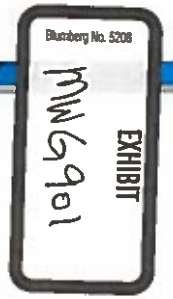
Sierra Club Environmental, et al. v. Midwest Generation, LLC.

Respondent Expert John Seymour



John Seymour

Geosyntec consultants

engineers | scientists | innovators

- Geosyntec Consultants, Chicago, IL
- M.S. Civil (Geotechnical) Engineering
- B.S. Civil (Soils and Construction) Engineering
- Professional Engineer licensed in four states
- 40 years of experience
- 14+ years experience with CCRs
- Experience at dozens of CCR Ponds and Landfills
  - Siting
  - Site Investigations
  - Design
  - Construction
  - Closure
  - Remediation
- Qualified Professional Engineer under the CCR Rule

Resume 2018 Updates

- **CCR Surface Impoundment Closure Plan, Illinois:**
  Engineer and project manager to develop closure plan of CCR pond complex for submittal to Illinois EPA
- **CCR Surface Impoundment Closure Design, Illinois:**
  Engineer and leader for design of CCR pond complex including new closure concept
- **Groundwater monitoring system CCR Assessment, Ohio and Kentucky:**
  Assessing eight CCR units for compliance with US EPA CCR rule (40 CFR 257)
- **CCR sites, Ohio, West Virginia, Michigan:**
  Project manager to investigate various CCR landfilled areas
- **Site Remediation Program, Illinois:**
  Project manager for investigation of brownfield property under Illinois' SRP
- **Landfill site, Illinois:**
  Project manager to prepare application for groundwater management zone

Overview

- Common Factors
- Assessed site conditions for each facility
  - Site history and surroundings; ponds and how ash was handled
  - Groundwater elevations -> groundwater flow
  - Groundwater conditions and other ash data
  - Updated with additional data to 2017
- Compared bottom ash to groundwater conditions for each facility
- Risk Analysis

Overview

Common Factors

Common Factors

- Old sites = from 1920s/"youngest" is 1965
- 1978 Poz-o-Pac or other liners
- **MWG's actions 1999-2013**
  - Pond relining project
  - CCAs (GMZs, ELUCs)
- Wyoming Coal
- **On Site Data/MWG coal ash constituents**
  - Samples of bottom ash from ponds
  - Samples of historic ash areas
- No risk to potential receptors

Common Factors – MWG Actions 1999-2013

- Pond Relinings
  - Reviewed construction documents
    - Subgrade
    - Liner installation/60 M HDPE
    - Leak detection
  - Contractor dredging procedures
- 2013 CCAs
  - GMZs
  - ELUCs

Analyses of Bottom Ash From MWG Ponds

Generating Station:	Powerton		Waukegan		Will County
Sample Date:	May 2004	March 2007	July 2004	July 2004	December 2010
Sample ID:	Bottom Ash	Bottom Ash	Bottom Ash-1	Bottom Ash-2	3 South Bottom Ash
Methods 6010B/6020/7041A/7470A/7841 (mg/L)					
Antimony	<0.003	<0.0060	<0.0060	<0.0060	<0.0060
Arsenic	<0.010	<0.050	<0.050	<0.050	<0.050
Barium	0.39	0.27	0.19	0.12	<0.50
Beryllium	<0.004	<0.0040	<0.004	<0.004	<0.0040
Boron	0.087	<0.10	1.1	2	1.3
Cadmium	<0.002	<0.0050	<0.005	<0.005	<0.0050
Chromium	<0.010	<0.025	<0.050	<0.050	<0.025
Cobalt	<0.005	<0.025	<0.050	<0.050	<0.025
Copper	<0.010	<0.025	<0.050	<0.050	<0.025
Iron	<0.050	<0.10	<0.10	<0.10	<0.10
Lead	<0.005	<0.0075	<0.0075	<0.0075	<0.0075
Manganese	<0.010	<0.025	<0.050	<0.050	<0.025
Mercury	<0.0002	<0.0020	<0.0020	<0.0020	<0.0020
Nickel	<0.010	<0.025	<0.050	<0.050	<0.050
Selenium	<0.010	<0.050	Not Analyzed	Not Analyzed	<0.050
Silver	<0.005	<0.025	<0.050	<0.050	<0.025
Thallium	<0.002	<0.0020	<0.0020	<0.0020	<0.0020
Zinc	0.044	<0.10	<0.10	<0.10	<0.10
Method 9056 (mg/L)					
Sulfate	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	49
SM 2540C (mg/L)					
Total Dissolved Solid	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	200
Sources:	MWG13-15_11356	MWG13-15_10951	MWG13-15_12814	MWG13-15_12815	MWG13-15_14712-13

Potential Leaching Characteristics of Historical Ash in Fill Materials

Generating station:	Joliet #29	Powerton	Will County
Sample Date:	July 2005 KPRG	May 2004 Andrews Engineering	June/August 2015 KPRG
Sample location:	15 soil borings from former ash placement area	8 ash samples from test pits in the Limestone Runoff Basin	20 soil borings at the Will County site
Findings:	-high degree of statistical certainty that the criteria established in 415 ILCS 5/3.135 (formerly 415 ILCS 5/3.94) a-5(B) are met and that the material may be considered CCB for engineering/ beneficial reuse	Metals were less than the IEPA Class I groundwater standards except selenium and chromium (2 wells); no impacts of selenium or chromium above groundwater standards	High degree of statistical certainty that the criteria established in 415 ILCS 5/3.135 (formerly 415 ILCS 5/3.94) a-5(B) are met and that the material may be considered CCB for engineering/ beneficial reuse
Sources:	MWG13-15_19486-668	MWG13-15_11302-492	MWG13-15_49565-649

No Risk to Potential Receptors

- No potable water receptors
- The potential surface water risks were evaluated using a screening level approach that compared concentrations in groundwater to Illinois Water Quality Standards (WQS) or Water Quality Criteria (WQC).
- "An assessment of human and ecological receptors in surface water indicates that there is no risk to the surface water environment at each site based on regulatory risk standards and standards of practice for risk assessments."

