	**Bottle**	**D3987/6010B**	**D3987/7000 G**	**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:** 2 Btl (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

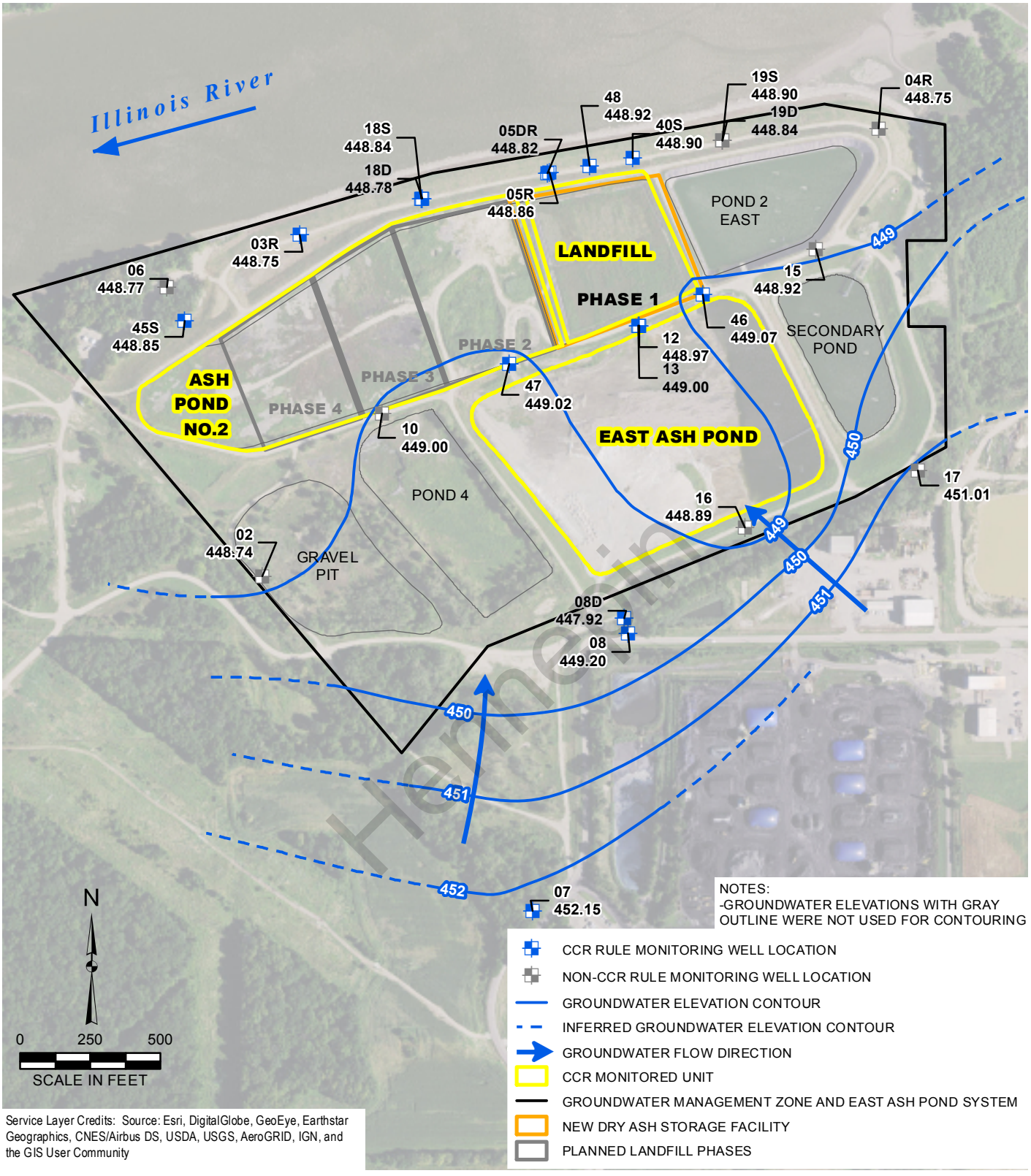
Sample Narrative
ASTM D3987, SW-846 3020A, Metals in Shake Extract by GFAA
TI - Matrix interference present in sample.

22-8 notice
DB 7/24/09

900 ~~FeWS~~
DB 7/24/09

Appendix B

Groundwater Contour Maps, 2015-2018



DRAWN BY/DATE:
SDS 1/25/17
REVIEWED BY/DATE:
TBN 1/26/17
APPROVED BY/DATE:
JJW 2/9/17

HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 1: DECEMBER 8, 2015

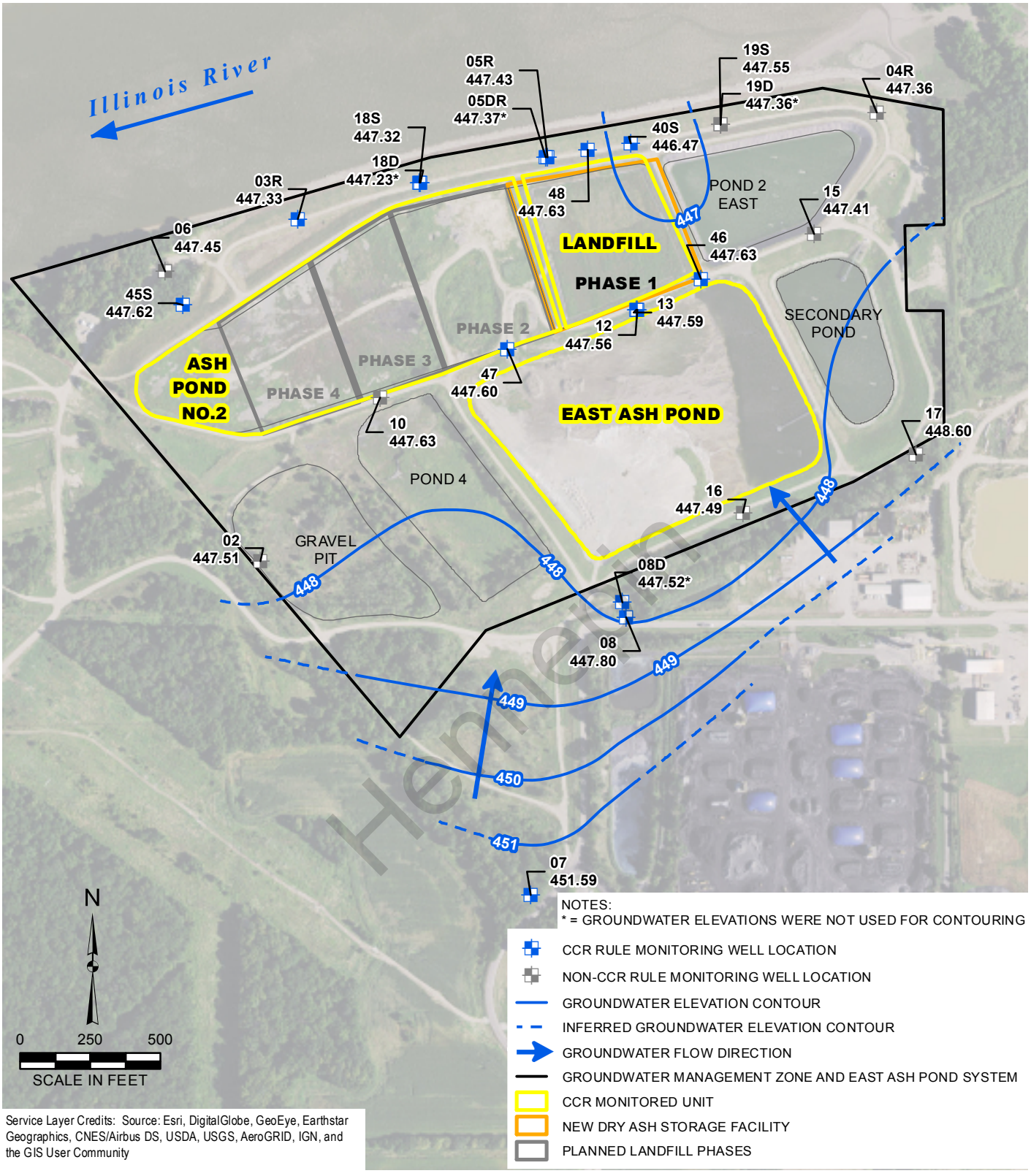
DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

