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2019 Annual Groundwater Monitoring and Corrective Action Report

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2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

NEWTON LANDFILL 2, NEWTON POWER STATION

Bright ideas. Sustainable change.

2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT NEWTON LANDFILL 2, NEWTON POWER STATION

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ACRONYMS AND ABBREVIATIONS

ASD	Alternate Source Demonstration
CCR	Coal Combustion Residuals
LF2	Landfill 2
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 Newton Landfill 2 (LF2) located at Newton Power Station near Newton, Illinois.

Groundwater is being monitored at Newton LF2 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 G06D, G220, G222, G223, and R217D
- Calcium at well R217D
- Chloride at wells G06D, G202, G203, G208, G220, G222, G223, G224, and R217D
- Fluoride at wells G208, G220, and G222
- Sulfate at well R217D
- Total Dissolved Solids at well R217D

Alternate Source Demonstrations (ASDs) were completed for the SSIs referenced above and Newton LF2 remains in the Detection Monitoring Program.

1. INTRODUCTION

This report has been prepared by Ramboll on behalf of Illinois Power Generating Company, to provide the information required by 40 C.F.R. § 257.90(e) for Newton LF2 located at Newton Power Station near Newton, 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 Newton LF2 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 Newton LF2 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.[1] 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 May, August, and November 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.

[1] Sampling was limited to G06D, G202, G203, G208, G220, G222, G223, ang G224 during the August 2018 sampling event to confirm Appendix III parameters initially detected at concentrations greater than statistical background values in the preceding sampling event to confirm SSIs, as allowed by the Statistical Analysis Plan.

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
May 21-23, 2018	July 9, 2018	Appendix III	Boron (G220, G222) Chloride (G06D, G202, G203, G208, G222, G223, G224) Fluoride (G220, G222)	October 7, 2018	January 7, 2019
August 15, 16, and 20-23, 2018	July 9, 2018	Appendix III Greater than Background [1]	NA	NA	NA
November 12-16, 2018	January 16, 2019	Appendix III	Boron (G220, G222, G223) Chloride (G06D, G202, G203, G208, G220, G222, G223, G224) Fluoride (G208, G220)	April 15, 2019	July 15, 2019
February 19-21, 2019	April 15, 2019	Appendix III	Boron (G06D, G220, G222, G223, R217D) Calcium (R217D) Chloride (G06D, G202, G203, G208, G220, G222, G223, G224, R217D) Fluoride (G208, G220) Sulfate (R217D) Total Dissolved Solids (R217D)	July 15, 2019	October 14, 2019
August 21-22, 2019	October 28, 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, Newton Landfill 2, Newton Power Station, Newton, Illinois, Project No. 2285, Revision 0, October 17, 2017.

Natural Resource Technology, an OBG Company (NRT/OBG), 2017b. Statistical Analysis Plan, Coffeen Power Station, Newton Power Station, Illinois Power Generating Company, October 17, 2017.

TABLES

TABLE 1.
2019 ANALYTICAL RESULTS - GROUNDWATER ELEVATION AND APPENDIX III PARAMETERS
2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
NEWTON POWER STATION
UNIT ID 502 - NEWTON LANDFILL 2
NEWTON, 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												
G201	38.937181	-88.294411	2/19/2019 7:36	15.00	529.85	0.098	170	4.3	0.727	7.4	600	960
			8/22/2019 13:33	15.06	529.79	0.12	180	4.2	0.760	7.3	600	1000
G48MG	38.939256	-88.896017	2/19/2019 8:43	17.02	528.51	0.048	71	18	0.301	7.0	58	580
			8/22/2019 14:22	17.90	527.63	0.14	38	26	0.657	7.0	110	600
Downgradient Monitoring Wells												
G06D	38.927233	-88.296383	2/19/2019 15:17	28.60	503.09	0.25	120	58	0.635	7.5	5.0	900
			8/22/2019 11:25	28.50	503.19	0.18	110	57	0.740	7.4	1.9	820
G202	38.930883	-88.290564	2/21/2019 14:49	46.43	493.21	0.096	130	59	0.485	7.2	190	740
			8/22/2019 16:00	48.00	491.64	0.12	120	61	0.510	7.2	53	680
G203	38.928603	-88.292222	2/21/2019 15:41	39.00	494.02	0.076	140	57	0.364	7.1	170	870
			8/22/2019 15:15	38.97	494.05	0.090	130	52	0.443	7.0	150	780
G208	38.929639	-88.298186	2/20/2019 17:26	26.75	508.19	0.17	110	53	1.04	7.5	9.5	820
			8/22/2019 10:42	26.88	508.06	0.21	110	45	1.07	7.5	2.7	800
G220	38.928419	-88.299517	2/20/2019 15:10	16.27	518.26	0.30	110	39	1.24	7.1	41	730
			8/21/2019 15:15	17.64	516.89	0.31	110	37	1.24	7.0	33	800
G222	38.927203	-88.299675	2/20/2019 13:49	14.74	519.49	0.21	140	76	0.940	7.0	150	1000
			8/21/2019 16:00	15.93	518.30	0.23	140	69	0.982	7.1	130	1100
G223	38.930167	-88.293456	2/21/2019 8:10	32.02	501.54	0.23	120	130	0.645	7.1	21	1000
			8/22/2019 9:15	33.27	500.29	0.27	140	130	0.716	7.2	55	980
G224	38.931775	-88.292400	2/21/2019 11:00	41.41	492.86	0.080	120	55	0.359	7.4	130	740
			8/22/2019 8:30	42.30	491.97	0.095	120	50	0.465	7.3	130	740
R217D	38.932191	-88.290118	2/21/2019 14:00	14.64	523.54	0.20	550	58	0.287	6.9	2100	3200
			8/21/2019 13:59	20.15	518.03	0.17	210	45	0.644	7.0	710	1600

[O: RAB 12/23/19, C: KLT 12/26/19]

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
NEWTON POWER STATION
UNIT ID 502 - NEWTON LANDFILL 2
NEWTON, ILLINOIS
DETECTION MONITORING PROGRAM

Parameter	Statistical Background Value (UPL)
40 C.F.R. Part 257 Appendix III	
Boron (mg/L)	0.18
Calcium (mg/L)	160
Chloride (mg/L)	34
Fluoride (mg/L)	1.037
pH (S.U.)	6.6 / 8.1
Sulfate (mg/L)	760
Total Dissolved Solids (mg/L)	1005

[O: RAB 12/23/19, C: KLT 12/26/19]

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 MONITORING WELL LOCATION
DOWNGRADIENT MONITORING WELL LOCATION
CCR MONITORED UNIT

0 300 600 Feet

MONITORING WELL LOCATION MAP
NEWTON LANDFILL 2
UNIT ID:502

2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
VISTRA CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, 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
NEWTON LANDFILL 2
JANUARY 7, 2019

January 7, 2019

Title 40 of the Code of Federal Regulations (C.F.R.) § 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 Illinois Power Generating Company 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 Newton Landfill 2 (LF2) located near Newton, Illinois.

The second semi-annual detection monitoring samples (Detection Monitoring Round 2 [D2]) were collected on May 21-23, 2018 and analytical data were received on July 9, 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 G208, G220, G222, and G223
- Calcium at well G203
- Chloride at wells G06D, G202, G203, G208, G222, G223, and G224
- Fluoride at wells G208, G220, and G222

In accordance with the Statistical Analysis Plan (NRT/OBG, 2017a), to confirm the SSIs, wells G06D, G202, G203, G208, G220, G222, G223, and G224 were resampled on August 15-23, 2018 and analyzed only for the SSI parameters at each well. Following evaluation of analytical data from the resample, the following SSIs were confirmed:

- Boron at wells G220 and G222
- Chloride at wells G06D, G202, G203, G208, G222, G223, and G224
- Fluoride at wells G220 and G222

Pursuant to 40 C.F.R. § 257.94(e)(2), the following demonstrates that sources other than the Newton LF2 were the cause of the SSIs listed above. This ASD was complete by January 7, 2019, within 90 days of determination of the SSIs, as required by 40 C.F.R. § 257.94(e)(2).

SITE LOCATION AND DESCRIPTION

The Newton Power Station (Site) is located in Jasper County, in the southeastern part of central Illinois, approximately 7 miles southwest of the town of Newton. The area is surrounded by Newton Lake. Beyond the lake is agricultural land.

DESCRIPTION OF PHASE II LANDFILL CCR UNIT

The Phase II Landfill (LF2) includes three lined disposal cells (Figure 1). LF2 Cells 1 and 2, encompassing approximately 12 acres, and LF2 Cell 3, encompassing approximately 7 acres.

GEOLOGY AND HYDROGEOLOGY

The site geology and hydrogeology are summarized below from the Hydrogeologic Monitoring Plan (NRT/OBG, 2017b).

GEOLOGY

Quaternary deposits in the Newton area consist mainly of diamictons and outwash deposits that were deposited during Illinoian and Pre-Illinoian glaciations. The unconsolidated deposits occurring at Newton Power Station include the following units (beginning at the ground surface):

- Ash/Fill Units – CCR and fill within the various CCR Units.
- Upper Confining Unit – Low permeability clays and silts, including the Peoria Silt (Loess Unit) in upland areas and the Cahokia Formation in the flood plain and channel areas to the south and east, underlain by the Sangamon Soil, and the predominantly clay diamictons of the Hagarstown (Till) and Vandalia (Till) Members of the Glasford Formation.
- Uppermost Aquifer (Groundwater Monitoring Zone) – Thin to moderately thick (3 to 17 ft), moderate to high permeability sand, silty sand, and sandy silt/clay units of the Mulberry Grove Member of the Glasford Formation.
- Lower Confining Unit – Thick, very low permeability silty clay diamictons of the Smithboro (Till) Member of the Glasford Formation and the silty clay diamictons of the Banner Formation.

The bedrock beneath the unconsolidated deposits consists of Pennsylvanian-age Mattoon Formation that is mostly shale near the bedrock surface, but is characterized at depth by a complex sequence of shales, thin limestones, coals, underclays, and several sandstones. The erosional surface of the Pennsylvanian-age Mattoon Formation bedrock ranges widely in depth in the vicinity of the site, but is typically encountered at 90 to 120 ft below ground surface (bgs).

HYDROGEOLOGY

The information used to describe the hydrogeology is based on the local geology obtained from published sources, hydrogeologic investigation data, and boring data collected during monitoring well installation. CCR monitoring well locations are shown in Figure 1.

The Uppermost Aquifer, the Mulberry Grove Member, typically consists of fine to coarse sand with varying amounts of clay, silt, and fine to coarse gravel. The portion of the Mulberry Grove Member at the site that is defined as a sand layer ranges in thickness from 3 to 17 ft, with an average thickness of 8 ft. With only a few exceptions, the sand layer occurs between depths of 55 to 88 ft bgs.

The lower hydrostratigaphic units, which comprise lower limit of the Uppermost Aquifer, consist of the Smithboro Member and the Banner Formation, both of which are predominantly low permeability clay diamictons with varying amounts of silt, sand, and gravel. These lower hydrostratigraphic units are 30 ft to more than 50 ft thick above the underlying bedrock.

Groundwater elevations across LF2 ranged from approximately 491 to 529 ft MSL (NAVD88) during D2 (Figure 2). The groundwater elevation contours shown on Figure 2 were measured on May 17, 2018, the first day of a combined sampling event at the Site for LF2 and the Primary Ash Pond and for multiple monitoring programs required by both federal and state regulatory agencies. Overall groundwater flow within the Uppermost Aquifer beneath the site in February 2019 was southward toward Newton Lake, but with flow converging to the south-southeast along the major axis of LF2 Cells 1 & 2, and a predominantly eastward flow under LF2 Cell 3. Based on groundwater flow directions near LF2, groundwater beneath LF2 Cells 1 and 2 does not influence groundwater beneath LF2 Cell 3.

GROUNDWATER MONITORING

The Uppermost Aquifer monitoring system for LF2 Cells 1, 2, and 3 is shown on Figure 1 and described below. The relative positions of CCR monitoring wells in relation to groundwater flow direction are shown in Figure 2.

BACKGROUND GROUNDWATER MONITORING

Monitoring wells G201 and G48MG are used to monitor background water quality for LF2 (all cells).

DOWNGRADIENT GROUNDWATER MONITORING

Downgradient groundwater quality at LF2 Cells 1 and 2 is monitored using wells G202, G203, G223, G224, and R217D (which replaced well G217D in October 2017).