Seymour Report, Pg. 5

Overview

- Common Factors
- Assessed site conditions for each facility
  - Site history and surroundings, ponds and how ash was handled
  - Groundwater elevation and groundwater flow
  - Groundwater conditions and other ash data
  - Updated with additional data to 2017
- **Compared bottom ash to groundwater conditions for each facility**
- PCE Analysis

Comparison With Groundwater Conditions

- Conducted a comparison of the occurrence of groundwater constituents detected in 2014 [and updated to 2017] compared to sets of indicators of leachate from ash stored in ponds and from EPRI research.
- The profiles of the constituents in the groundwater do not match the profiles of leachate constituent indicators in the ponds at the plant sites.
- Groundwater impacts are not the result of ash stored in the ponds at sites

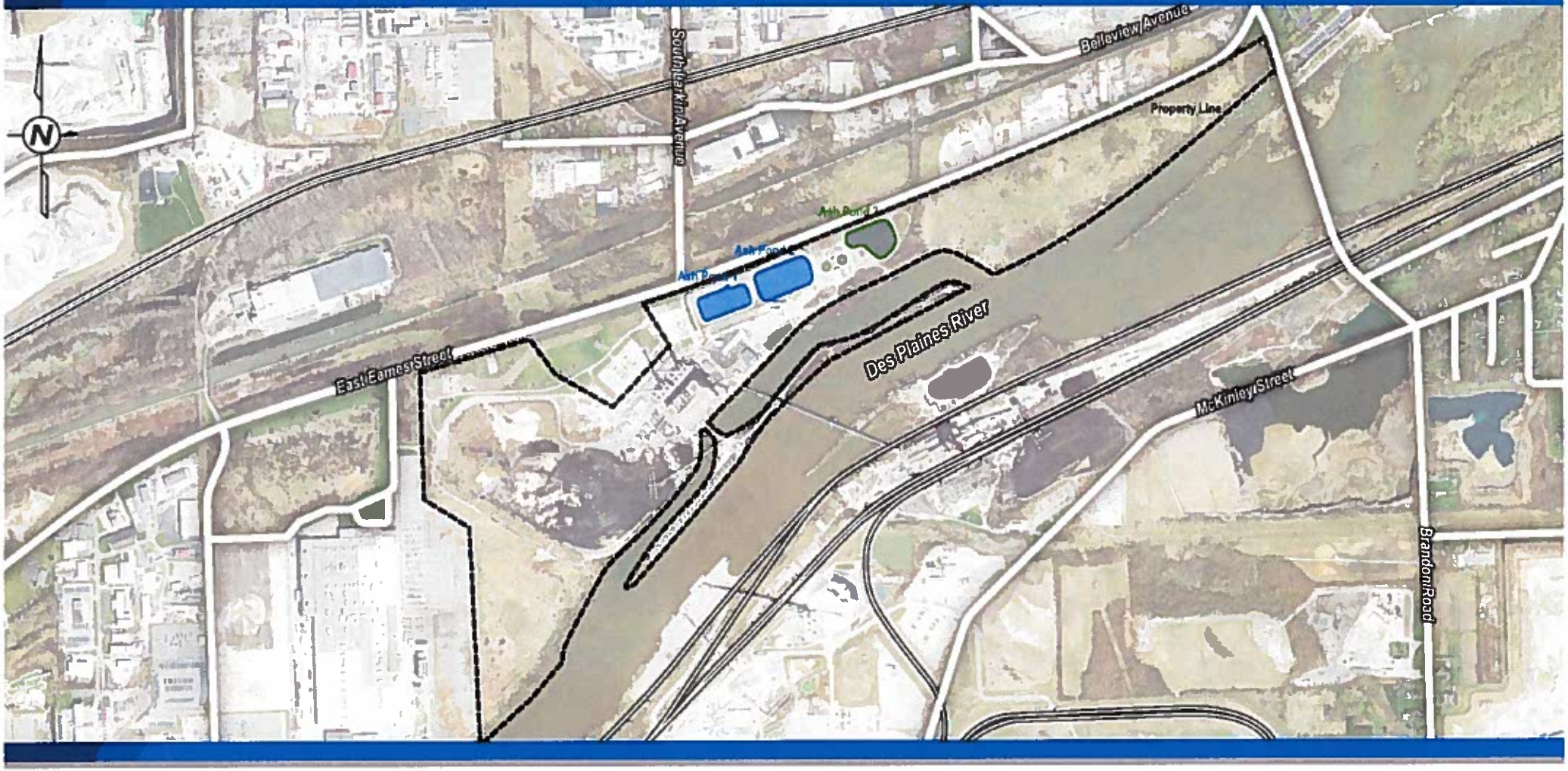
Overview

- **Assessed site conditions for each facility**
  - **Site history and surroundings; ponds and how ash was handled**
  - **Groundwater elevations -> groundwater flow**
  - **Groundwater conditions and other ash data**
  - **Updated with additional data to 2017**

Joliet #29 – Site History and Surroundings

- Operating for 30 years before MWG (1965)
- 2016 converted to natural gas – no ash
- When operating, most ash went off site - did not go to ponds
- **Review of Impoundments** (pre-2016)
  - Ponds 1 and 2 were used consecutively; Pond 3 was "finishing" – de minimis ash
  - Ponds lined and relined
- Historic ash / samples
- Administrative Controls/ GMZ and ELUC
- No potable water wells/no risk to receptors