Y:\Mapping\Projects\22\2285MXD\GW_Contours\Round_01\R1_HennepinEast_GW_Contours.mxd Author: sstolz Date/Time: 3/2/2017, 2:55:08 PM



Y:\Mapping\Projects\22\2285MXD\GW_Contours\Round_02\R2_HennepinEast_GW_Contours.mxd Author: sstolz Date/Time: 3/2/2017 4:02:59 PM

DRAWN BY/DATE:
SDS 1/25/17
REVIEWED BY/DATE:
TBN 1/26/17
APPROVED BY/DATE:
JJW 2/9/17

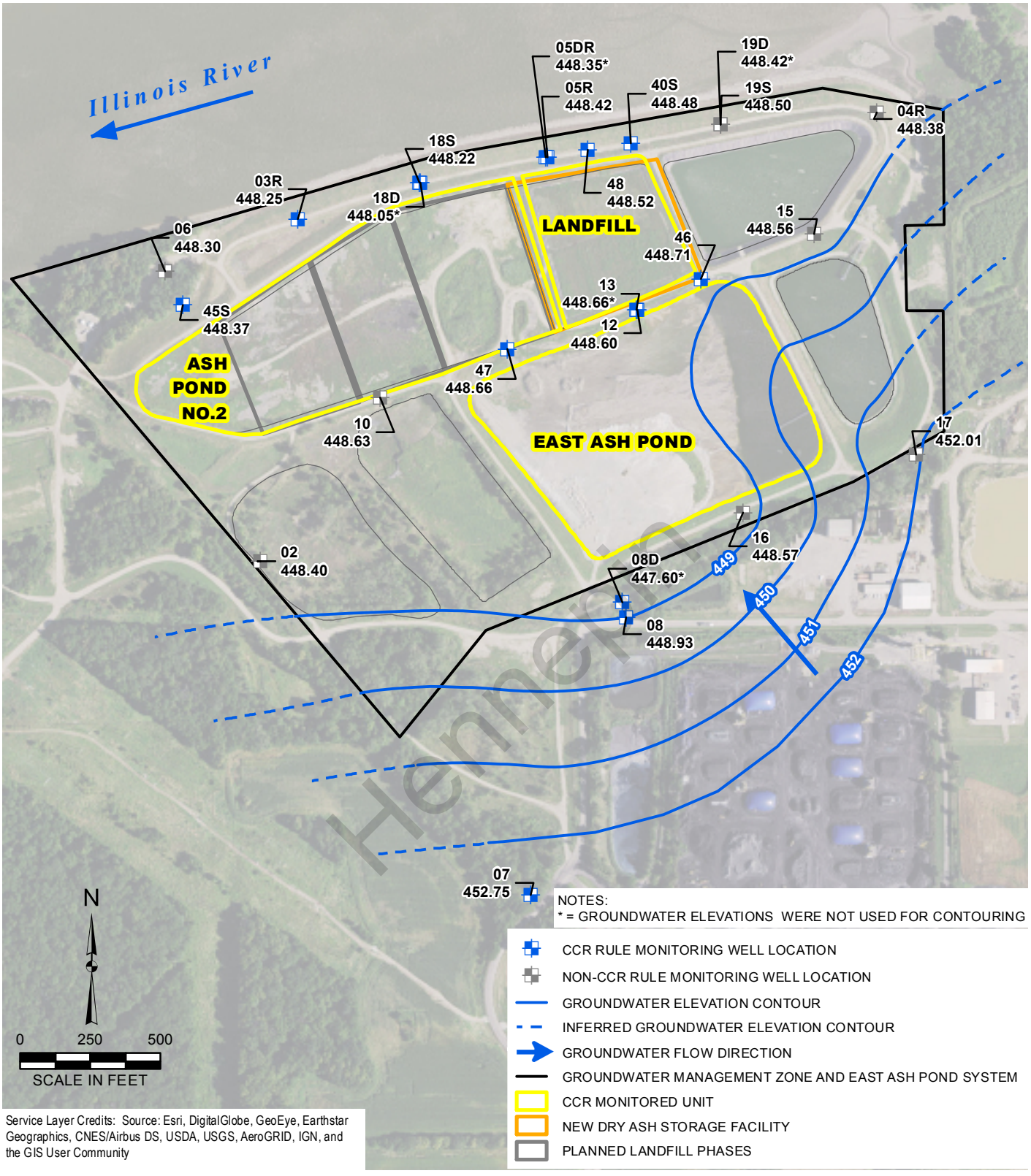
HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 2: MARCH 8, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