Downgradient groundwater quality at LF2 Cell 3 is monitored using wells G06D, G208, G220, and G222.

ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

As allowed by 40 C.F.R. § 257.94(e)(2), this ASD demonstrates that sources other than LF2 caused the SSI(s), or that the SSI(s) was a result of natural variation in groundwater quality. This ASD is based on the following lines of evidence (LOE):

1. Landfill Design and Operation.
2. No CCR material has been placed in LF2 Cell 3.
3. The ionic composition in groundwater is different than the ionic composition of leachate.
4. The ionic composition in groundwater downgradient of LF2 Cells 1 and 2 is similar to groundwater downgradient of LF2 Cell 3 (where no CCR material has been placed).
5. Groundwater quality in monitoring wells downgradient of LF2 Cells 1 and 2 is statistically similar to groundwater quality in monitoring wells downgradient of LF2 Cell 3 (where no CCR material has been placed).
6. Groundwater flow directions indicate monitoring wells G223, G224, and R217D are not downgradient of LF2 Cells 1 and 2.

These lines of evidence are described and supported in greater detail below.

LINE OF EVIDENCE #1: LANDFILL DESIGN AND OPERATION

LF2 Cells 1 and 2 were constructed, and began receiving CCR, in 1997. A portion of LF2 Cell 2 is currently in operation. LF2 Cell 3 is currently inactive and has not received CCR since construction in 2011.

The constructed liner and leachate collection system for LF2 Cells 1, 2, and 3 include the following design components from top to bottom:

- Soil cover for frost protection;
- 10-ounce-per-square-yard (sy) geotextile separation layer between the leachate management system and the frost protection soil cover;
- 1-foot thick sand drainage layer;
- 60-mil high-density polyethylene (HDPE) geomembrane; and
- Three-foot-thick compacted, low-permeability soil having a maximum hydraulic conductivity of 1.0×10^{-7} centimeters per second (cm/sec).

These components meet or exceed the landfill liner performance standards of 40 C.F.R. § 257. The landfill design criteria were intended to provide protection to the Uppermost Aquifer. In addition, the Uppermost Confining Unit provides hydraulic separation between the CCR units at the Site and the Uppermost Aquifer (OBG, 2019). These factors support the conclusion that LF2 is not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

LINE OF EVIDENCE #2: NO CCR MATERIAL HAS BEEN PLACED IN LF2 CELL 3

LF2 Cell 3 has never contained CCR; therefore, it cannot be the source of the CCR constituents boron, chloride or fluoride detected in downgradient groundwater monitoring wells. Furthermore, groundwater flow directions near LF2 (Figure 2) indicate groundwater beneath LF2 Cells 1 and 2 does not influence groundwater beneath LF2 Cell 3, so LF2 Cells 1 and 2 cannot be the source of CCR constituents detected in LF2 Cell 3 downgradient monitoring wells.

LINE OF EVIDENCE #3: THE IONIC COMPOSITION IN GROUNDWATER IS DIFFERENT THAN THE IONIC COMPOSITION OF LEACHATE

Piper diagrams graphically represent ionic composition of aqueous solutions. A Piper diagram displays the position of water samples with respect to their major cation and anion content on the two lower triangular portions of the diagram, providing the information which, when combined on the central, diamond-shaped portion of the diagram, identify composition categories or groupings (groundwater facies). Figure 3, below, is a Piper diagram that displays the ionic composition of samples from the background and downgradient monitoring wells associated with LF2 based on Quarter 3 2018 samples. Figure 3 also includes data collected from the combined LF1 and LF2 leachate tank in Quarter 2 of 2017. Major cations and anions were not analyzed in samples collected from the LF1 and LF2 leachate tank subsequent to Quarter 2 2017.

It is evident from the Piper diagram (Figure 3) that leachate is in the sodium-sulfate hydrochemical facies, and the LF2 groundwater samples (blue symbols) are in the no dominant-bicarbonate hydrochemical facies. All LF2 Cell 1, 2, and 3 groundwater samples cluster into a single distinct hydrochemical facies. Downgradient groundwater samples associated with LF2 have a different ionic composition than leachate, indicating that leachate is not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

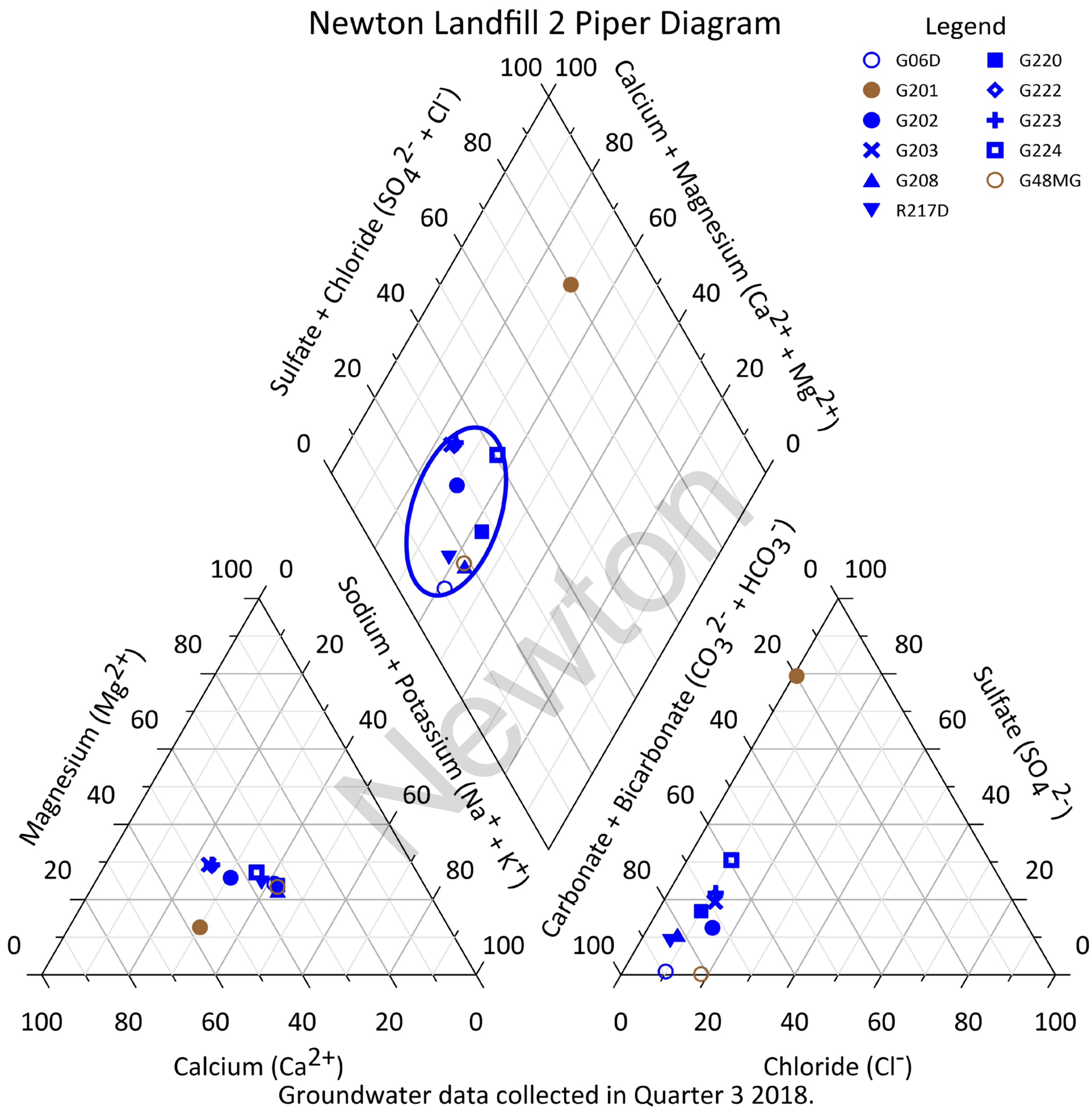


Figure 3. Piper Diagram Showing Ionic Composition of Samples of Background and Downgradient Groundwater Associated with LF2

LINE OF EVIDENCE #4: THE IONIC COMPOSITION IN GROUNDWATER DOWNGRADIENT OF LF2 CELLS 1 AND 2 IS SIMILAR TO GROUNDWATER DOWNGRADIENT OF LF2 CELL 3 (WHERE NO CCR MATERIAL HAS BEEN PLACED)

As illustrated in the Piper diagram (Figure 3), the ionic composition of all LF2 Cell 1, 2, and 3 groundwater samples are similar and cluster into a single distinct hydrochemical facies (no dominant-bicarbonate). The similarity in ionic composition of groundwater downgradient of LF2 Cell 3 and LF2 Cells 1 and 2, coupled with the fact that Cell 3 has never contained CCR, indicate that LF2 Cells 1 and 2 are not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

LINE OF EVIDENCE #5: GROUNDWATER QUALITY IN MONITORING WELLS DOWNGRADIENT OF LF2 CELLS 1 AND 2 IS STATISTICALLY SIMILAR TO GROUNDWATER QUALITY IN MONITORING WELLS DOWNGRADIENT OF LF2 CELL 3 (WHERE NO CCR MATERIAL HAS BEEN PLACED)

Box plots graphically represent the first quartile (Q1), median (Q2), and third quartile (Q3) of a given dataset using lines to construct a box where the lower line, midline and upper line of the box represent the values of Q1, Q2 and Q3, respectively. The minimum and maximum values of the dataset (excluding outliers) are illustrated by whisker lines extending beyond the first and third quartiles of the box plot. Outliers are represented by single points plotted outside of the range of the whiskers. Chloride SSIs were identified at all LF2 cells (LF2 Cells 1, 2, and 3) during the D4 sampling event, whereas, other SSIs were only identified at LF2 Cell 3. Figure 4, below, display the chloride data for downgradient groundwater at LF2; triangle symbols identify outlier values that are at least 1.5 times the interquartile range (IQR) and “x” symbols identify outlier values that are at least 3 times the IQR.

Chloride

Box plots of the chloride concentrations observed in LF2 Cells 1 and 2 downgradient monitoring wells (cyan), and LF2 Cell 3 downgradient monitoring wells (blue) are shown in Figure 4 below.

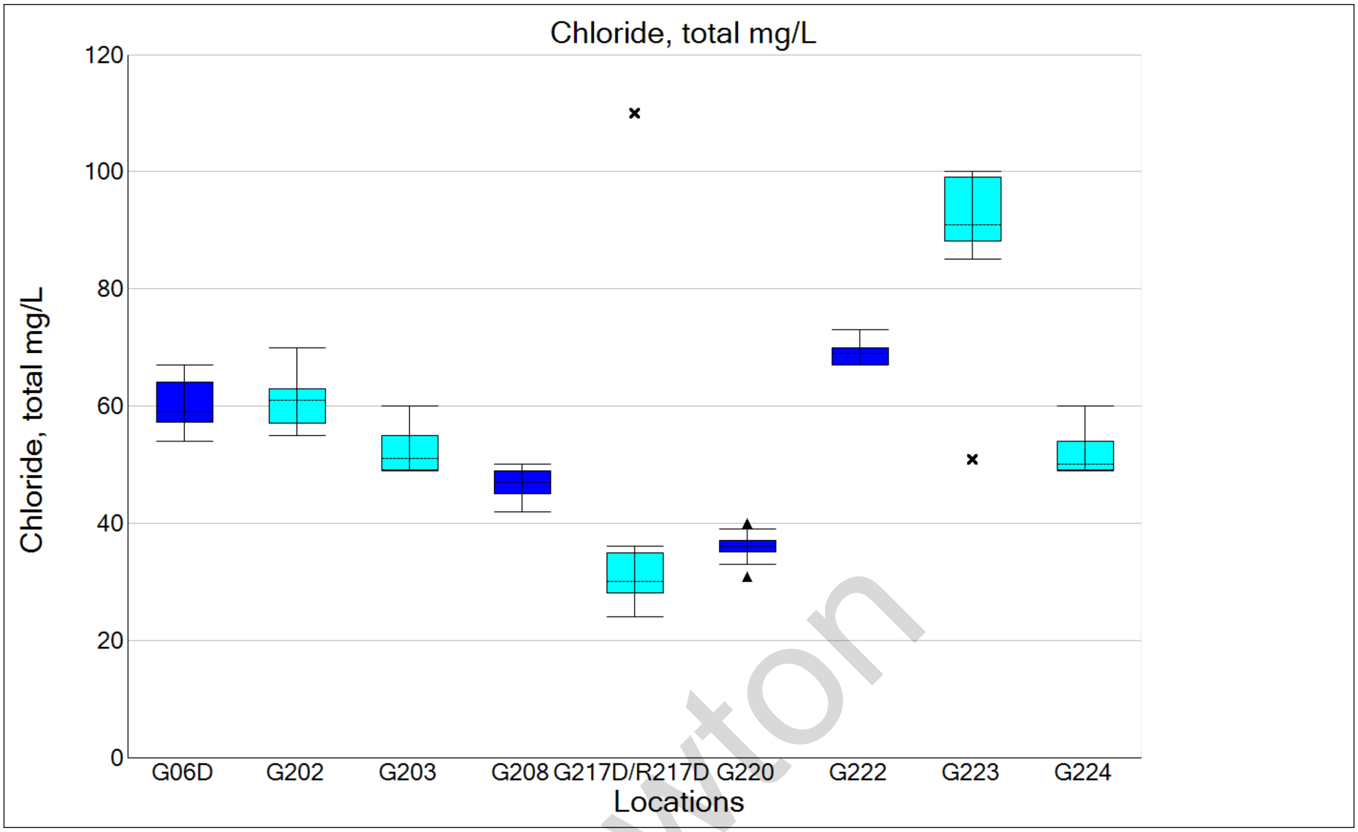


Figure 4. Chloride Box Plot for LF2 Cells 1 and 2 Downgradient Monitoring Wells (cyan) and LF2 Cell 3 Downgradient Monitoring Wells (blue)