Joliet #29

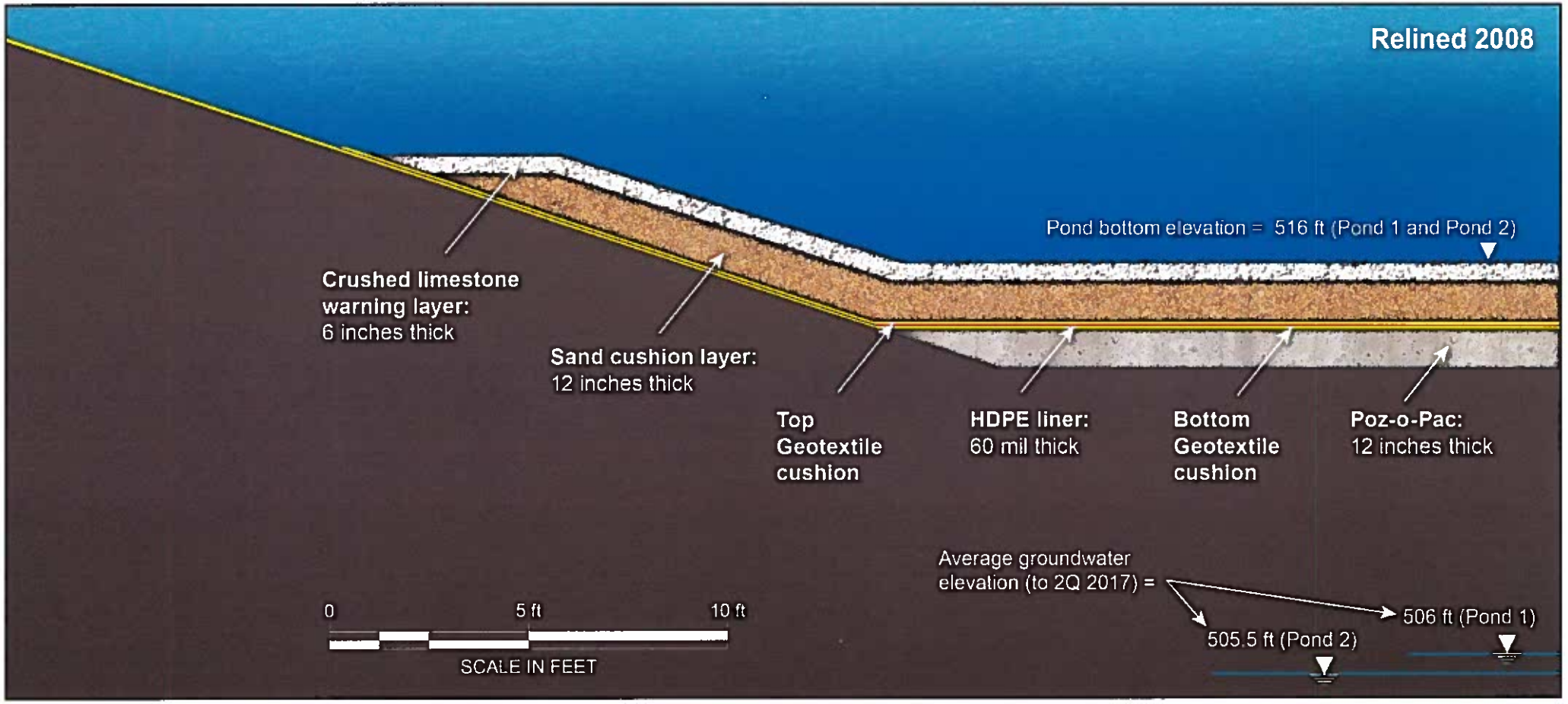

N
Belleview Avenue
Property Line
Ash Pond 2
Ash Pond 1
Ash Pond 3
Des Plaines River
East Eames Street
McKinley Street
Brandon Road

Joliet #29 – Impoundments

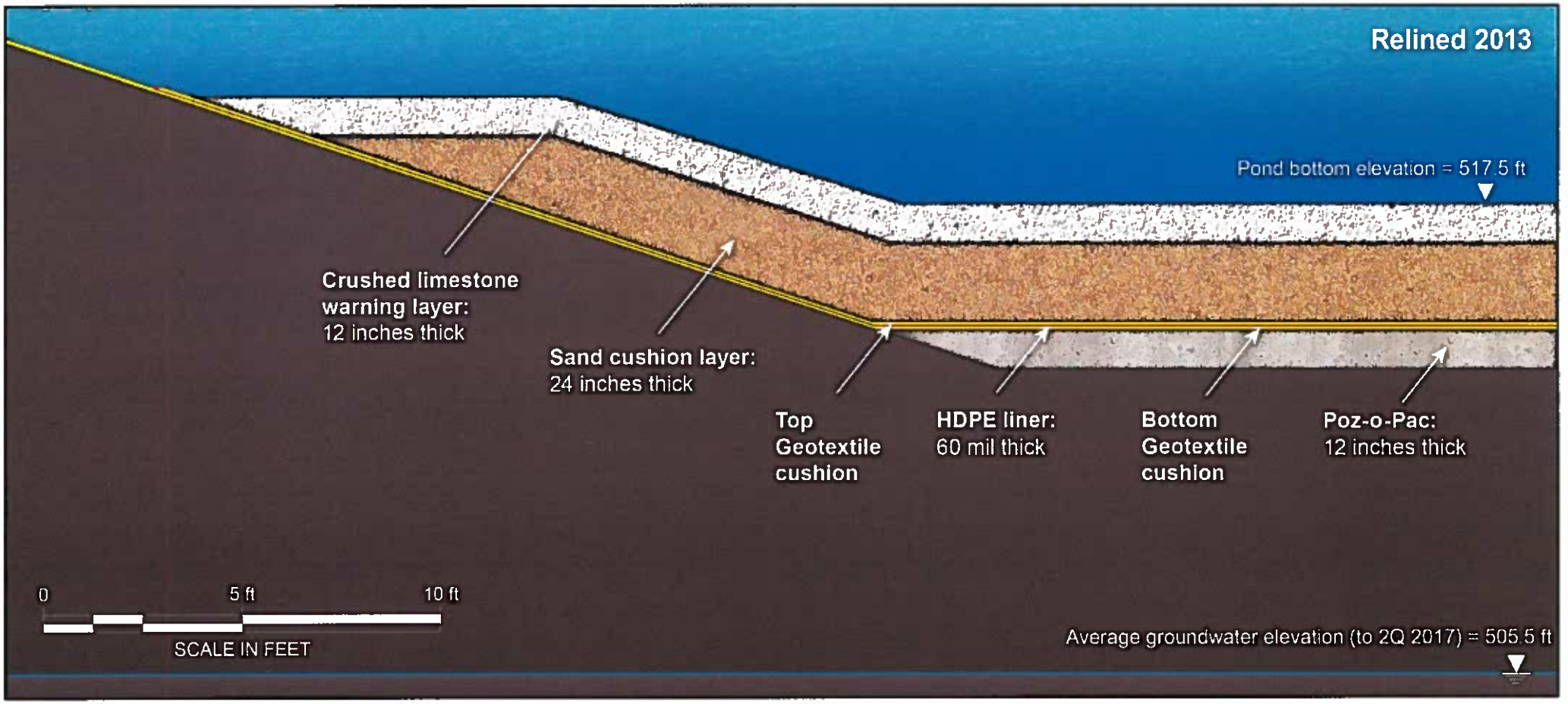
Station	Ash pond	Date Constructed/Liners	Date Relined With HDPE	Scheduled Ash Removal
Joliet #29 1964-65 Facility Operation Converted to gas in 2016	Ash Pond 1 Before 2015, used intermittently when the conveyer was not operating	1978 • Bituminous seal coat • Poz-o-Pac—12 inches thick • Compacted granular material—12 inches thick	2008 12" Poz-o-Pac; geotextile; HDPE; geotextile; sand; warning layer	**No ash as of 2015** Previously emptied every 2-4 years*
	Ash Pond 2 Used intermittently used when the conveyer is not operating	1978 • Bituminous seal coat • Poz-o-Pac—12 inches thick • Compacted granular material—12 inches thick	2008 12" Poz-o-Pac; geotextile; HDPE; geotextile; sand; warning layer	**No new ash**; to be emptied of ash in 2018. Previously emptied every 2-4 years
	Ash Pond 3 **Finishing pond**	1978 • Bituminous seal coat • Poz-o-Pac —12 inches thick • Compacted granular material—12 inches thick	2013 12" Poz-o-Pac; geotextile; HDPE; geotextile; sand; warning layer	**No ash** Emptied for relining