DRAWN BY/DATE:
SDS 1/25/17
REVIEWED BY/DATE:
TBN 1/26/17
APPROVED BY/DATE:
JJW 2/9/17

HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 3: JUNE 7, 2016

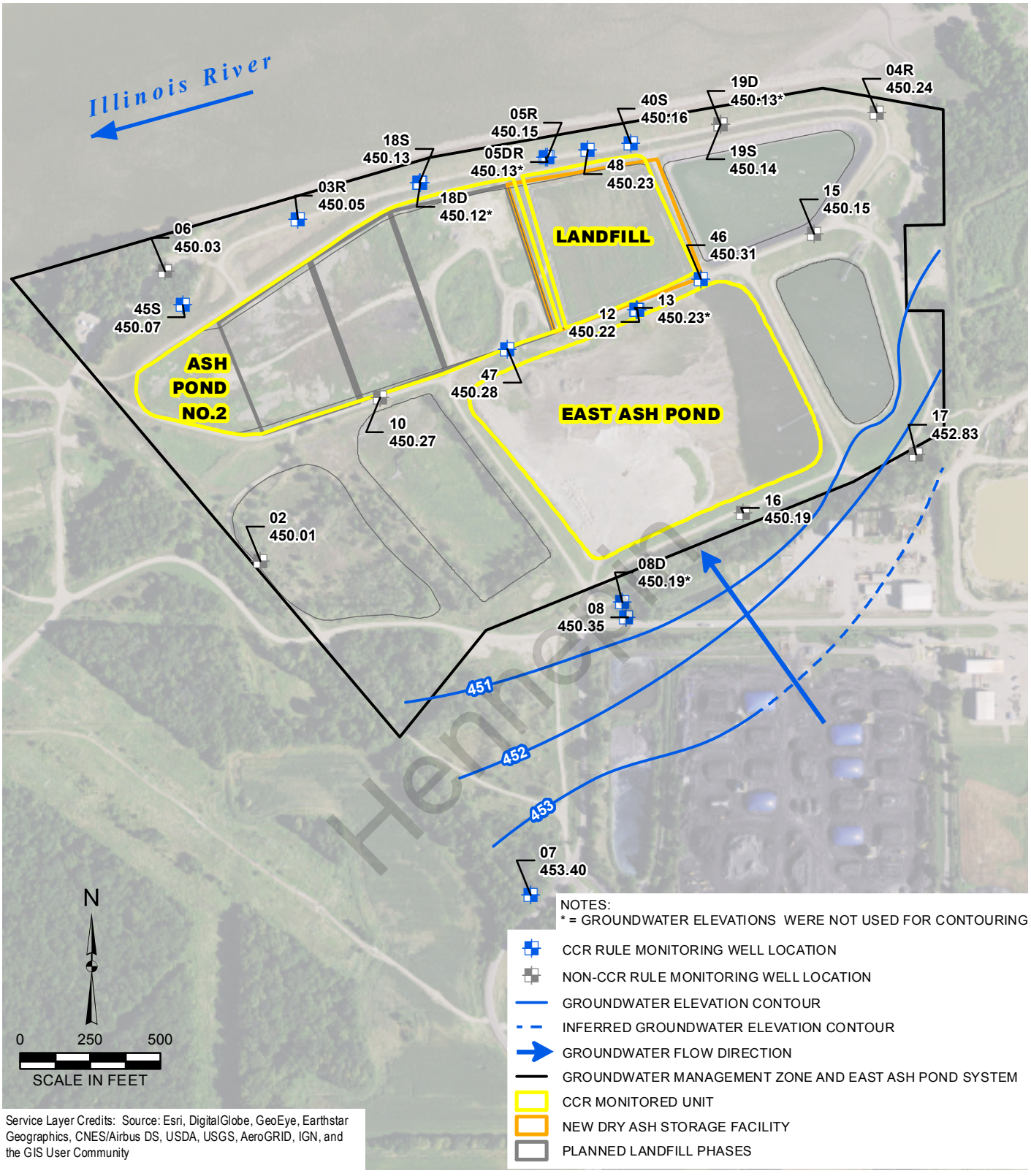
DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

Y:\Mapping\Projects\22\2285MXD\GW_Contours\Round_03\R3_HennepinEast_GW_Contours.mxd Author: stolzsd: Date/Time: 4/11/2017, 6:08:24 PM



DRAWN BY/DATE:
SDS 1/25/17
REVIEWED BY/DATE:
TBN 1/27/17
APPROVED BY/DATE:
JJW 2/7/17

HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 4: SEPTEMBER 9, 2016

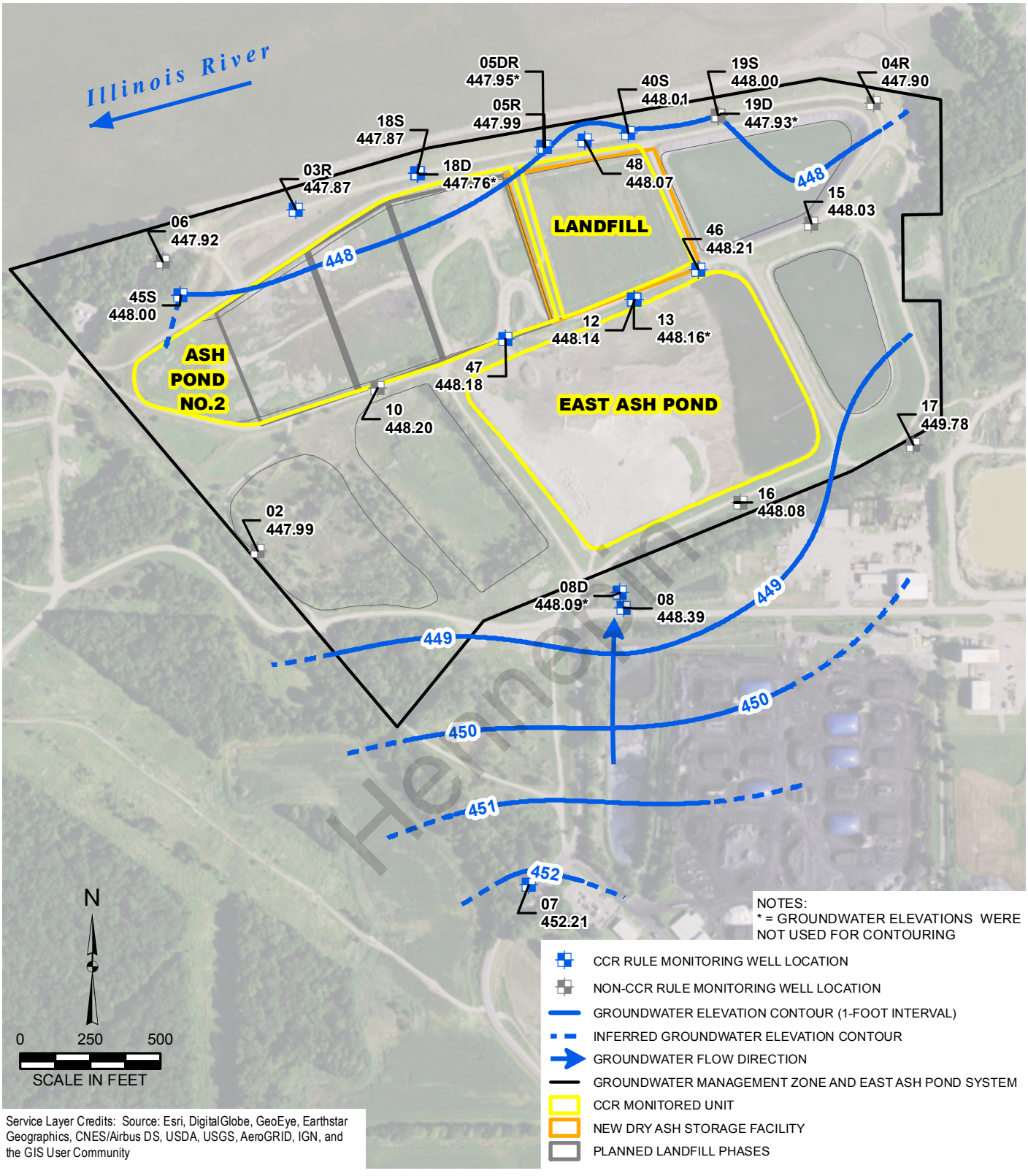
DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

Y:\Mapping\Projects\22\2285MXD\GW_Contours\Round_04R4_HennepinEast_GW_Contours.mxd Author: sstolz Date/Time: 3/3/2017 2:15:29 PM



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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SDS 3/6/17
REVIEWED BY/DATE:
TBN 3/6/17
APPROVED BY/DATE:
JJW 9/1/17

HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 5: DECEMBER 7, 2016

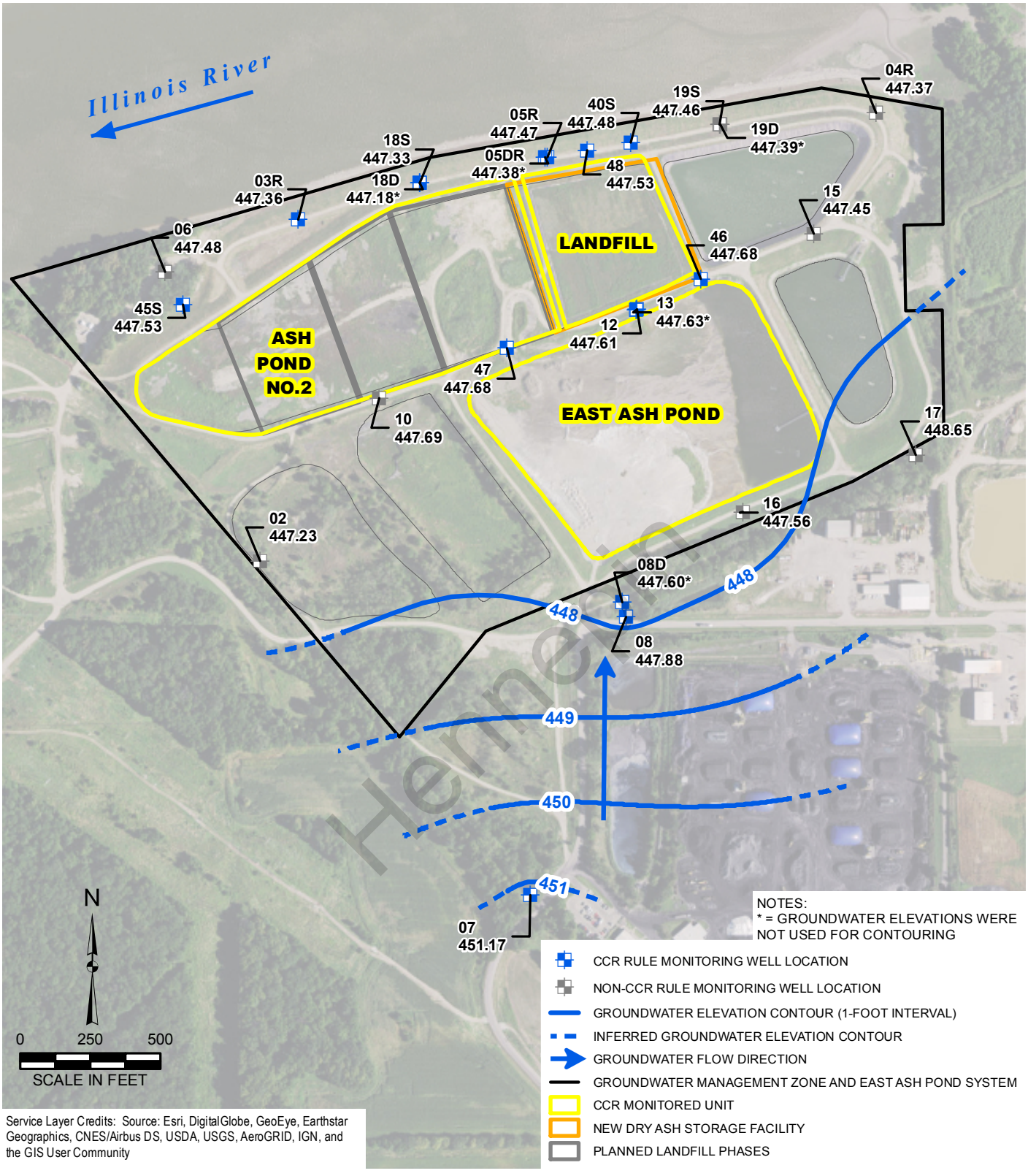
DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

Y:\Mapping\Projects\2285\MXD\GW_Contours\Round_05\R5_HennepinEast_GW_Contours.mxd Author: stolzsd; Date/Time: 9/8/2017, 4:22:43 PM



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REVIEWED BY/DATE:
TBN 3/6/17
APPROVED BY/DATE:
JJW 9/1/17

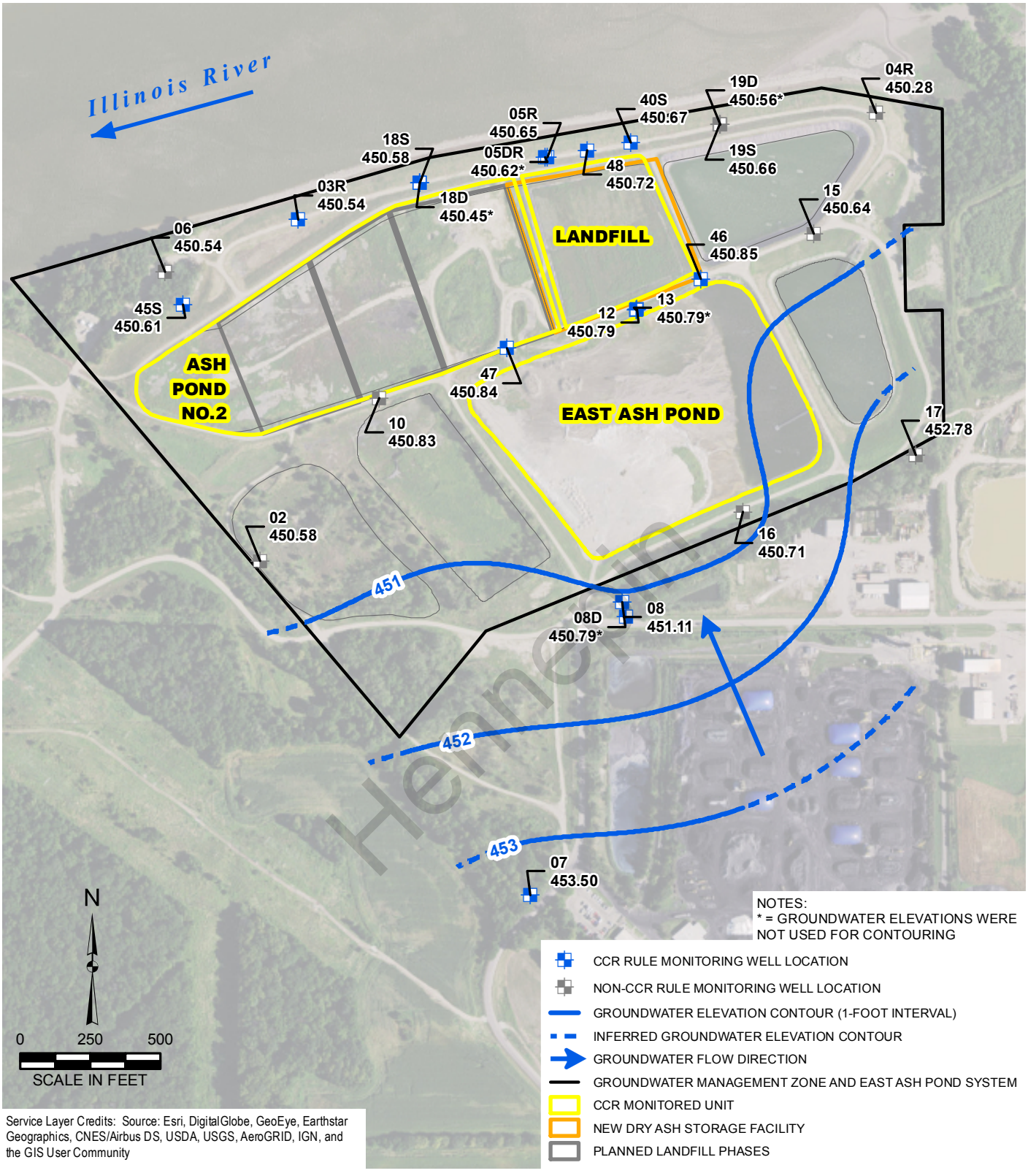
HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 6: FEBRUARY 20, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