The following observations can be made from Figure 5:

- The minimum and maximum chloride concentrations in wells downgradient of LF2 Cell 3 range from 31 to 73 mg/L.
- The minimum and maximum chloride concentrations in wells downgradient of LF2 Cells 1 and 2 range from 24 to 110 mg/L.

Chloride concentrations are within or below the range of concentrations observed at wells downgradient of LF2 Cell 3, with the exception of concentrations at monitoring well G223 and potential statistical outlier concentrations at G217D/R217D (illustrated with black symbols outside of the box plots in Figure 4).

The similarity of groundwater quality downgradient of LF2 Cell 3 and groundwater quality downgradient of LF2 Cells 1 and 2, as represented by the ranges of chloride concentrations (Figure 5), coupled with the fact that Cell 3 has never contained CCR, indicates that LF2 Cells 1 and 2 are not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

LINE OF EVIDENCE #6: GROUNDWATER FLOW DIRECTIONS INDICATE MONITORING WELLS G223, G224, AND R217D ARE NOT DOWNGRADIENT OF LF2 CELLS 1 AND 2.

Downgradient groundwater at LF2 Cells 1 and 2 is monitored using wells G202, G203, G223, G224, and R217D. Groundwater flow directions indicate monitoring wells G223, G224, and R217D are not downgradient of LF2 Cells 1 and 2 as illustrated in Figure 2. LF2 Cells 1 and 2 are not the source of CCR constituents detected in the LF2 groundwater monitoring wells G223, G224, and R217D based on the position of the monitoring wells relative to groundwater flow directions.

Based on these four lines of evidence, it has been demonstrated that Newton Landfill 2 is not the source of the boron SSIs at G220 and G222; the chloride SSIs at G06D, G202, G203, G208, G222, G223, and G224; and fluoride SSIs at G220 and G222.

This information serves as the written ASD prepared in accordance with 40 C.F.R. § 257.94(e)(2) that the SSIs observed during the D2 were not due to the LF2. Therefore, an assessment monitoring program is not required, and the Newton Landfill 2 will remain in detection monitoring.

REFERENCES

Natural Resource Technology, an OBG Company (NRT/OBG), 2017a, Statistical Analysis Plan, Coffeen Power Station, Newton Power Station, Illinois Power Generating Company, October 17, 2017.

Natural Resource Technology, an OBG Company (NRT/OBG), 2017b, Hydrogeologic Monitoring Plan, Newton Primary Ash Pond – CCR Unit ID 501, Newton Landfill 2 – CCR Unit ID 502, Newton Power Station, Canton, Illinois, Illinois Power Generating Company, October 17, 2017.

OBG, 2019, 40 C.F.R. § 257.94(e)(2): Alternate Source Demonstration: Newton Primary Ash Pond, January 7, 2019.

ATTACHMENTS

Figure 1	Facility Location Map with Newton Landfill 2 (Phase II Landfill) Management Units and Sample Locations
Figure 2	Groundwater Elevation Contour Map – May 17, 2018

I, Eric J. Tlachac, a qualified professional engineer 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.

LICENSED PROFESSIONAL ENGINEER
ERIC J. TLACHAC
062-063091
STATE OF ILLINOIS

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.

LICENSED PROFESSIONAL GEOLOGIST
NICOLE M. PAGANO
196-000750
ILLINOIS

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

Figures

DRAWN BY: MPG
REVIEWED BY: JJW
APPROVED BY: NMP

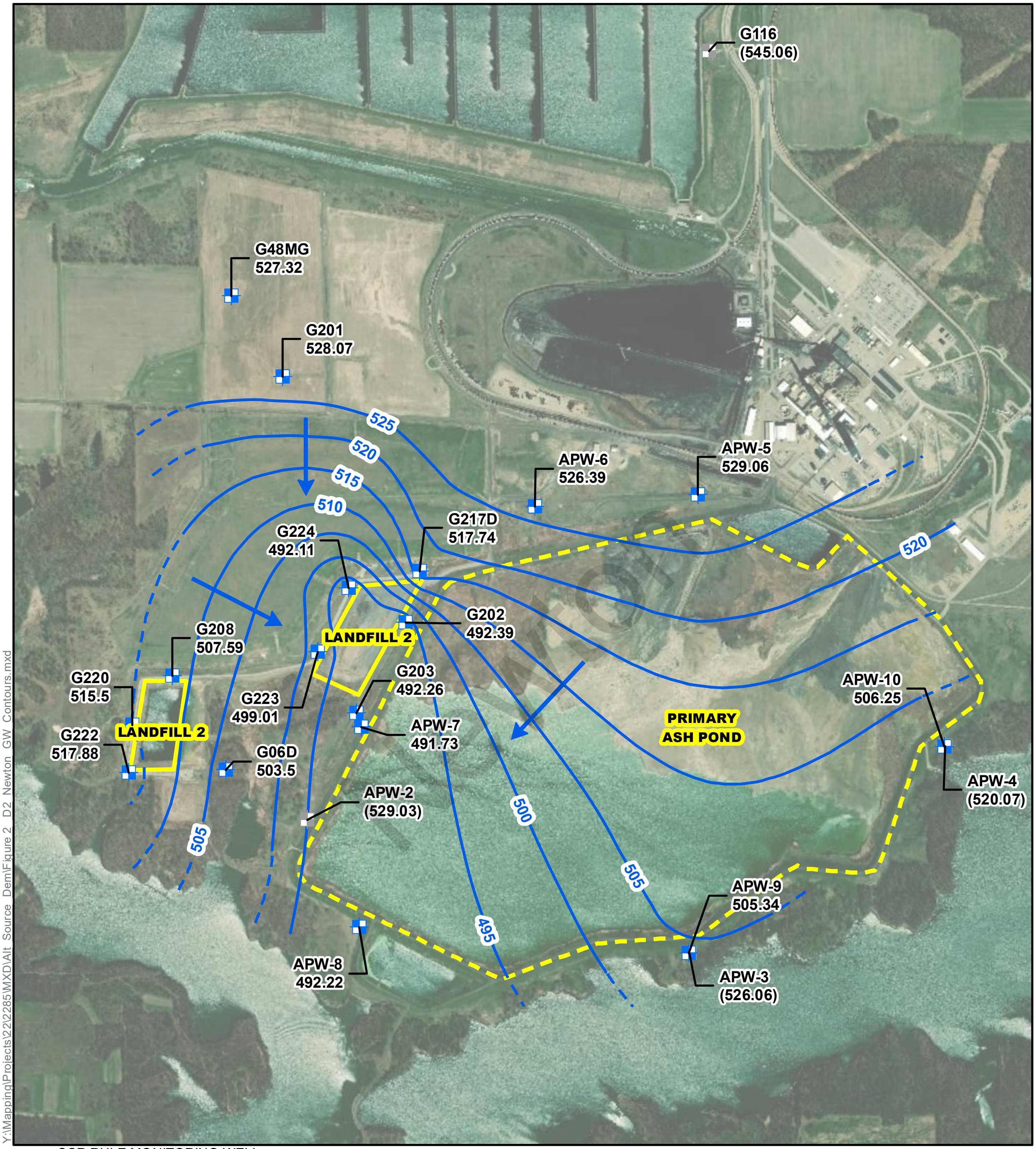
FACILITY LOCATION MAP WITH NEWTON LANDFILL 2 (PHASE II LANDFILL) MANAGEMENT UNITS AND SAMPLE LOCATIONS

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 67719

FIGURE NO: 1

Y:\Mapping\Projects\22\2285\MXD\Alt_Source_Dem\Figure 1_Newton Landfill Phase2_FINAL.mxd Author: STOLZSD



CCR RULE MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FOOT INTERVAL)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

LANDFILL 2 CCR MONITORED UNIT

PRIMARY ASH POND CCR MONITORED UNIT

NEWTON LANDFILL 2 (UNIT ID: 502)
GROUNDWATER ELEVATION CONTOUR MAP
MAY 17, 2018

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

0 325 650 1,300
Feet

N

O'BRIEN & GERE ENGINEERS, INC.

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

July 15, 2019

Title 40 of the Code of Federal Regulations (C.F.R.) § 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 Illinois Power Generating Company 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 Newton Landfill 2 (LF2) located near Newton, Illinois.

The third semi-annual detection monitoring samples (Detection Monitoring Round 3 [D3]) were collected on November 12-16, 2018 and analytical data were received on January 16, 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 16, 2019, within 90 days of receipt of the analytical data. The statistical analysis identified the following SSIs at downgradient monitoring wells:

- Boron at wells G220, G222, and G223
- Chloride at wells G06D, G202, G203, G208, G220, G222, G223, and G224
- Fluoride at wells G208 and G220

Because the Detection Monitoring Round 4 (D4) was completed on February 19-21, 2019, within 90 days from the D3 SSI determination, and in accordance with the Statistical Analysis Plan (NRT/OBG, 2017a), results from D4 sampling were used to verify the D3 SSIs. Following evaluation of analytical data from the D4 sampling, the following SSIs were confirmed for D3:

- Boron at wells G220, G222, and G223
- Chloride at wells G06D, G202, G203, G208, G220, G222, G223, and G224
- Fluoride at wells G208 and G220

Pursuant to 40 C.F.R. § 257.94(e)(2), the following demonstrates that sources other than the Newton LF2 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).

SITE LOCATION AND DESCRIPTION

The Newton Power Station (Site) is located in Jasper County, in the southeastern part of central Illinois, approximately 7 miles southwest of the town of Newton. The area is surrounded by Newton Lake. Beyond the lake is agricultural land.

DESCRIPTION OF PHASE II LANDFILL CCR UNIT

The Phase II Landfill (LF2) includes three lined disposal cells (Figure 1). LF2 Cells 1 and 2, encompassing approximately 12 acres, and LF2 Cell 3, encompassing approximately 7 acres.

GEOLOGY AND HYDROGEOLOGY

The site geology and hydrogeology are summarized below from the Hydrogeologic Monitoring Plan (NRT/OBG, 2017b).

GEOLOGY

Quaternary deposits in the Newton area consist mainly of diamictons and outwash deposits that were deposited during Illinoian and Pre-Illinoian glaciations. The unconsolidated deposits occurring at Newton Power Station include the following units (beginning at the ground surface):

- Ash/Fill Units – CCR and fill within the various CCR Units.
- Upper Confining Unit – Low permeability clays and silts, including the Peoria Silt (Loess Unit) in upland areas and the Cahokia Formation in the flood plain and channel areas to the south and east, underlain by the Sangamon Soil, and the predominantly clay diamictons of the Hagarstown (Till) and Vandalia (Till) Members of the Glasford Formation.
- Uppermost Aquifer (Groundwater Monitoring Zone) – Thin to moderately thick (3 to 17 ft), moderate to high permeability sand, silty sand, and sandy silt/clay units of the Mulberry Grove Member of the Glasford Formation.
- Lower Confining Unit – Thick, very low permeability silty clay diamictons of the Smithboro (Till) Member of the Glasford Formation and the silty clay diamictons of the Banner Formation.