*Per DiCola testimony/ponds emptied in succession

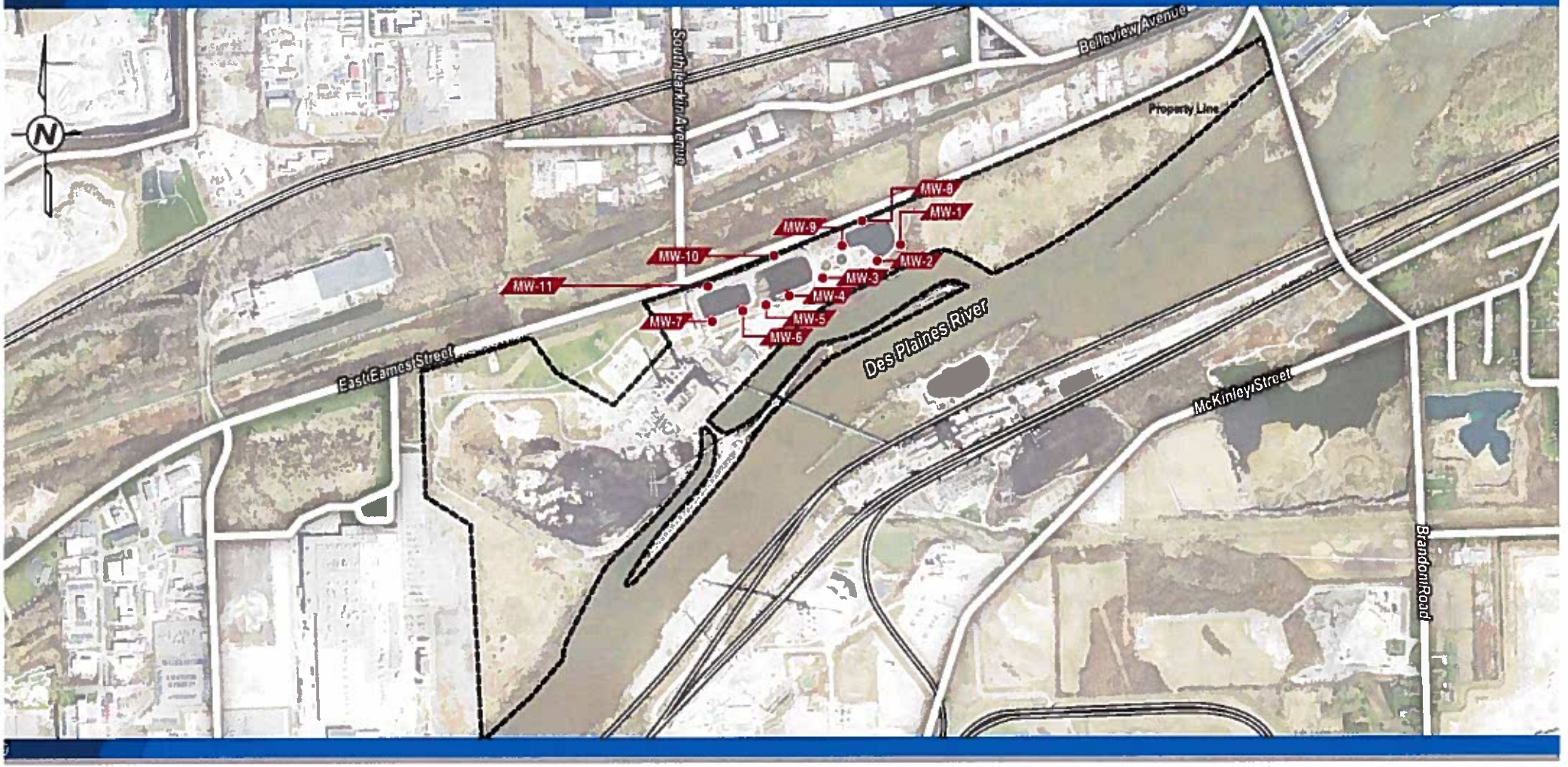
Joliet #29 – Ash Ponds 1 and 2



Joliet #29 – Ash Pond 3



Joliet #29


N
South Larkin Avenue
Belleview Avenue
Property Line
MW-8
MW-1
MW-9
MW-10
MW-2
MW-11
MW-3
MW-4
MW-7
MW-5
MW-6
East Eames Street
Des Plaines River
McKinley Street
Brandon Road


GROUNDWATER CONTOUR LINE
GROUNDWATER FLOW LINE
ASH POND 1
ASH POND 2
ASH POND 3
506.0
505.6
506.17
MW-11
505.80
MW-10
MW-08
505.74
MW-09
505.66
NM
MW-01
MW-02
505.69
MW-03
505.73
505.72
MW-04
MW-05
506.60
505.74
MW-08
MW-07
505.77
INTAKE CHANNEL
±505
DES PLAINES RIVER
±505
0
250'
APPROXIMATE SCALE
N
ENVIRONMENTAL CONSULTATION & REMEDIATION
K P R G
KPRG and Associates, Inc.
GROUNDWATER CONTOUR MAP 04/2017
JOLIET #29 GENERATING STATION
JOLIET, ILLINOIS
Scale: 1" = 250'
Date: June 22, 2017
KPRG Project No. 12313.0
FIGURE 2

Joliet #29 – Updated Table 5-5

Quarterly Groundwater Monitoring (2016-Q3 to 2017-Q2) Compared to Indicators in Impoundments/ponds (MWG site specific analyses)