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 5/25/17
REVIEWED BY/DATE:
TBN 5/25/17
APPROVED BY/DATE:
JJW 9/1/17

HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 7: APRIL 25, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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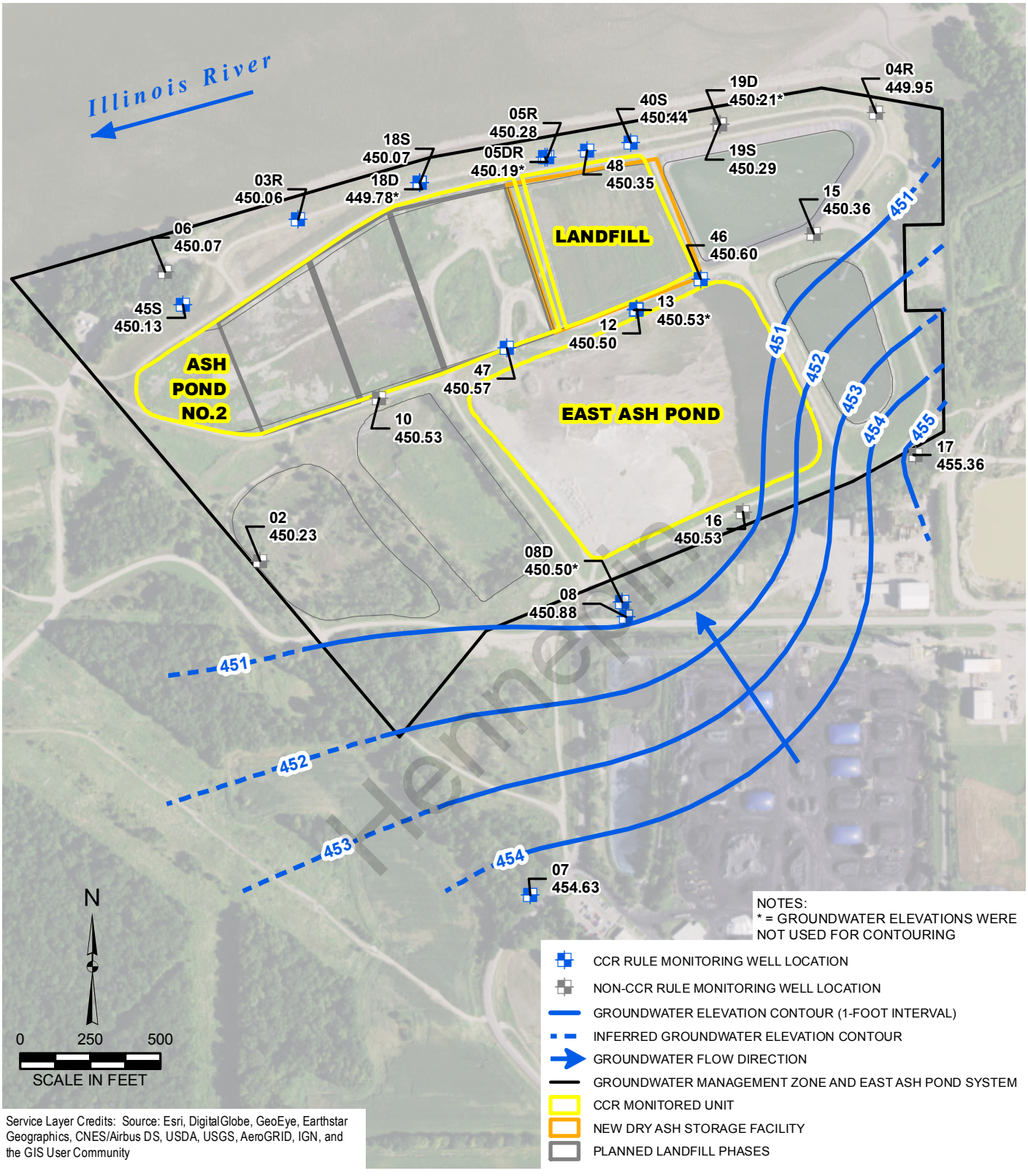


DRAWN BY/DATE:
SDS 7/20/17
REVIEWED BY/DATE:
TBN 7/20/17
APPROVED BY/DATE:
JJW 9/1/17

HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 8: JUNE 8, 2017

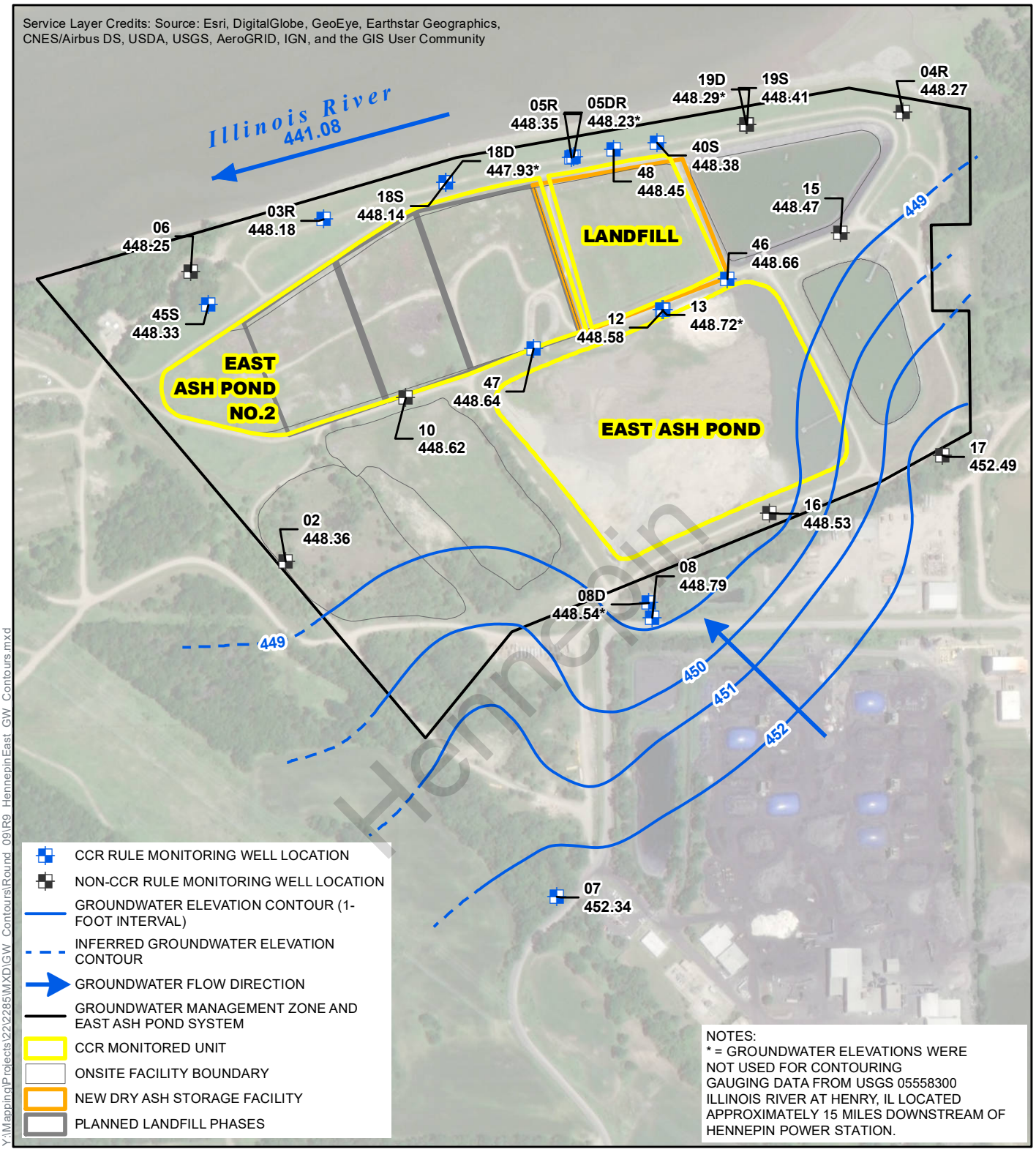
DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