The bedrock beneath the unconsolidated deposits consists of Pennsylvanian-age Mattoon Formation that is mostly shale near the bedrock surface, but is characterized at depth by a complex sequence of shales, thin limestones, coals, underclays, and several sandstones. The erosional surface of the Pennsylvanian-age Mattoon Formation bedrock ranges widely in depth in the vicinity of the site, but is typically encountered at 90 to 120 ft below ground surface (bgs).

HYDROGEOLOGY

The information used to describe the hydrogeology is based on the local geology obtained from published sources, hydrogeologic investigation data, and boring data collected during monitoring well installation. CCR monitoring well locations are shown in Figure 1.

The Uppermost Aquifer, the Mulberry Grove Member, typically consists of fine to coarse sand with varying amounts of clay, silt, and fine to coarse gravel. The portion of the Mulberry Grove Member at the site that is defined as a sand layer ranges in thickness from 3 to 17 ft, with an average thickness of 8 ft. With only a few exceptions, the sand layer occurs between depths of 55 to 88 ft bgs.

The lower hydrostratigaphic units, which comprise lower limit of the Uppermost Aquifer, consist of the Smithboro Member and the Banner Formation, both of which are predominantly low permeability clay diamictons with varying amounts of silt, sand, and gravel. These lower hydrostratigraphic units are 30 ft to more than 50 ft thick above the underlying bedrock.

Groundwater elevations across LF2 ranged from approximately 486 to 530 ft MSL (NAVD88) during D3 (Figure 2). The groundwater elevation contours shown on Figure 2 were measured on November 8, 2018, the first day of a combined sampling event at the Site for LF2 and the Primary Ash Pond and for multiple monitoring programs required by both federal and state regulatory agencies. Overall groundwater flow within the Uppermost Aquifer beneath the site in February 2019 was southward toward Newton Lake, but flow converging to the south-southeast along the major axis of LF2 Cells 1 and 2, and a predominantly eastward flow under LF2 Cell 3. Based on groundwater flow directions near LF2, groundwater beneath LF2 Cells 1 and 2 does not influence groundwater beneath LF2 Cell 3.

GROUNDWATER MONITORING

The Uppermost Aquifer monitoring system for LF2 Cells 1, 2, and 3 is shown on Figure 1 and described below. The relative positions of CCR monitoring wells in relation to groundwater flow direction are shown in Figure 2.

BACKGROUND GROUNDWATER MONITORING

Monitoring wells G201 and G48MG are used to monitor background water quality for LF2 (all cells).

DOWNGRADIENT GROUNDWATER MONITORING

Downgradient groundwater quality at LF2 Cells 1 and 2 is monitored using wells G202, G203, G223, G224, and R217D (which replaced well G217D in October 2017).

Downgradient groundwater quality at LF2 Cell 3 is monitored using wells G06D, G208, G220, and G222.

ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

As allowed by 40 C.F.R. § 257.94(e)(2), this ASD demonstrates that sources other than LF2 caused the SSI(s), or that the SSI(s) was a result of natural variation in groundwater quality. This ASD is based on the following lines of evidence (LOE):

1. Landfill Design and Operation.
2. No CCR material has been placed in LF2 Cell 3.
3. The ionic composition in groundwater is different than the ionic composition of leachate.
4. The ionic composition in groundwater downgradient of LF2 Cells 1 and 2 is similar to groundwater downgradient of LF2 Cell 3 (where no CCR material has been placed).
5. Groundwater quality in monitoring wells downgradient of LF2 Cells 1 and 2 is statistically similar to groundwater quality in monitoring wells downgradient of LF2 Cell 3 (where no CCR material has been placed).
6. Groundwater flow directions indicate monitoring wells G223, G224, and R217D are not downgradient of LF2 Cells 1 and 2.

These lines of evidence are described and supported in greater detail below.

LINE OF EVIDENCE #1: LANDFILL DESIGN AND OPERATION

LF2 Cells 1 and 2 were constructed, and began receiving CCR, in 1997. A portion of LF2 Cell 2 is currently in operation. LF2 Cell 3 is currently inactive and has not received CCR since construction in 2011.

The constructed liner and leachate collection system for LF2 Cells 1, 2, and 3 include the following design components from top to bottom:

- Soil cover for frost protection;
- 10-ounce-per-square-yard (sy) geotextile separation layer between the leachate management system and the frost protection soil cover;
- 1-foot thick sand drainage layer;
- 60-mil high-density polyethylene (HDPE) geomembrane; and
- Three-foot-thick compacted, low-permeability soil having a maximum hydraulic conductivity of 1.0×10^{-7} centimeters per second (cm/sec).

These components meet or exceed the landfill liner performance standards of 40 C.F.R. § 257. The landfill design criteria were intended to provide protection to the Uppermost Aquifer. In addition, the Uppermost Confining Unit provides hydraulic separation between the CCR units at the Site and the Uppermost Aquifer (OBG, 2019). These factors support the conclusion that LF2 is not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

LINE OF EVIDENCE #2: NO CCR MATERIAL HAS BEEN PLACED IN LF2 CELL 3

LF2 Cell 3 has never contained CCR; therefore, it cannot be the source of the CCR constituents boron, chloride or fluoride detected in downgradient groundwater monitoring wells. Furthermore, groundwater flow directions near LF2 (Figure 2) indicate groundwater beneath LF2 Cells 1 and 2 does not influence groundwater beneath LF2 Cell 3, so LF2 Cells 1 and 2 cannot be the source of CCR constituents detected in LF2 Cell 3 downgradient monitoring wells.

LINE OF EVIDENCE #3: THE IONIC COMPOSITION IN GROUNDWATER IS DIFFERENT THAN THE IONIC COMPOSITION OF LEACHATE

Piper diagrams graphically represent ionic composition of aqueous solutions. A Piper diagram displays the position of water samples with respect to their major cation and anion content on the two lower triangular portions of the diagram, providing the information which, when combined on the central, diamond-shaped portion of the diagram, identify composition categories or groupings (groundwater facies). Figure 3, below, is a Piper diagram that displays the ionic composition of samples from the background and downgradient monitoring wells associated with LF2 based on Quarter 3 2018 samples. Figure 3 also includes data collected from the combined LF1 and LF2 leachate tank in Quarter 2 of 2017. Major cations and anions were not analyzed in samples collected from the LF1 and LF2 leachate tank subsequent to Quarter 2 2017.

It is evident from the Piper diagram (Figure 3) that leachate is in the sodium-sulfate hydrochemical facies, and the LF2 groundwater samples (blue symbols) are in the no dominant-bicarbonate hydrochemical facies. All LF2 Cell 1, 2, and 3 groundwater samples cluster into a single distinct hydrochemical facies. Downgradient groundwater samples associated with LF2 have a different ionic composition than leachate, indicating that leachate is not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

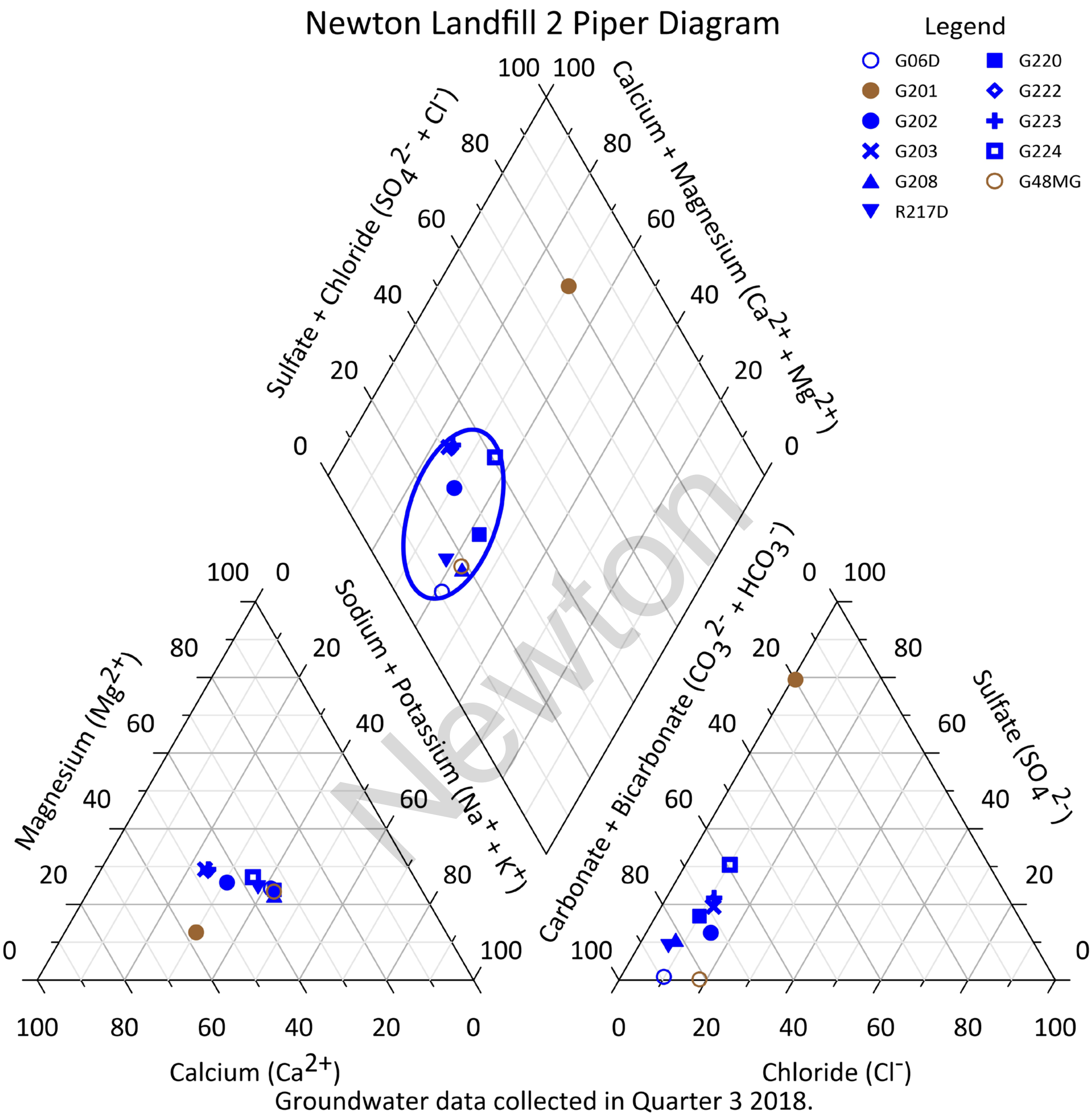


Figure 3. Piper Diagram Showing Ionic Composition of Samples of Background and Downgradient Groundwater Associated with LF2

LINE OF EVIDENCE #4: THE IONIC COMPOSITION IN GROUNDWATER DOWNGRADIENT OF LF2 CELLS 1 AND 2 IS SIMILAR TO GROUNDWATER DOWNGRADIENT OF LF2 CELL 3 (WHERE NO CCR MATERIAL HAS BEEN PLACED)

As illustrated in the Piper diagram (Figure 3), the ionic composition of all LF2 Cell 1, 2, and 3 groundwater samples are similar and cluster into a single distinct hydrochemical facies (no dominant-bicarbonate). The similarity in ionic composition of groundwater downgradient of LF2 Cell 3 and LF2 Cells 1 and 2, coupled with the fact that Cell 3 has never contained CCR, indicate that LF2 Cells 1 and 2 are not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

LINE OF EVIDENCE #5: GROUNDWATER QUALITY IN MONITORING WELLS DOWNGRADIENT OF LF2 CELLS 1 AND 2 IS STATISTICALLY SIMILAR TO GROUNDWATER QUALITY IN MONITORING WELLS DOWNGRADIENT OF LF2 CELL 3 (WHERE NO CCR MATERIAL HAS BEEN PLACED)

Box plots graphically represent the first quartile (Q1), median (Q2), and third quartile (Q3) of a given dataset using lines to construct a box where the lower line, midline and upper line of the box represent the values of Q1, Q2 and Q3, respectively. The minimum and maximum values of the dataset (excluding outliers) are illustrated by whisker lines extending beyond the first and third quartiles of the box plot. Outliers are represented by single points plotted outside of the range of the whiskers. Boron and chloride SSIs were identified at all LF2 cells (LF2 Cells 1, 2, and 3) during the D4 sampling event, whereas, other SSIs were only identified at LF2 Cell 3. Figures 4 and 5, below, display the boron chloride data for downgradient groundwater at LF2; triangle symbols identify outlier values that are at least 1.5 times the interquartile range (IQR) and "x" symbols identify outlier values that are at least 3 times the IQR.