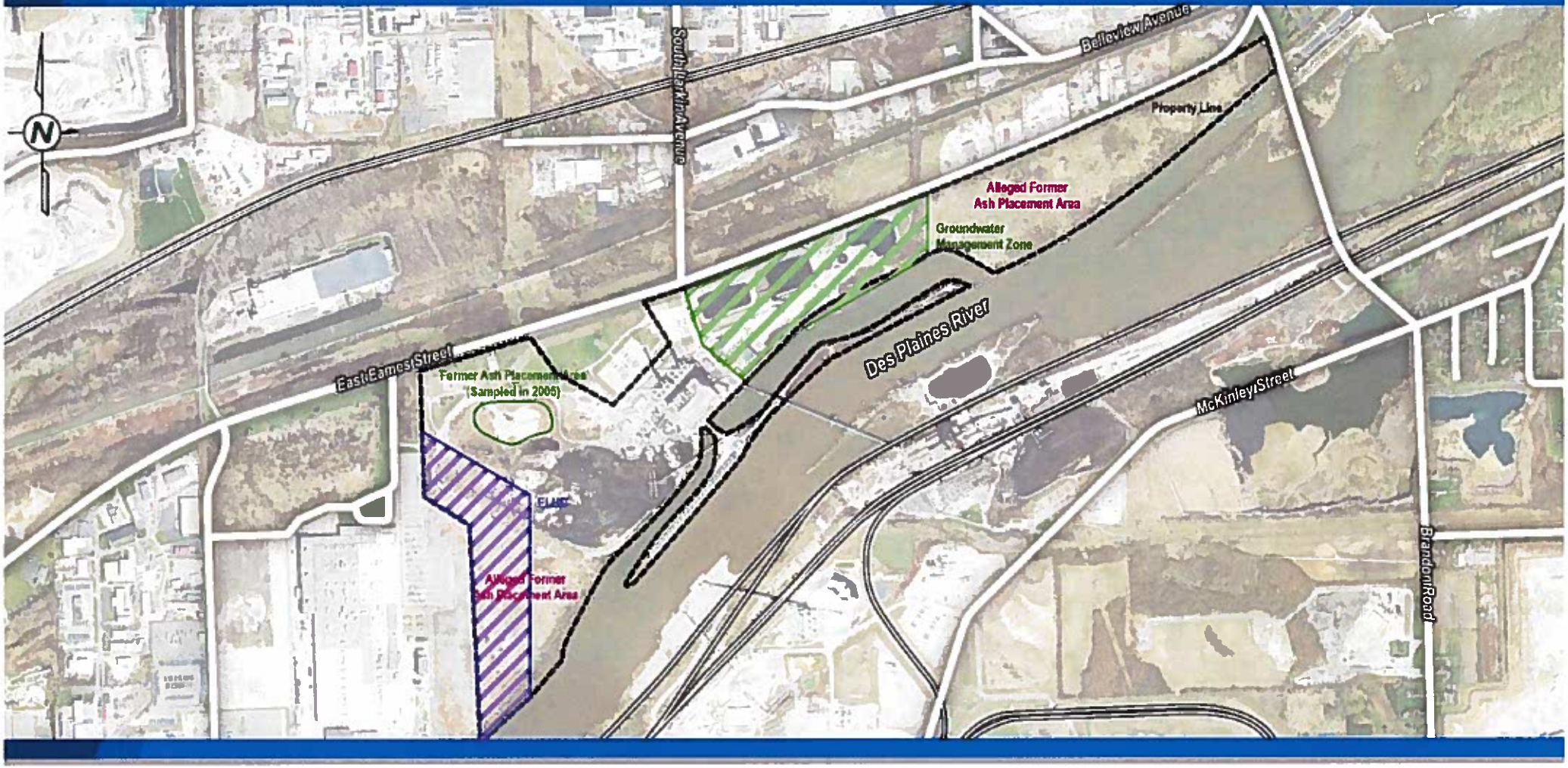
Constituent	Constituent is an Indicator of Leachate from Ash Currently Stored in Impoundments [1]	Constituents Detected During Most Recent Year (2016-Q3 to 2017-Q2) of Quarterly Groundwater Monitoring [2]										
		Joliet No. 29 Generating Station										
		MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11
Arsenic				x	x		x	x		x		x
Barium	Yes (Table 5-1)	x	x	x	x	x	x	x	x	x	x	x
Boron	Yes (Table 5-1)	x	x	x	x	x	x	x	x	x	x	x
Cobalt					x					x		
Iron				x			x			x		
Manganese		x					x	x	x	x		
Mercury										x		
Nickel		x	x	x	x	x	x	x	x	x		x
Selenium		x		x		x	x					x
Sulfate	Yes (Table 5-1)	x	x	x	x	x	x	x	x	x	x	x
Number of Observed Constituents that are not Consistent with Indicators of Leachate from Ash Currently Stored in Impoundments [3]		3	1	4	3	2	5	3	2	6	0	3
Percentage of Observed Constituents that are not Consistent with Indicators of Leachate from Ash Currently Stored in Impoundments [4]		50%	25%	57%	50%	40%	63%	50%	40%	67%	0%	50%

Joliet #29 – Updated Table 5-4

Quarterly Groundwater Monitoring (2016-Q3 to 2017-Q2) Compared to Indicators in Impoundments/ponds (EPRI, 2006)

Constituent	Constituent is an Indicator of Leachate from Ash in Impoundments [1]	Constituents Detected during Most Recent Year (2016-Q3 to 2017-Q2) of Quarterly Groundwater Monitoring [2] — Joliet No. 29 Generating Station										
		MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11
Antimony	Yes (Table 5-2)											
Arsenic	Yes (Table 5-2)			x	x		x	x		x		x
Barium	Yes (Table 5-2)	x	x	x	x	x	x	x	x	x	x	x
Boron	Yes (Table 5-2)	x	x	x	x	x	x	x	x	x	x	x
Cadmium	Yes (Table 5-2)											
Chromium	Yes (Table 5-2)											
Cobalt	Yes (Table 5-2)				x					x		
Copper	Yes (Table 5-2)											
Iron				x			x			x		
Lead	Yes (Table 5-2)											
Manganese	Yes (Table 5-2)	x					x	x	x	x		
Mercury	Yes (Table 5-2)									x		
Nickel	Yes (Table 5-2)	x	x	x	x	x	x	x	x	x		x
Selenium	Yes (Table 5-2)	x		x		x	x					x
Sulfate	Yes (Table 5-2)	x	x	x	x	x	x	x	x	x	x	x
Zinc	Yes (Table 5-2)											
Number of Observed Constituents that are not Consistent with Indicators of Leachate from Ash in Impoundments [3]		9	11	10	9	10	9	9	10	8	12	9
Percentage of Observed Constituents that are not Consistent with Indicators of Leachate from Ash in Impoundments [4]		56%	69%	63%	56%	63%	56%	56%	63%	50%	75%	56%