Y:\Mapping\Projects\2285\MXD\GW_Contours\Round_08\R8_HennepinEast_GW_Contours.mxd Author: stolzsd; Date/Time: 9/8/2017, 4:31:23 PM



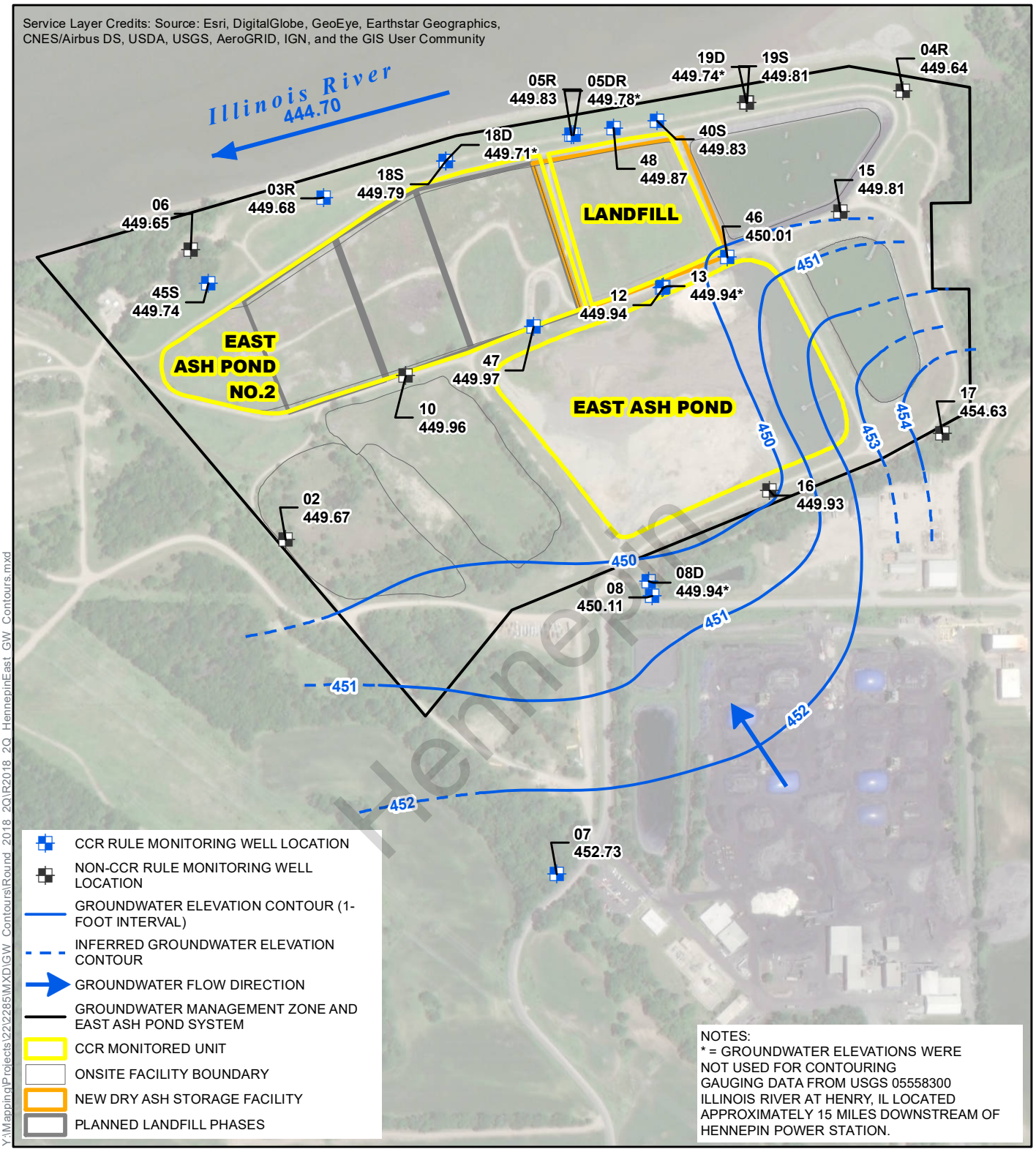
HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
GROUNDWATER ELEVATION CONTOUR MAP
NOVEMBER 15, 2017

CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

N

0 125 250 500
Feet

O'BRIEN & GERE ENGINEERS, INC.