Boron

Box plots of the boron concentrations observed in LF2 Cells 1 and 2 downgradient monitoring wells (cyan), and LF2 Cell 3 downgradient monitoring wells (blue) are shown in Figure 4 below.

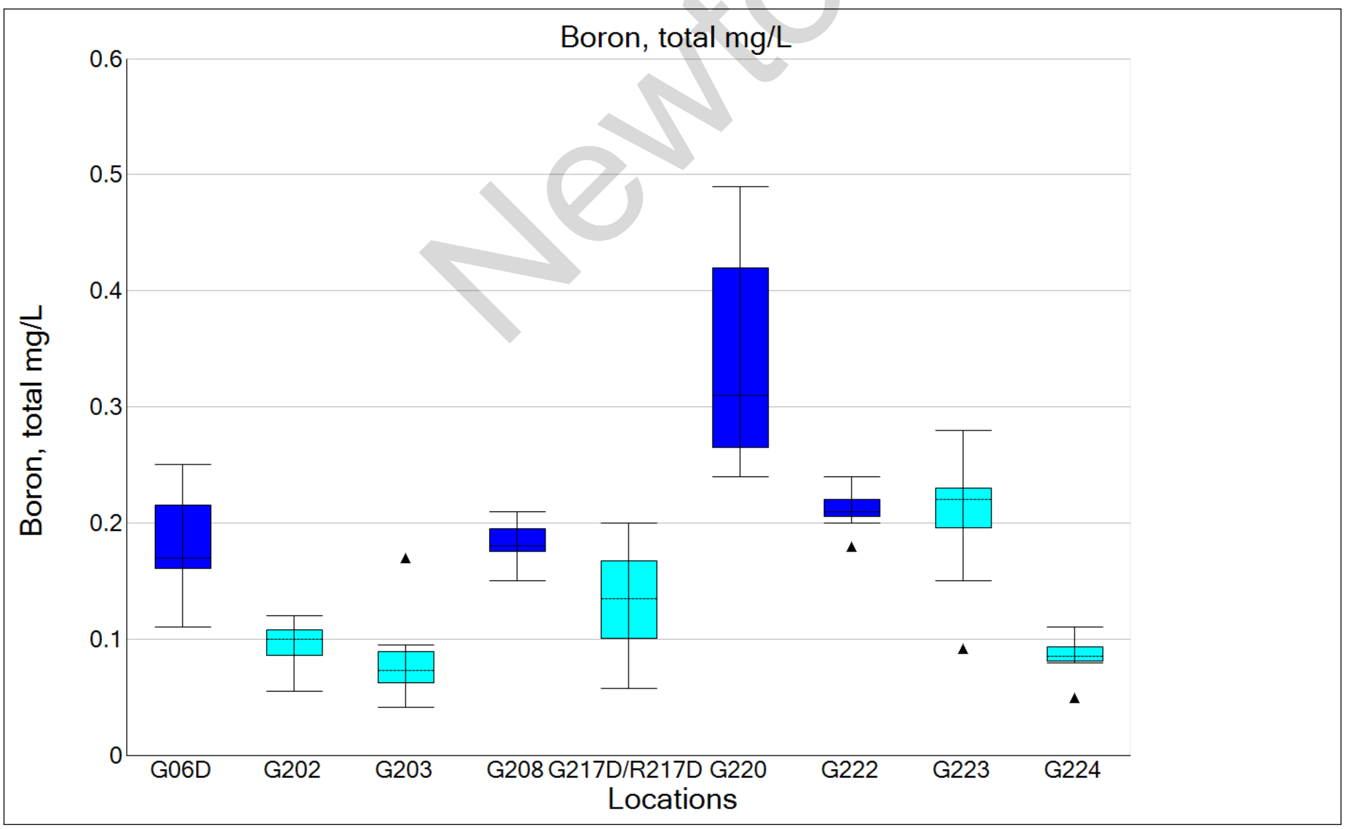


Figure 4. Boron Box Plot for LF2 Cells 1 and 2 Downgradient Monitoring Wells (cyan) and LF2 Cell 3 Downgradient Monitoring Wells (blue)

The following observations can be made from Figure 5:

- The minimum and maximum boron concentrations in wells downgradient of LF2 Cell 3 ranged from 0.11 to 0.49 mg/L.
- The minimum and maximum boron concentrations in wells downgradient of LF2 Cells 1 and 2 ranged from 0.041 to 0.28 mg/L.

Boron concentrations were within or below the range of concentrations observed at wells downgradient of LF2 Cell 3.

Chloride

Box plots of the chloride concentrations observed in LF2 Cells 1 and 2 downgradient monitoring wells (cyan), and LF2 Cell 3 downgradient monitoring wells (blue) are shown in Figure 5 below.

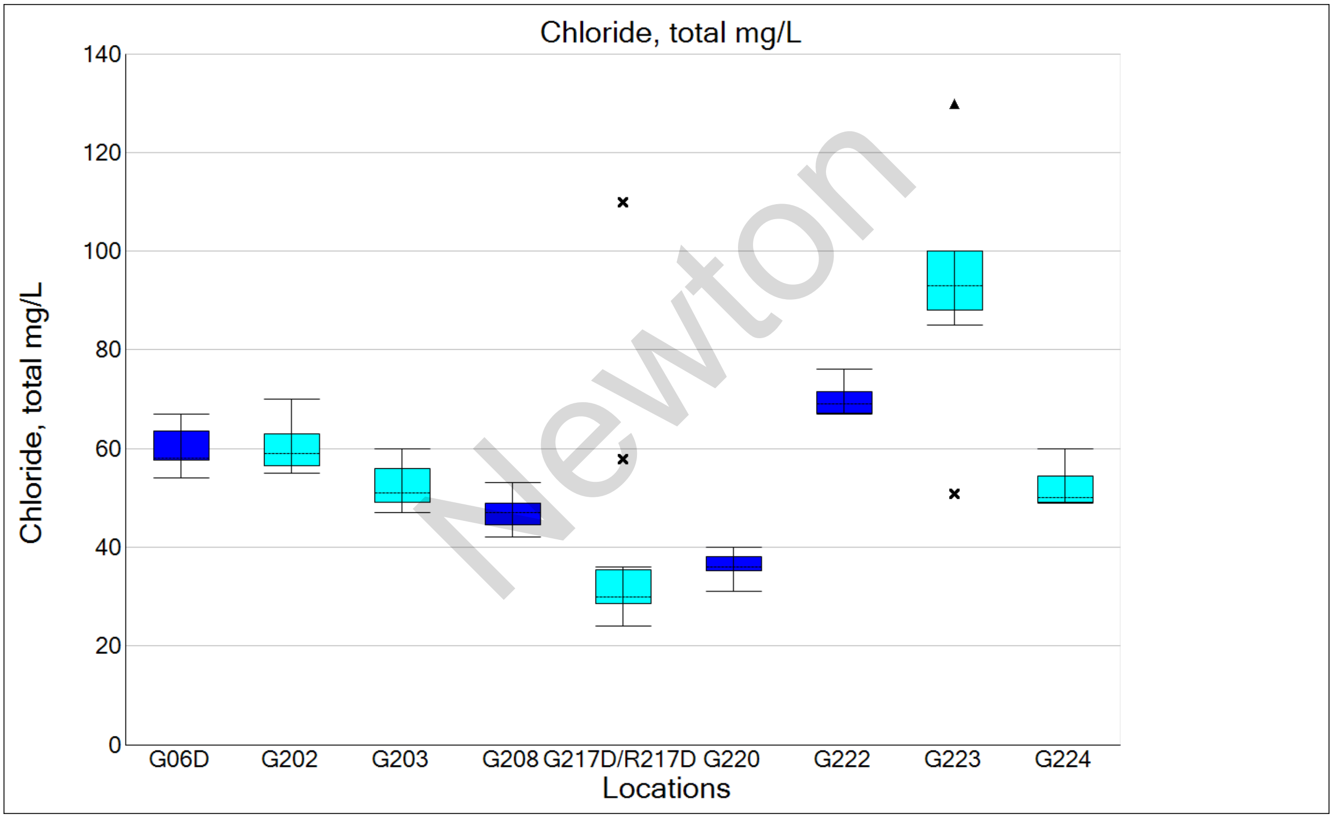


Figure 5. Chloride Box Plot for LF2 Cells 1 and 2 Downgradient Monitoring Wells (cyan) and LF2 Cell 3 Downgradient Monitoring Wells (blue)

The following observations can be made from Figure 7:

- The minimum and maximum chloride concentrations in wells downgradient of LF2 Cell 3 range from 31 to 76 mg/L.
- The minimum and maximum chloride concentrations in wells downgradient of LF2 Cells 1 and 2 range from 24 to 130 mg/L.

Chloride concentrations are within or below the range of concentrations observed at wells downgradient of LF2 Cell 3, with the exception of concentrations at monitoring well G223 and potential statistical outlier concentrations at G217D/R217D (illustrated with black symbols outside of the box plots in Figure 5).

The similarity of groundwater quality downgradient of LF2 Cell 3 and groundwater quality downgradient of LF2 Cells 1 and 2, as represented by the ranges of boron chloride concentrations (Figures 4 and 5, respectively), indicate that LF2 Cells 1 and 2 are not the source of CCR constituents detected in the LF2 groundwater monitoring wells

LINE OF EVIDENCE #6: GROUNDWATER FLOW DIRECTIONS INDICATE MONITORING WELLS G223, G224, AND R217D ARE NOT DOWNGRADIENT OF LF2 CELLS 1 AND 2.

Downgradient groundwater at LF2 Cells 1 and 2 is monitored using wells G202, G203, G223, G224, and R217D. Groundwater flow directions indicate monitoring wells G223, G224, and R217D are not downgradient of LF2 Cells 1 and 2 as illustrated in Figure 2. LF2 Cells 1 and 2 are not the source of CCR constituents detected in the LF2 groundwater monitoring wells G223, G224, and R217D based on the position of the monitoring wells relative to groundwater flow directions.

Based on these six lines of evidence, it has been demonstrated that Newton Landfill 2 is not the source of the boron SSIs at G220, G222, and G223; the chloride SSIs at G06D, G202, G203, G208, G220, G222, G223, and G224; and fluoride SSIs at G208 and G220.

This information serves as the written ASD prepared in accordance with 40 C.F.R. § 257.94(e)(2) that the SSIs observed during the D3 were not due to the LF2. Therefore, an assessment monitoring program is not required, and the Newton Landfill 2 will remain in detection monitoring.

REFERENCES

Natural Resource Technology, an OBG Company (NRT/OBG), 2017a, Statistical Analysis Plan, Coffeen Power Station, Newton Power Station, Illinois Power Generating Company, October 17, 2017.

Natural Resource Technology, an OBG Company (NRT/OBG), 2017b, Hydrogeologic Monitoring Plan, Newton Primary Ash Pond – CCR Unit ID 501, Newton Landfill 2 – CCR Unit ID 502, Newton Power Station, Canton, Illinois, Illinois Power Generating Company, October 17, 2017.

OBG, 2019, 40 C.F.R. § 257.94(e)(2): Alternate Source Demonstration: Newton Primary Ash Pond, July 15, 2019.

ATTACHMENTS

Figure 1	Facility Location Map with Newton Landfill 2 (Phase II Landfill) Management Units and Sample Locations
Figure 2	Groundwater Elevation Contour Map – November 8, 2018

I, Eric J. Tlachac, a qualified professional engineer 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.

Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
O'Brien and 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
O'Brien and Gere Engineers, Inc., a Ramboll Company
Date: July 15, 2019

Figures

DRAWN BY: MPG
REVIEWED BY: JJW
APPROVED BY: NMP

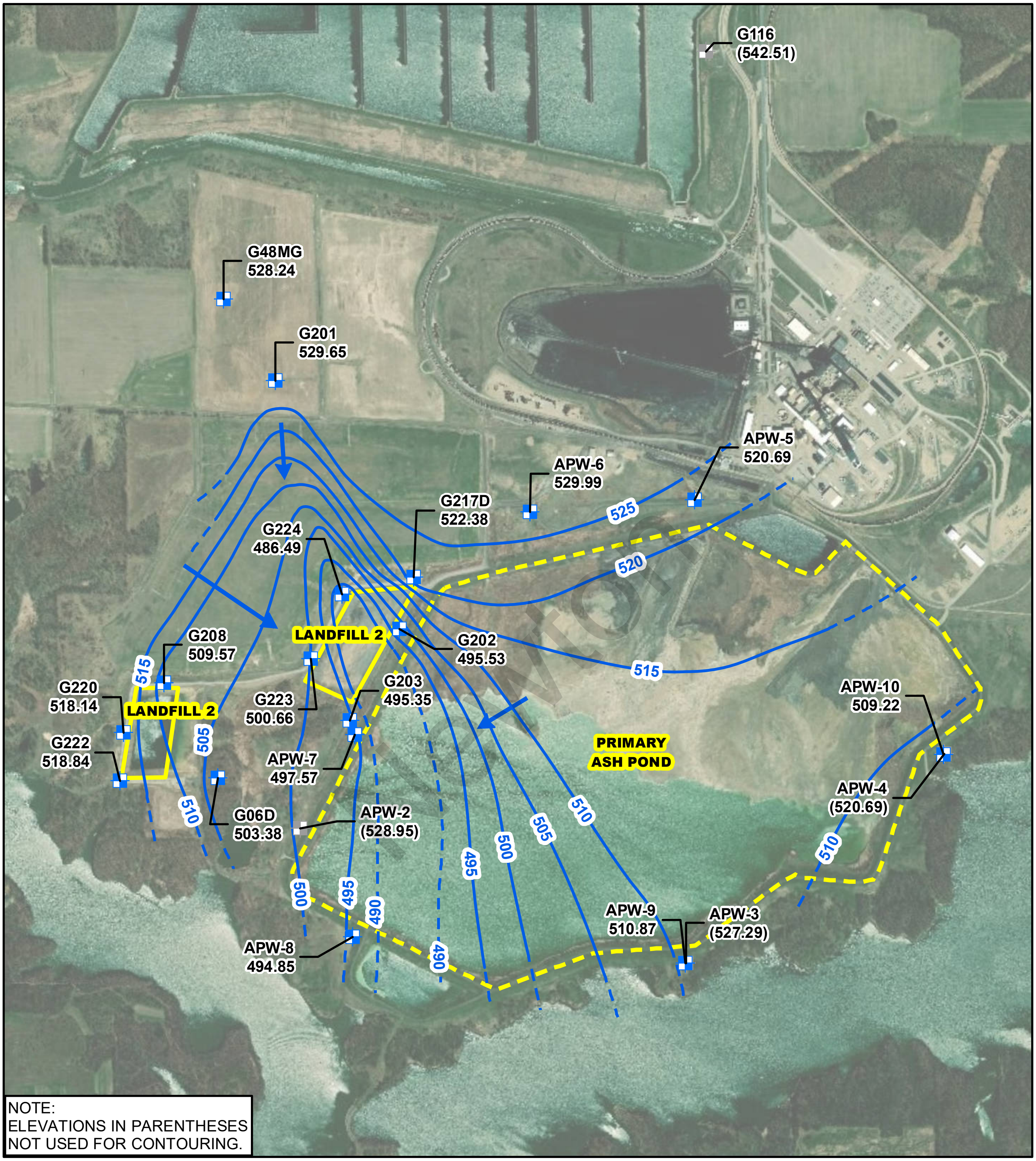
FACILITY LOCATION MAP WITH NEWTON LANDFILL 2 (PHASE II LANDFILL) MANAGEMENT UNITS AND SAMPLE LOCATIONS

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 67719

FIGURE NO: 1

Y:\Mapping\Projects\22\2285\MXD\Alt_Source_Dem\Figure 1_Newton Landfill Phase2_FINAL.mxd Author: STOLZSD



CCR RULE MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FOOT INTERVAL)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

LANDFILL 2 CCR MONITORED UNIT

PRIMARY ASH POND CCR MONITORED UNIT

NEWTON LANDFILL 2 (UNIT ID: 502)
GROUNDWATER ELEVATION CONTOUR MAP
NOVEMBER 8, 2018

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

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O'BRIEN & GERE ENGINEERS, INC.

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

October 14, 2019

Title 40 of the Code of Federal Regulations (C.F.R.) § 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 Illinois Power Generating Company 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 Newton Landfill 2 (LF2) located near Newton, Illinois.

The fourth semi-annual detection monitoring samples (Detection Monitoring Round 4 [D4]) were collected on February 19-21, 2019 and analytical data were received on April 15, 2019. In accordance with 40 C.F.R. § 257.93(h)(2) and the Statistical Analysis Plan (NRT/OBG 2017a), 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 analysis identified the following SSIs at downgradient monitoring wells:

- Boron at wells G06D, G220, G222, G223, and R217D
- Calcium at well R217D
- Chloride at wells G06D, G202, G203, G208, G220, G222, G223, G224, and R217D
- Fluoride at wells G208 and G220
- Sulfate at well R217D
- Total Dissolved Solids (TDS) at well R217D

Pursuant to 40 C.F.R. § 257.94(e)(2), the following demonstrates that sources other than the Newton LF2 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).

SITE LOCATION AND DESCRIPTION

The Newton Power Station (Site) is located in Jasper County, in the southeastern part of central Illinois, approximately 7 miles southwest of the town of Newton. The area is surrounded by Newton Lake. Beyond the lake is agricultural land.

DESCRIPTION OF PHASE II LANDFILL CCR UNIT

The Phase II Landfill (LF2) includes three lined disposal cells (Figure 1). LF2 Cells 1 and 2, encompassing approximately 12 acres, and LF2 Cell 3, encompassing approximately 7 acres.

GEOLOGY AND HYDROGEOLOGY

The site geology and hydrogeology are summarized below from the Hydrogeologic Monitoring Plan (NRT/OBG, 2017b).

GEOLOGY

Quaternary deposits in the Newton area consist mainly of diamictons and outwash deposits that were deposited during Illinoian and Pre-Illinoian glaciations. The unconsolidated deposits occurring at Newton Power Station include the following units (beginning at the ground surface):

- Ash/Fill Units – CCR and fill within the various CCR Units.
- Upper Confining Unit – Low permeability clays and silts, including the Peoria Silt (Loess Unit) in upland areas and the Cahokia Formation in the flood plain and channel areas to the south and east, underlain by the Sangamon Soil, and the predominantly clay diamictons of the Hagarstown (Till) and Vandalia (Till) Members of the Glasford Formation.
- Uppermost Aquifer (Groundwater Monitoring Zone) – Thin to moderately thick (3 to 17 ft), moderate to high permeability sand, silty sand, and sandy silt/clay units of the Mulberry Grove Member of the Glasford Formation.
- Lower Confining Unit – Thick, very low permeability silty clay diamictons of the Smithboro (Till) Member of the Glasford Formation and the silty clay diamictons of the Banner Formation.

The bedrock beneath the unconsolidated deposits consists of Pennsylvanian-age Mattoon Formation that is mostly shale near the bedrock surface, but is characterized at depth by a complex sequence of shales, thin limestones, coals, underclays, and several sandstones. The erosional surface of the Pennsylvanian-age Mattoon Formation bedrock ranges widely in depth in the vicinity of the site, but is typically encountered at 90 to 120 ft below ground surface (bgs).

HYDROGEOLOGY

The information used to describe the hydrogeology is based on the local geology obtained from published sources, hydrogeologic investigation data, and boring data collected during monitoring well installation. CCR monitoring well locations are shown in Figure 1.

The Uppermost Aquifer, the Mulberry Grove Member, typically consists of fine to coarse sand with varying amounts of clay, silt, and fine to coarse gravel. The portion of the Mulberry Grove Member at the site that is defined as a sand layer ranges in thickness from 3 to 17 ft, with an average thickness of 8 ft. With only a few exceptions, the sand layer occurs between depths of 55 to 88 ft bgs.

The lower hydrostratigaphic units, which comprise lower limit of the Uppermost Aquifer, consist of the Smithboro Member and the Banner Formation, both of which are predominantly low permeability clay diamictons with varying amounts of silt, sand, and gravel. These lower hydrostratigraphic units are 30 ft to more than 50 ft thick above the underlying bedrock.

Groundwater elevations across LF2 ranged from approximately 492 to 524 ft MSL (NAVD88) during D4 (Figure 2). The groundwater elevation contours shown on Figure 2 were measured on February 18, 2019, the first day of a combined sampling event at the Site for LF2 and the Primary Ash Pond and for multiple monitoring programs required by both federal and state regulatory agencies. Overall groundwater flow beneath LF2, within the Uppermost Aquifer, is southward toward Newton Lake, but with flow converging to the south-southeast along the major axis of LF2 Cells 1 and 2, and a predominantly eastward flow near LF2 Cell 3. Based on groundwater flow directions near LF2, groundwater beneath LF2 Cells 1 and 2 does not influence groundwater beneath LF2 Cell 3.

GROUNDWATER MONITORING

The Uppermost Aquifer monitoring system for LF2 Cells 1, 2, and 3 is shown on Figure 1 and described below. The relative positions of CCR monitoring wells in relation to groundwater flow direction are shown in Figure 2.

BACKGROUND GROUNDWATER MONITORING

Monitoring wells G201 and G48MG are used to monitor background water quality for LF2 (all cells).

DOWNGRADIENT GROUNDWATER MONITORING

Downgradient groundwater quality at LF2 Cells 1 and 2 is monitored using wells G202, G203, G223, G224, and R217D (which replaced well G217D in October 2017).

Downgradient groundwater quality at LF2 Cell 3 is monitored using wells G06D, G208, G220, and G222.

ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

As allowed by 40 C.F.R. § 257.94(e)(2), this ASD demonstrates that sources other than LF2 caused the SSI(s), or that the SSI(s) was a result of natural variation in groundwater quality. This ASD is based on the following lines of evidence (LOE):

1. LF2 composite liner design.
2. No CCR material has been placed in LF2 Cell 3.
3. The ionic composition in groundwater is different than the ionic composition of leachate.
4. The ionic composition of groundwater downgradient of LF2 Cells 1 and 2 is similar to the ionic composition of groundwater downgradient of LF2 Cell 3 (where no CCR material has been placed).
5. Groundwater quality in monitoring wells downgradient of LF2 Cells 1 and 2 is statistically similar to groundwater quality in monitoring wells downgradient of LF2 Cell 3 (where no CCR material has been placed).
6. Groundwater flow directions indicate monitoring wells G223, G224, and R217D are not downgradient of LF2 Cells 1 and 2.

These lines of evidence are described and supported in greater detail below.

LINE OF EVIDENCE #1: LF2 COMPOSITE LINER DESIGN

LF2 Cells 1 and 2 were constructed, and began receiving CCR, in 1997. A portion of LF2 Cell 2 is currently in operation. LF2 Cell 3 is currently inactive and has not received CCR since construction in 2011.

The constructed liner and leachate collection system for LF2 Cells 1, 2, and 3 include the following design components from top to bottom:

- Soil cover for liner frost protection;
- 10-ounce-per-square-yard (sy) geotextile separation layer between the leachate management system and the frost protection soil cover;
- 1-foot thick sand drainage layer;
- 60 mil high-density polyethylene (HDPE) geomembrane; and
- Three-foot-thick compacted, low-permeability soil having a maximum hydraulic conductivity of 1.0×10^{-7} centimeters per second (cm/sec).

These components meet or exceed the landfill liner performance standards of 40 C.F.R. § 257. The landfill design criteria were intended to provide protection to the Uppermost Aquifer. In addition, the Uppermost Confining Unit provides hydraulic separation between the CCR units at the Site and the Uppermost Aquifer (OBG, 2019) These factors support the conclusion that LF2 is not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

LINE OF EVIDENCE #2: NO CCR MATERIAL HAS BEEN PLACED IN LF2 CELL 3

LF2 Cell 3 has never contained CCR; therefore, it cannot be the source of the CCR constituents boron, calcium, chloride, fluoride, sulfate or TDS detected in downgradient groundwater monitoring wells. Furthermore, groundwater flow directions near LF2 (Figure 2) indicate groundwater beneath LF2 Cells 1 and 2 does not influence groundwater beneath LF2 Cell 3, so LF2 Cells 1 and 2 cannot be the source of CCR constituents detected in LF2 Cell 3 downgradient monitoring wells.