Joliet #29


N
South Larkin Avenue
Belleview Avenue
Property Line
Alleged Former
Ash Placement Area
Groundwater
Management Zone
Des Plaines River
East Eames Street
Former Ash Placement Area
(Sampled in 2005)
McKinley Street
Brandon Road
Alleged Former
Ash Placement Area

Joliet #29

Updated Groundwater Constituent Temporal Trend Testing Results

Monitoring Well	Barium		Boron		Manganese		Sulfate	
	Trend Direction [a]	Slope (mg/L/yr)	Trend Direction [a]	Slope (mg/L/yr)	Trend Direction [a]	Slope (mg/L/yr)	Trend Direction [a]	Slope (mg/L/yr)
MW-01	Decreasing	-0.005	Decreasing	-0.020	No conclusion	--	Decreasing	-13
MW-02	Decreasing	-0.0035	Decreasing	-0.046	Decreasing	-0.00023	Decreasing	-15
MW-03	Increasing	0.0011	Increasing	0.023	Decreasing	-0.0057	Decreasing	-9.7
MW-04	No conclusion	--	No conclusion	--	Decreasing	-0.018	Decreasing	-15
MW-05	No conclusion	--	Increasing	0.031	No conclusion	--	Increasing	8.7
MW-06	Increasing	0.0045	Decreasing	-0.022	Decreasing	-0.0074	No conclusion	--
MW-07	No conclusion	--	Decreasing	-0.034	Decreasing	-0.012	Decreasing	-8.1
MW-08	No conclusion	--	No conclusion	--	No conclusion	--	No conclusion	--
MW-09	Decreasing	-0.0025	No conclusion	--	Increasing	0.23	Increasing	680
MW-10	No conclusion	--	Decreasing	-0.022	Decreasing	-0.0042	Decreasing	-10
MW-11	No conclusion	--	No conclusion	--	No conclusion	--	No conclusion	--

Joliet #29

Updated Temporal Trend Testing of Groundwater Concentrations for Site-Specific Indicators of Ash in Ponds

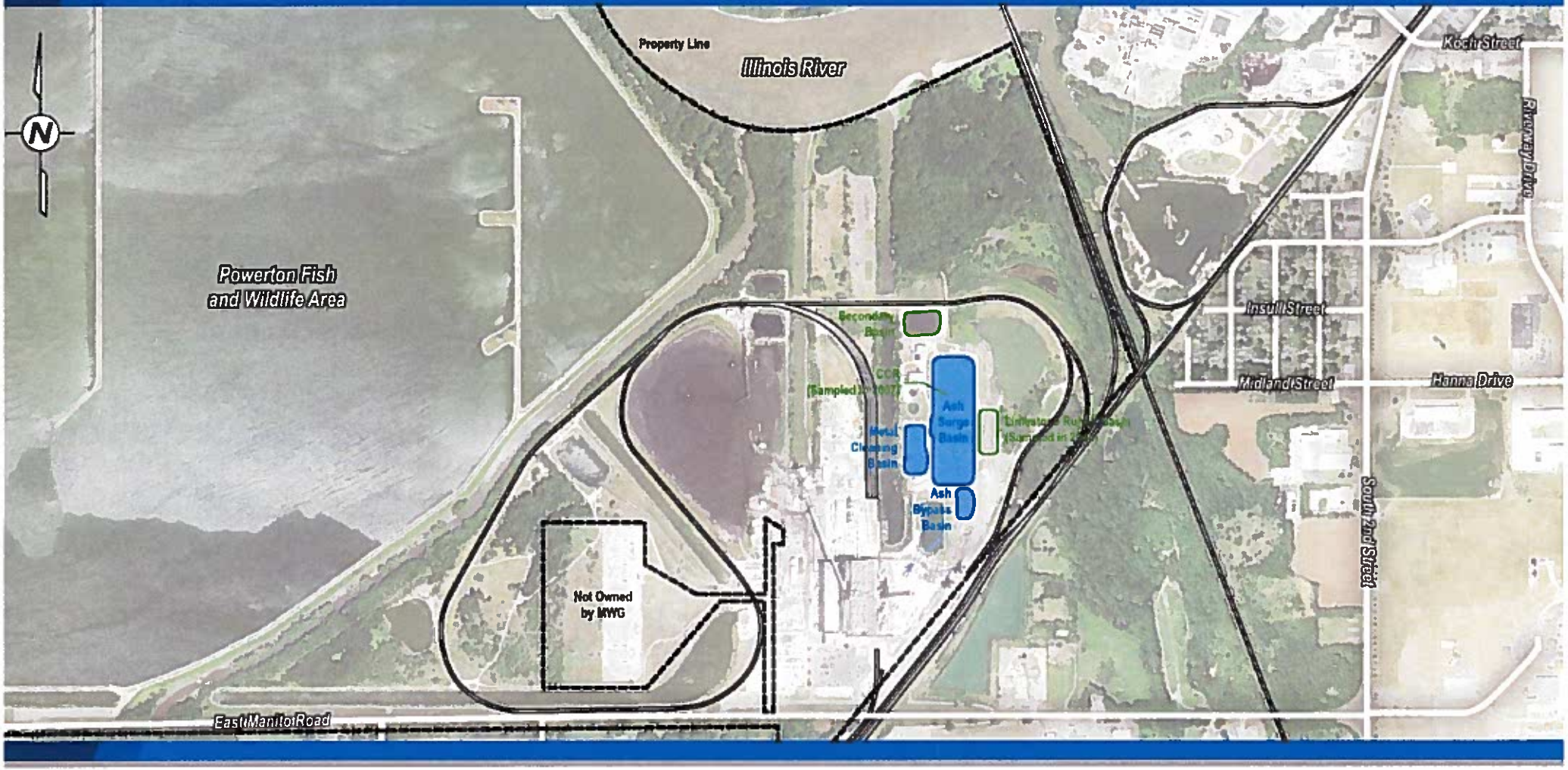
Trend	Barium	Boron	Manganese	Sulfate
Increasing	2 wells	2 wells	1 well	2 wells
Decreasing	3 wells	5 wells	6 wells	6 wells
No conclusion	6 wells	4 wells	4 wells	3 wells

- Overall, it appears that groundwater concentrations are slightly decreasing because:
  - The indicators are increasing at 1 to 2 wells out of 11 wells
  - The indicators are decreasing at 3 to 6 wells out of 11 wells
  - No conclusions could be made at 3 to 6 wells out of 11 wells