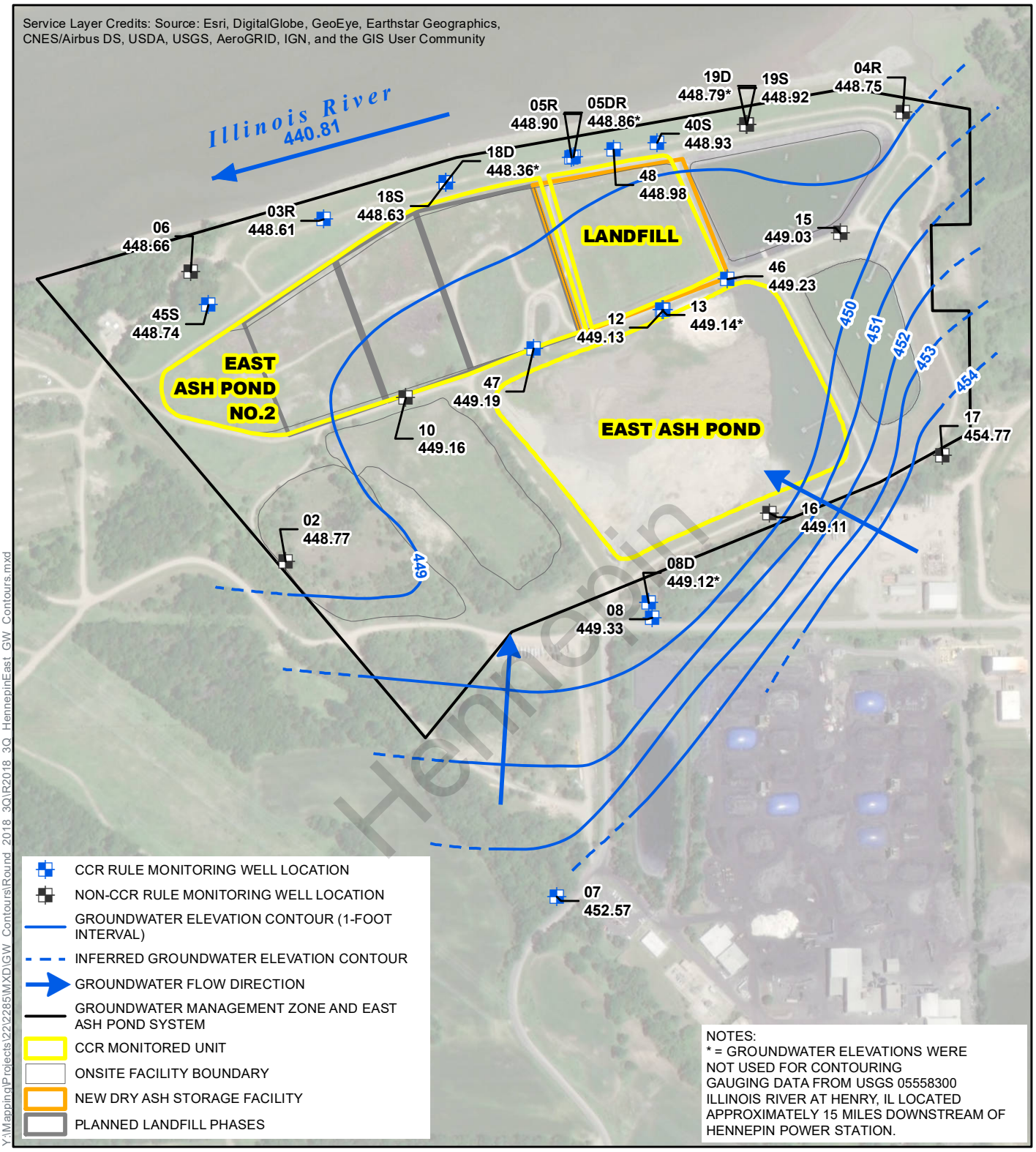
HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
GROUNDWATER ELEVATION CONTOUR MAP
JUNE 13, 2018

CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

0 125 250 500
Feet

N

O'BRIEN & GERE ENGINEERS, INC.



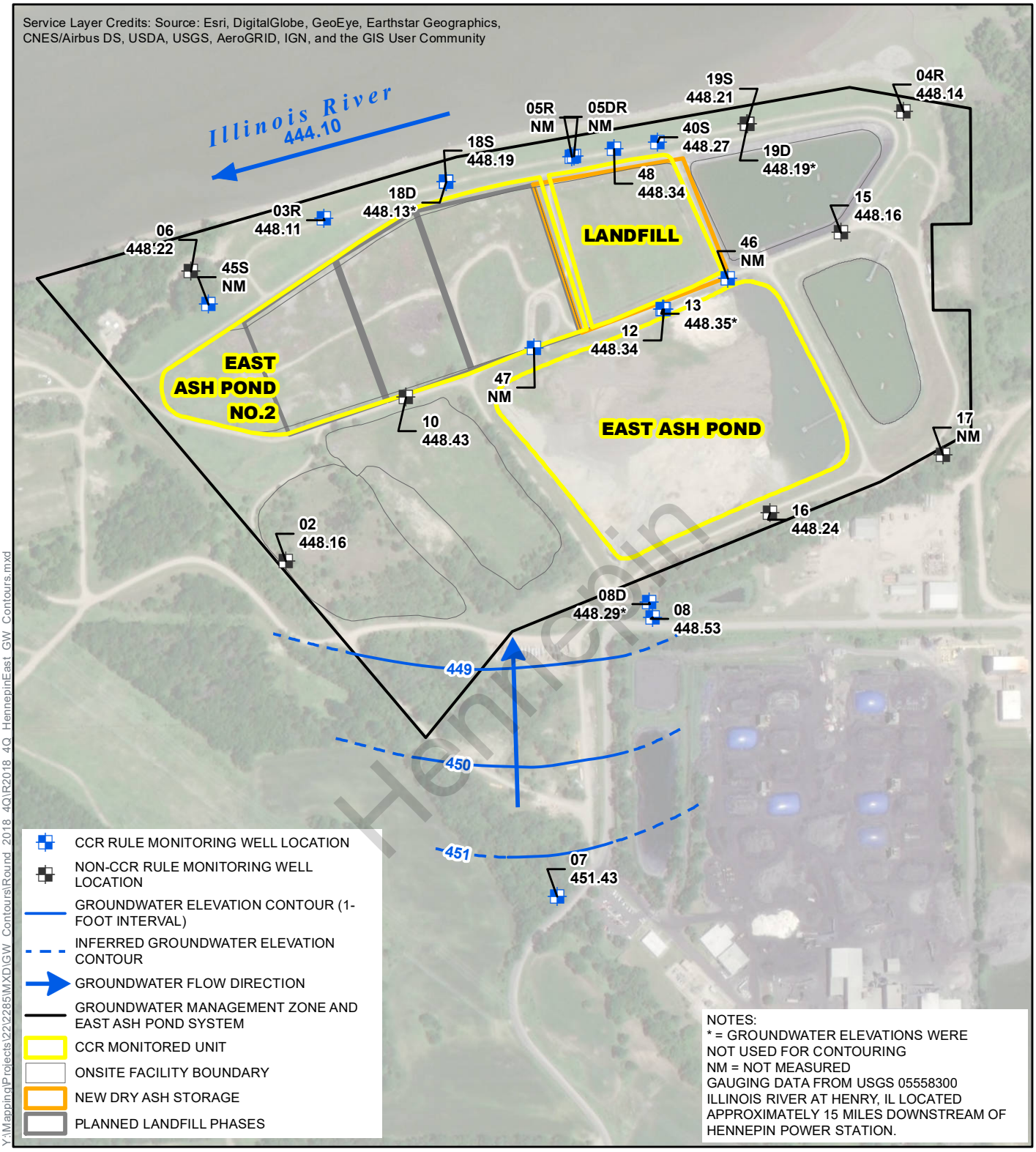
HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
GROUNDWATER ELEVATION CONTOUR MAP
SEPTEMBER 12, 2018

CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

0 125 250 500
Feet

N

O'BRIEN & GERE ENGINEERS, INC.