LINE OF EVIDENCE #3: THE IONIC COMPOSITION IN GROUNDWATER IS DIFFERENT THAN THE IONIC COMPOSITION OF LEACHATE

Piper diagrams graphically represent ionic composition of aqueous solutions. A Piper diagram displays the position of water samples with respect to their major cation and anion content on the two lower triangular portions of the diagram, providing the information which, when combined on the central, diamond-shaped portion of the diagram, identify composition categories or groupings (hydrochemical facies). Figure 3, below, is a Piper diagram that displays the ionic composition of samples collected from the background and downgradient monitoring wells associated with LF2 in Quarter 3 2018. Major cations and anions were not analyzed in samples collected from the background and downgradient wells subsequent to Quarter 3 2018. Figure 3 also displays the ionic composition of samples collected from the combined LF1 and LF2 leachate tank in Quarter 2 2017. Major cations and anions were not analyzed in samples collected from the LF1 and LF2 leachate tank subsequent to Quarter 2 2017.

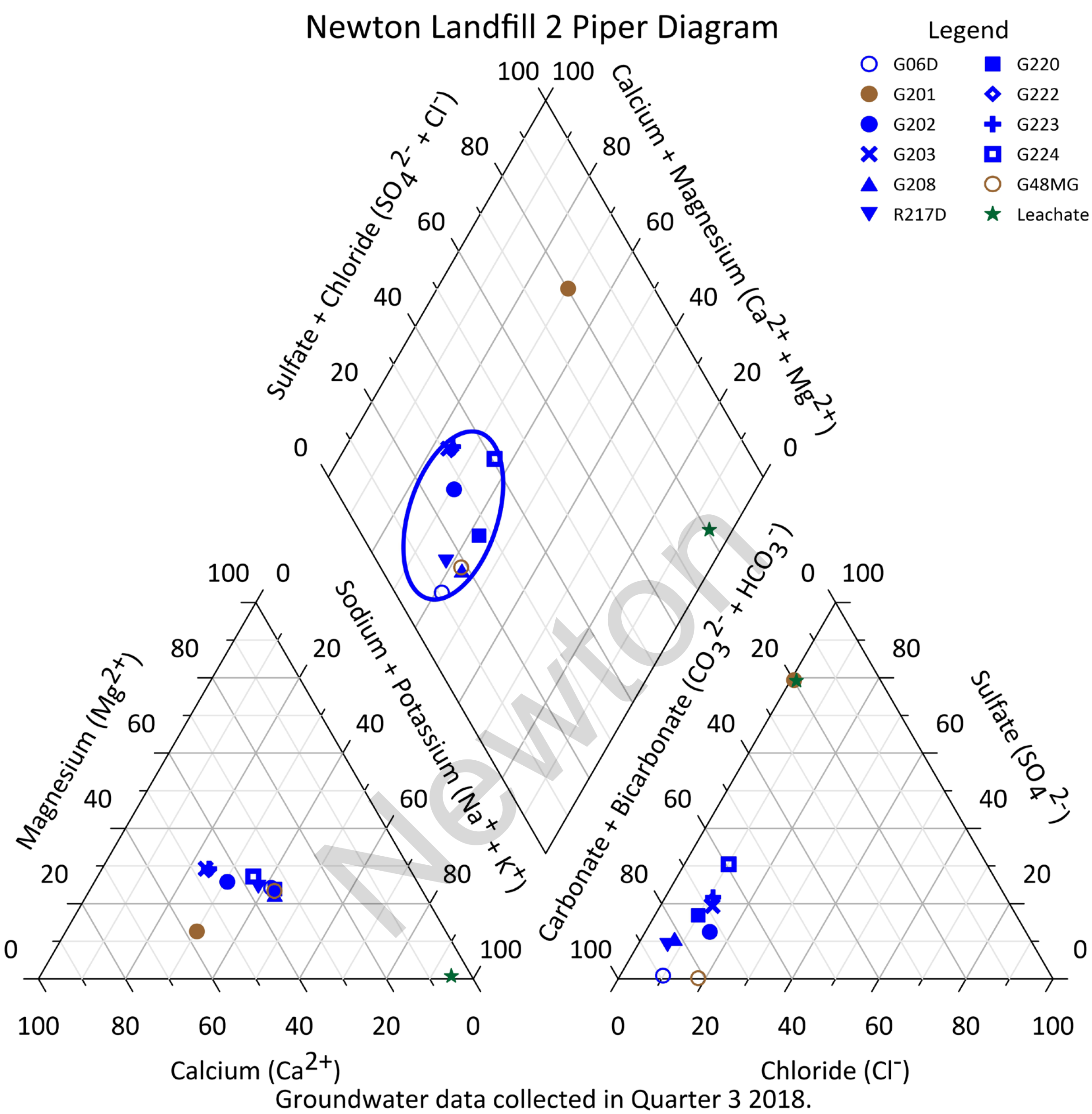

Figure 3. Piper Diagram Showing Ionic Composition of Samples of Groundwater Associated with LF2 and Leachate from Combined LF1 and LF2 Leachate Tank (note: the leachate sample was collected Quarter 2 2017).

It is evident from the Piper diagram (Figure 3) that leachate is in the sodium-sulfate hydrochemical facies, and the LF2 groundwater samples (blue symbols) are in the no dominant-bicarbonate hydrochemical facies. All LF2 Cell 1, 2, and 3 groundwater samples cluster into a single distinct hydrochemical facies. Downgradient groundwater samples associated with LF2 have a different ionic composition than leachate, indicating that leachate is not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

LINE OF EVIDENCE #4: THE IONIC COMPOSITION IN GROUNDWATER DOWNGRADIENT OF LF2 CELLS 1 AND 2 IS SIMILAR TO GROUNDWATER DOWNGRADIENT OF LF2 CELL 3 (WHERE NO CCR MATERIAL HAS BEEN PLACED)

As illustrated in the Piper diagram (Figure 3), the ionic composition of all LF2 Cell 1, 2, and 3 groundwater samples are similar and cluster into a single distinct hydrochemical facies (no dominant-bicarbonate). The similarity in ionic composition of groundwater downgradient of LF2 Cell 3 and LF2 Cells 1 and 2, coupled with the fact that Cell 3 has never contained CCR, indicate that LF2 Cells 1 and 2 are not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

LINE OF EVIDENCE #5: GROUNDWATER QUALITY IN MONITORING WELLS DOWNGRADIENT OF LF2 CELLS 1 AND 2 IS STATISTICALLY SIMILAR TO GROUNDWATER QUALITY IN MONITORING WELLS DOWNGRADIENT OF LF2 CELL 3 (WHERE NO CCR MATERIAL HAS BEEN PLACED)

Box plots graphically represent the first quartile (Q1), median (Q2), and third quartile (Q3) of a given dataset using lines to construct a box where the lower line, midline and upper line of the box represent the values of Q1, Q2 and Q3, respectively. The minimum and maximum values of the dataset (excluding outliers) are illustrated by whisker lines extending beyond the first and third quartiles of the box plot. Outliers are represented by single points plotted outside of the range of the whiskers. Boron and chloride SSIs were identified at all LF2 cells (LF2 Cells 1, 2, and 3) during the D4 sampling event, whereas, other SSIs were only identified at either LF2 Cells 1 and 2, or LF2 Cell 3. Figures 4 and 5, below, display the boron and chloride data for downgradient groundwater at LF2; triangle symbols identify outlier values that are at least 1.5 times the interquartile range (IQR) and "x" symbols identify outlier values that are at least 3 times the IQR.

Boron

Box plots of the boron concentrations observed in LF2 Cells 1 and 2 downgradient monitoring wells (cyan), and LF2 Cell 3 downgradient monitoring wells (blue) are shown in Figure 4 below.

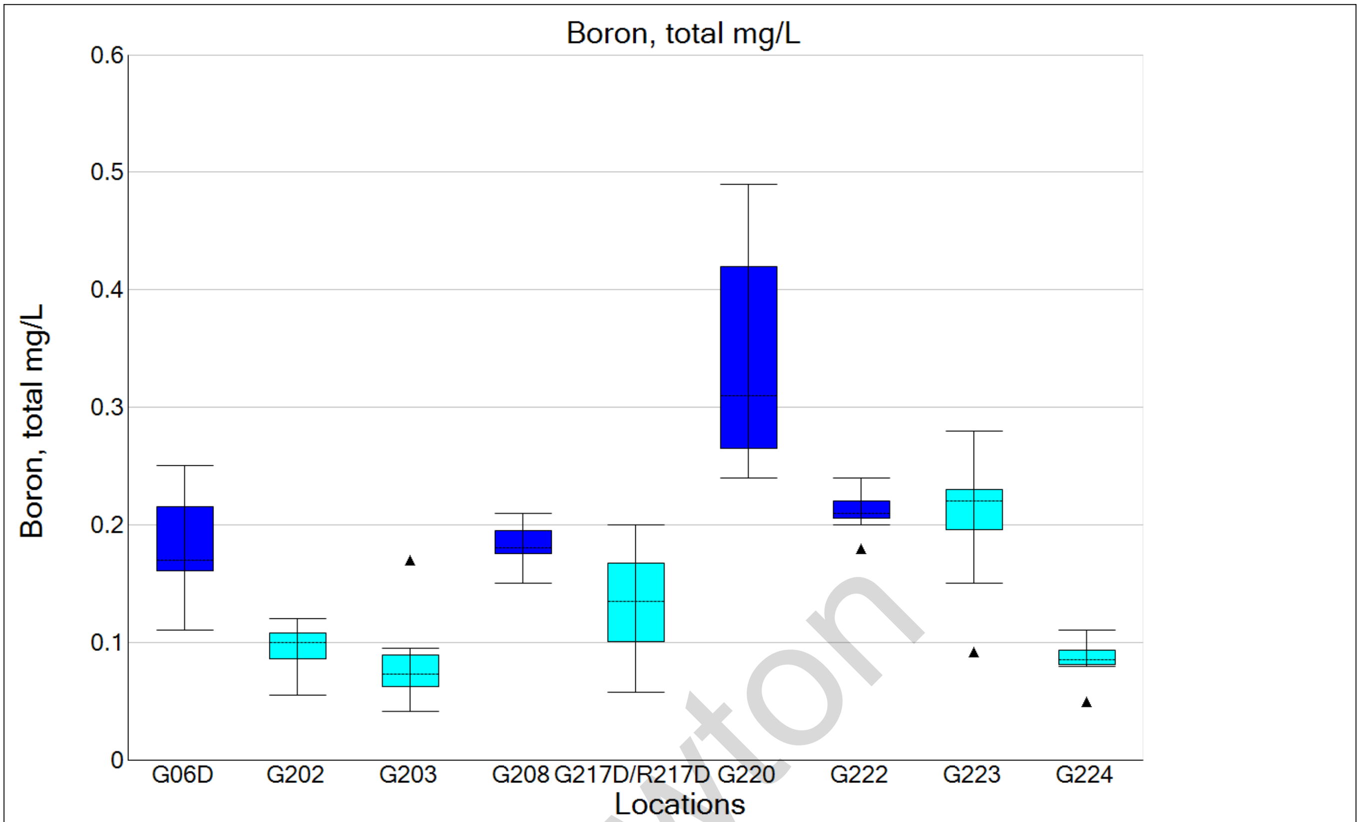

Figure 4. Boron Box Plot for LF2 Cells 1 and 2 Downgradient Monitoring Wells (cyan) and LF2 Cell 3 Downgradient Monitoring Wells (blue)

The following observations can be made from Figure 4

- The minimum and maximum boron concentrations in wells downgradient of LF2 Cell 3 ranged from 0.11 to 0.49 mg/L.
- The minimum and maximum boron concentrations in wells downgradient of LF2 Cells 1 and 2 ranged from 0.041 to 0.28 mg/L.

Boron concentrations downgradient of LF2 Cells 1 and 2 were within or below the range of concentrations observed at wells downgradient of LF2 Cell 3.