Powerton – Site History and Surroundings

- Operating since 1920s
- **Review of Impoundments/Ponds**
  - Ponds lined and relined
  - Secondary Basin underdrain system
- Pond ash sample results (2004 and 2007)
- Historic areas and samples (2004)
- Administrative controls/GMZ and ELUC
- No potable water wells/no risk to receptors

Powerton

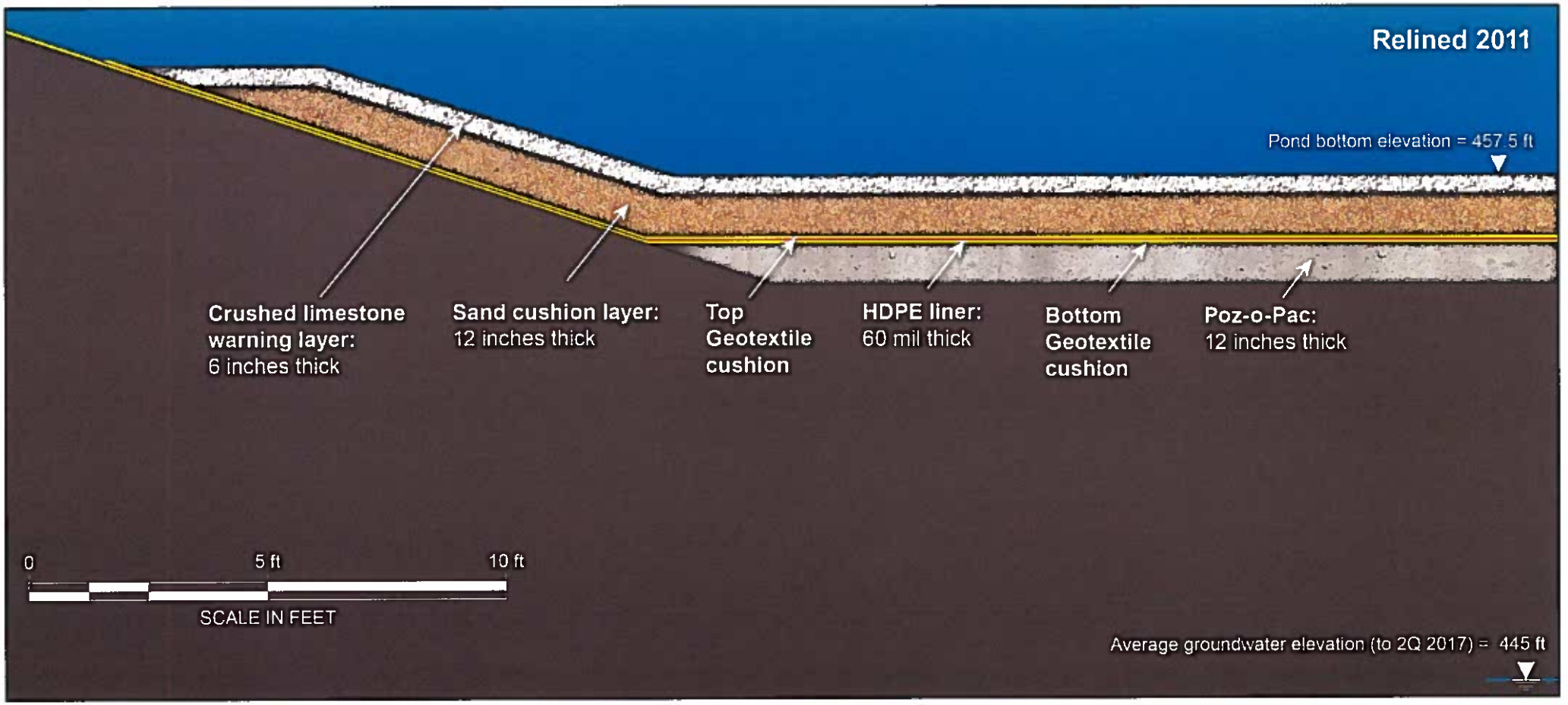

Property Line
Illinois River
Powerton Fish and Wildlife Area
Secondary Basin
CCR
Ash Surge Basin
Metal Cleaning Basin
Ash Bypass Basin
Not Owned by MWG
East Manito Road
Koch Street
Riverway Drive
Insull Street
Midland Street
Hanna Drive
South 2nd Street