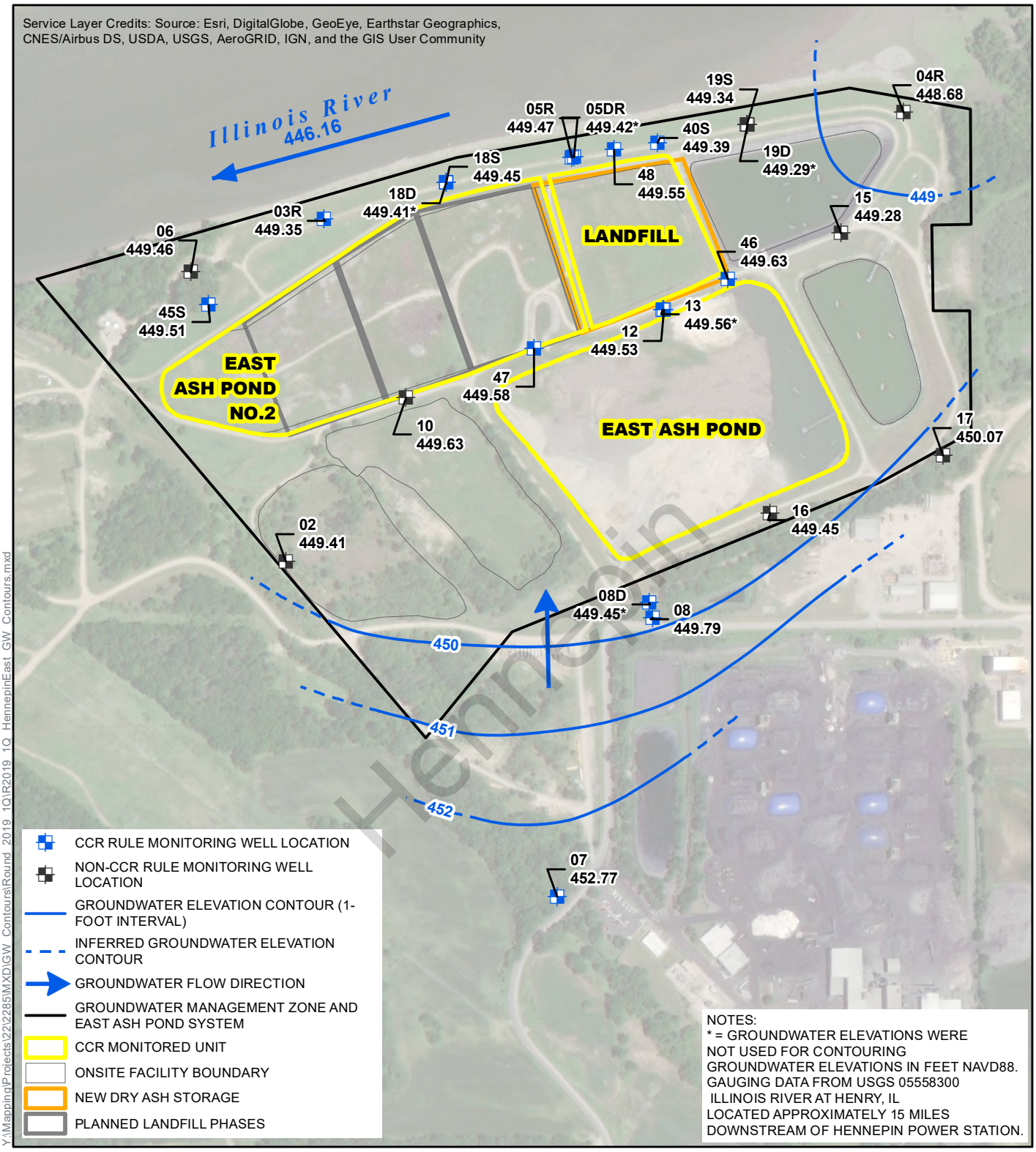
HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803) GROUNDWATER ELEVATION CONTOUR MAP DECEMBER 12, 2018

CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

0 125 250 500
Feet

N

O'BRIEN & GERE ENGINEERS, INC.



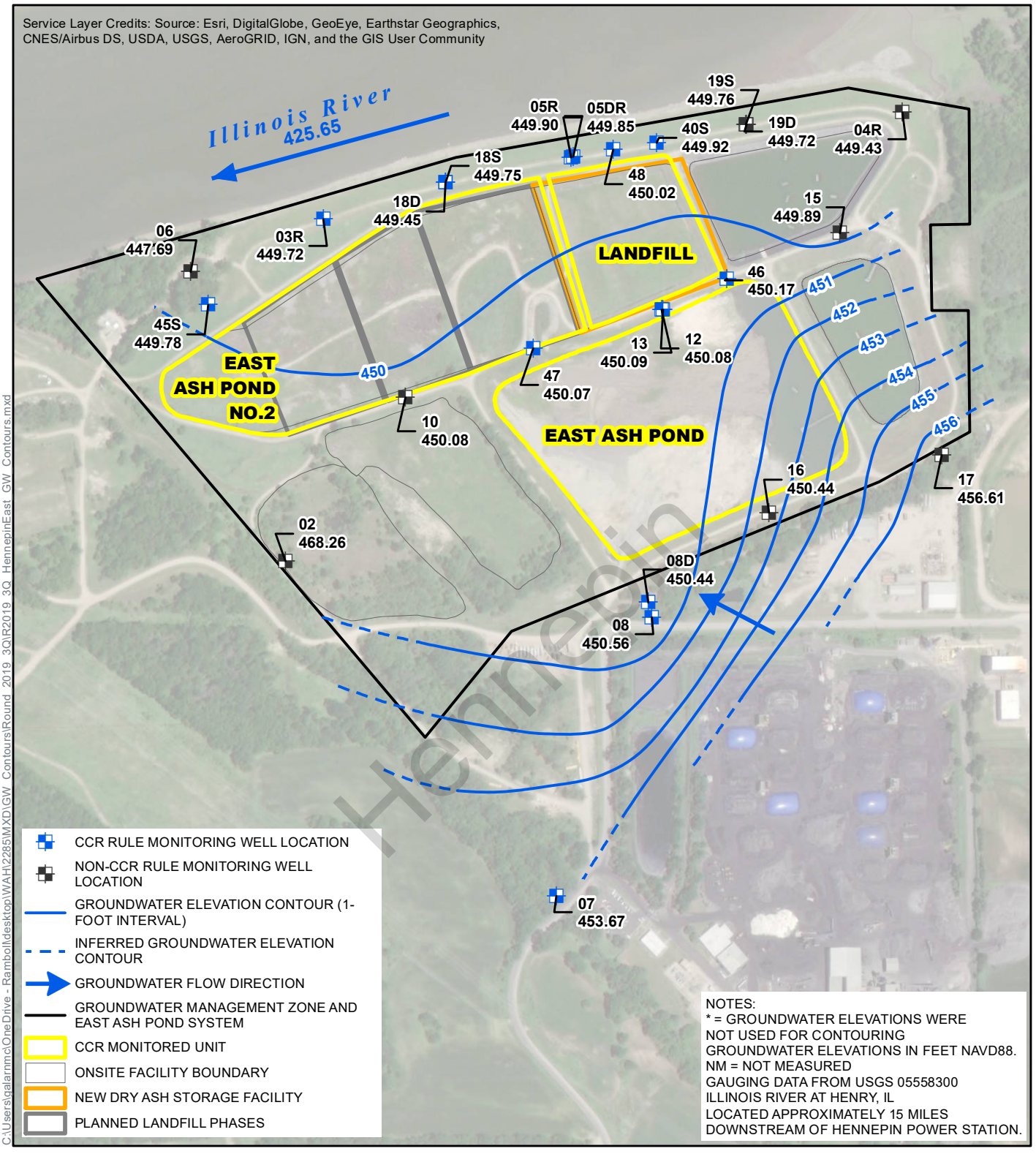
HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
GROUNDWATER ELEVATION CONTOUR MAP
MARCH 13, 2019

CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

0 125 250 500
Feet

N

O'BRIEN & GERE ENGINEERS, INC.



HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)
GROUNDWATER ELEVATION CONTOUR MAP
SEPTEMBER 17, 2019

CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

N

0 125 250 500
Feet

O'BRIEN & GERE ENGINEERS, INC.