Chloride

Box plots of the chloride concentrations observed in LF2 Cells 1 and 2 downgradient monitoring wells (cyan), and LF2 Cell 3 downgradient monitoring wells (blue) are shown in Figure 5 below.

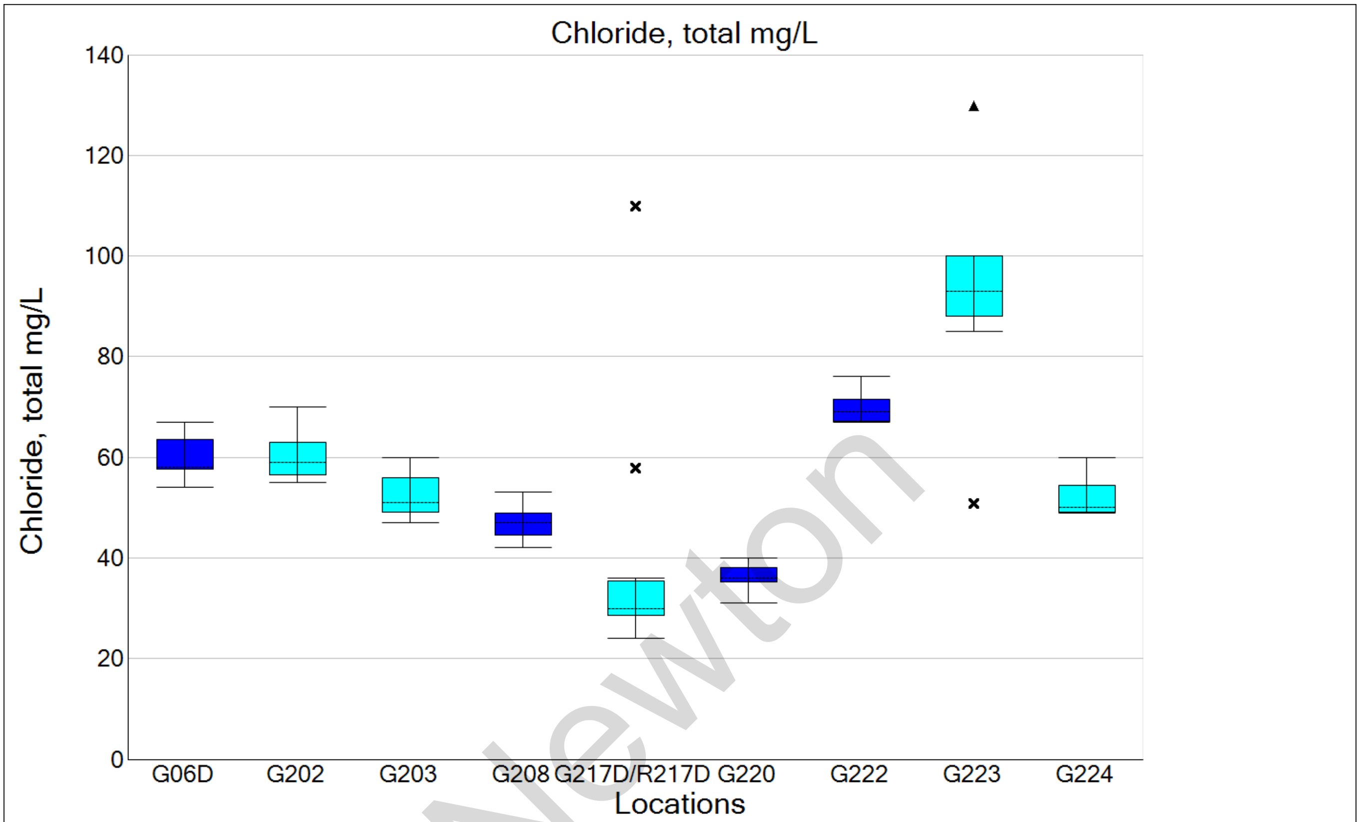

Figure 5. Chloride Box Plot for LF2 Cells 1 and 2 Downgradient Monitoring Wells (cyan) and LF2 Cell 3 Downgradient Monitoring Wells (blue)

The following observations can be made from Figure 5:

- The minimum and maximum chloride concentrations in wells downgradient of LF2 Cell 3 range from 31 to 76 mg/L.
- The minimum and maximum chloride concentrations in wells downgradient of LF2 Cells 1 and 2 range from 24 to 130 mg/L.

Chloride concentrations downgradient of LF2 Cells 1 and 2 are generally within or below the range of concentrations observed at wells downgradient of LF2 Cell 3. The exception is monitoring well G223 and potential statistical outlier concentrations at G217D/R217D (illustrated with black symbols outside of the whiskers in Figure 5).

The similarity of groundwater quality downgradient of LF2 Cell 3 and groundwater quality downgradient of LF2 Cells 1 and 2, as represented by the ranges of boron and chloride concentrations (Figures 4 and 5, respectively), coupled with the fact that Cell 3 has never contained CCR, indicates that LF2 Cells 1 and 2, are not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

LINE OF EVIDENCE #6: GROUNDWATER FLOW DIRECTIONS INDICATE MONITORING WELLS G223, G224, AND R217D ARE NOT DOWNGRADIENT OF LF2 CELLS 1 AND 2.

Downgradient groundwater at LF2 Cells 1 and 2 is monitored using wells G202, G203, G223, G224, and R217D. Groundwater flow directions indicate monitoring wells G223, G224, and R217D are not downgradient of LF2 Cells 1 and 2 as illustrated in Figure 2. LF2 Cells 1 and 2 are not the source of CCR constituents detected in the LF2 groundwater monitoring wells G223, G224, and R217D based on the position of the monitoring wells relative to groundwater flow directions.

Based on these six lines of evidence, it has been demonstrated that Newton Landfill 2 is not the source of the boron SSIs at G06D, G220, G222, G223, and R217D; the calcium SSI at R217D; the chloride SSIs at G06D, G202, G203, G208, G220, G222, G223, G224, and R217D; the fluoride SSIs at G208 and G220; the sulfate SSI at R217D; and the TDS SSI at R217D.

This information serves as the written ASD prepared in accordance with 40 C.F.R. § 257.94(e)(2) that the SSIs observed during D4 were not due to the LF2. Therefore, an assessment monitoring program is not required, and the Newton Landfill 2 will remain in detection monitoring.

REFERENCES

Natural Resource Technology, an OBG Company (NRT/OBG), 2017a, Statistical Analysis Plan, Coffeen Power Station, Newton Power Station, Illinois Power Generating Company, October 17, 2017.

Natural Resource Technology, an OBG Company (NRT/OBG), 2017b, Hydrogeologic Monitoring Plan, Newton Primary Ash Pond – CCR Unit ID 501, Newton Landfill 2 – CCR Unit ID 502, Newton Power Station, Canton, Illinois, Illinois Power Generating Company, October 17, 2017.

OBG, 2019, 40 C.F.R. § 257.94(e)(2): Alternate Source Demonstration: Newton Primary Ash Pond, October 14, 2019.

ATTACHMENTS

Figure 1	Facility Location Map with Newton Landfill 2 (Phase II Landfill) Management Units and Sample Locations
Figure 2	Groundwater Elevation Contour Map – February 18, 2019

I, Eric J. Tlachac, a qualified professional engineer 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.

Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
O'Brien and Gere Engineers, Inc., a Ramboll Company
Date: October 14, 2019

LICENSED PROFESSIONAL ENGINEER
ERIC J. TLACHAC
062-063091
STATE OF ILLINOIS

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
O'Brien and Gere Engineers, Inc., a Ramboll Company
Date: October 14, 2019

LICENSED PROFESSIONAL GEOLOGIST
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Figures

DRAWN BY: MPG
REVIEWED BY: JJW
APPROVED BY: NMP

FACILITY LOCATION MAP WITH NEWTON LANDFILL 2 (PHASE II LANDFILL) MANAGEMENT UNITS AND SAMPLE LOCATIONS

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 67719

FIGURE NO: 1

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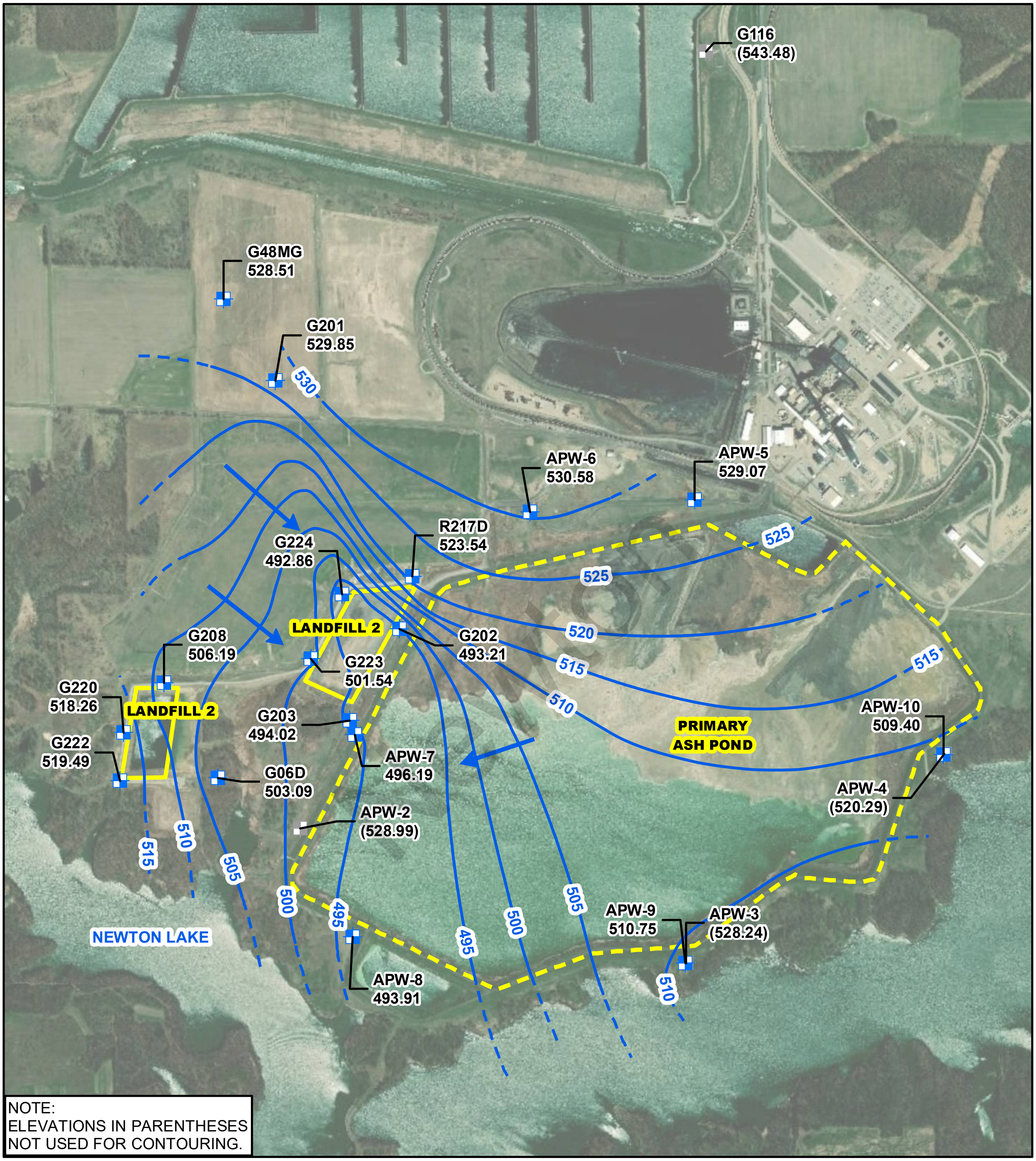
FIGURE NO. 2



NOTE:
ELEVATIONS IN PARENTHESES
NOT USED FOR CONTOURING.

CCR RULE MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FOOT INTERVAL)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

LANDFILL 2 CCR MONITORED UNIT

PRIMARY ASH POND CCR MONITORED UNIT

NEWTON LANDFILL 2 (UNIT ID: 502)
GROUNDWATER ELEVATION CONTOUR MAP
FEBRUARY 18, 2019

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

0 325 650 1,300
Feet

O'BRIEN & GERE ENGINEERS, INC.

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