Powerton – Impoundments

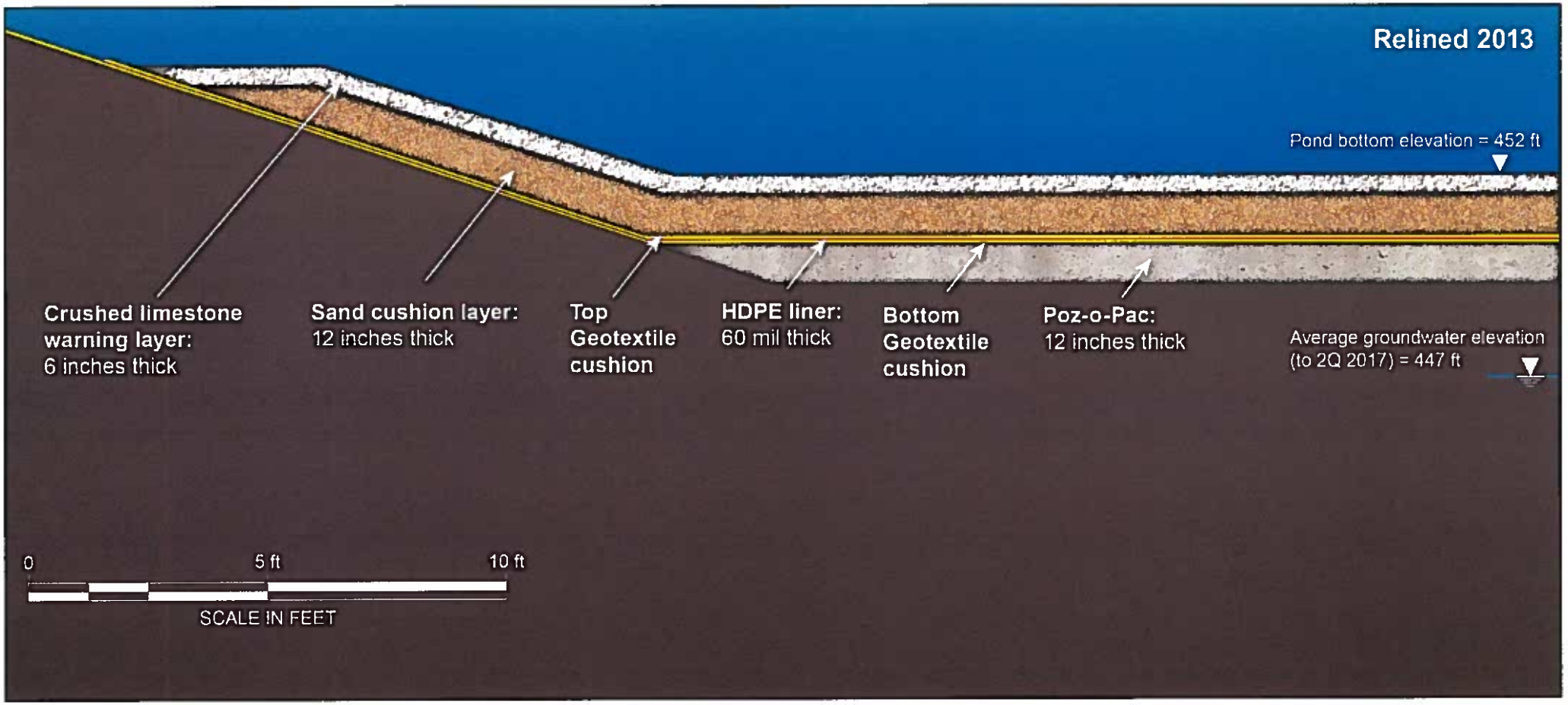
Station	Ash Pond	Date Constructed/Liners	Date Relined With HDPE	Scheduled Ash Removal
Powerton	**Ash Surge Basin**	1978 • Bituminous seal coat • Poz-o-Pac—12 inches thick on the bottom • Hypalon® liner on the sides • Compacted granular material	2013 12" Poz-o-Pac; geotextile; HDPE; geotextile; sand; warning layer	NONE since 2013 relining 6-8 years – as needed*
	Ash Bypass Basin Used only when emptying Ash Surge Basin	1978 12" Poz-o-Pac liner and Hypalon® sides	2010 Prepared subgrade; geotextile; HDPE; geotextile; sand; warning layer	6-8 years
	Metal Cleaning Basin	1978 • Bituminous seal coat • Poz-o-Pac—12 inches thick • Hypalon® liner along the sloped sides • Compacted granular material—12 inches thick	2010 12" Poz-o-Pac; geotextile; HDPE; geotextile; sand; warning layer	Temporary laydown area Ash removed annually, if needed
	Secondary Ash Basin/ Service Water Basin **Finishing Pond**	1978 Hypalon	2013 Prepared subgrade; geo-textile; under-drain system; geotextile; sand cushion; geo-textile; HDPE	De minimis ash/ Only emptied for relining

*Kelly Testimony

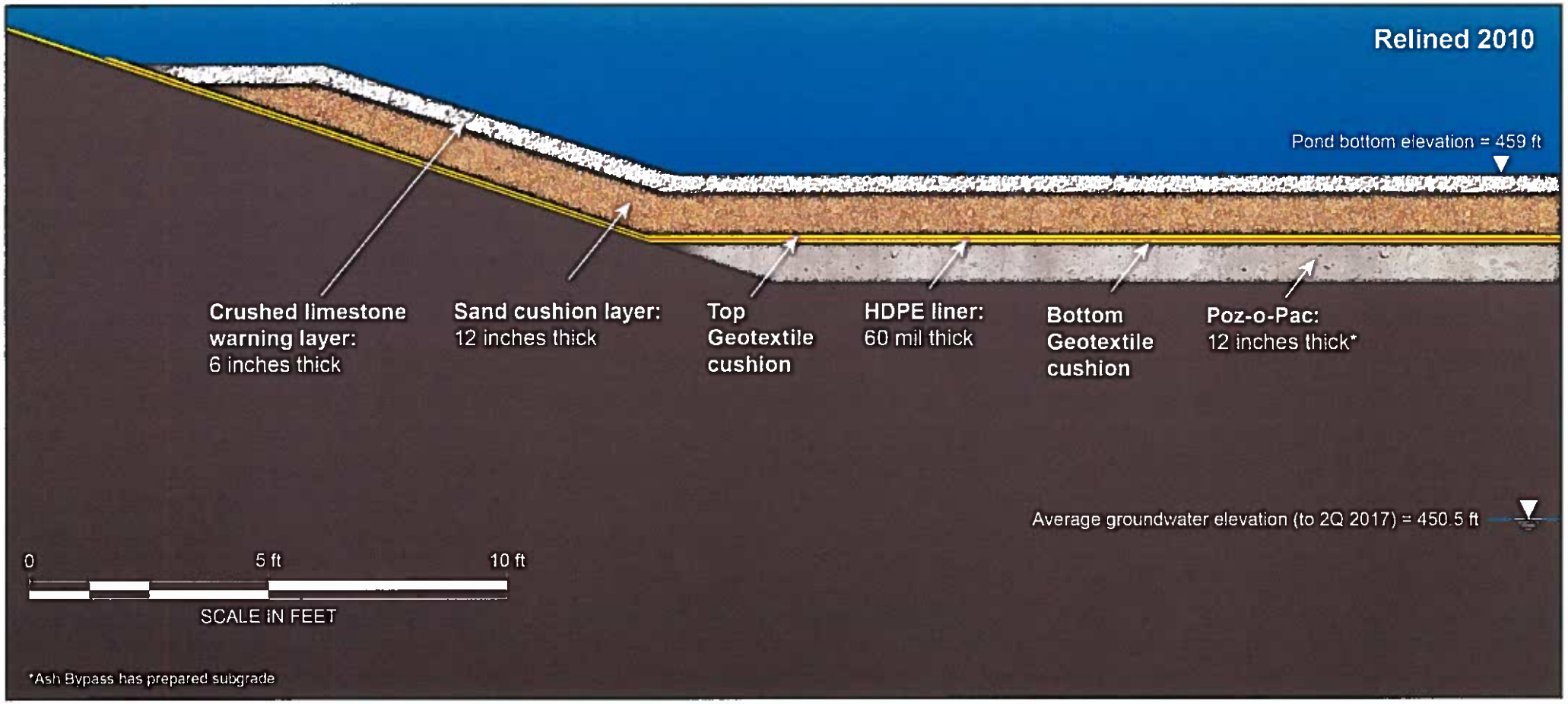
Powerton – Metal Cleaning Basin



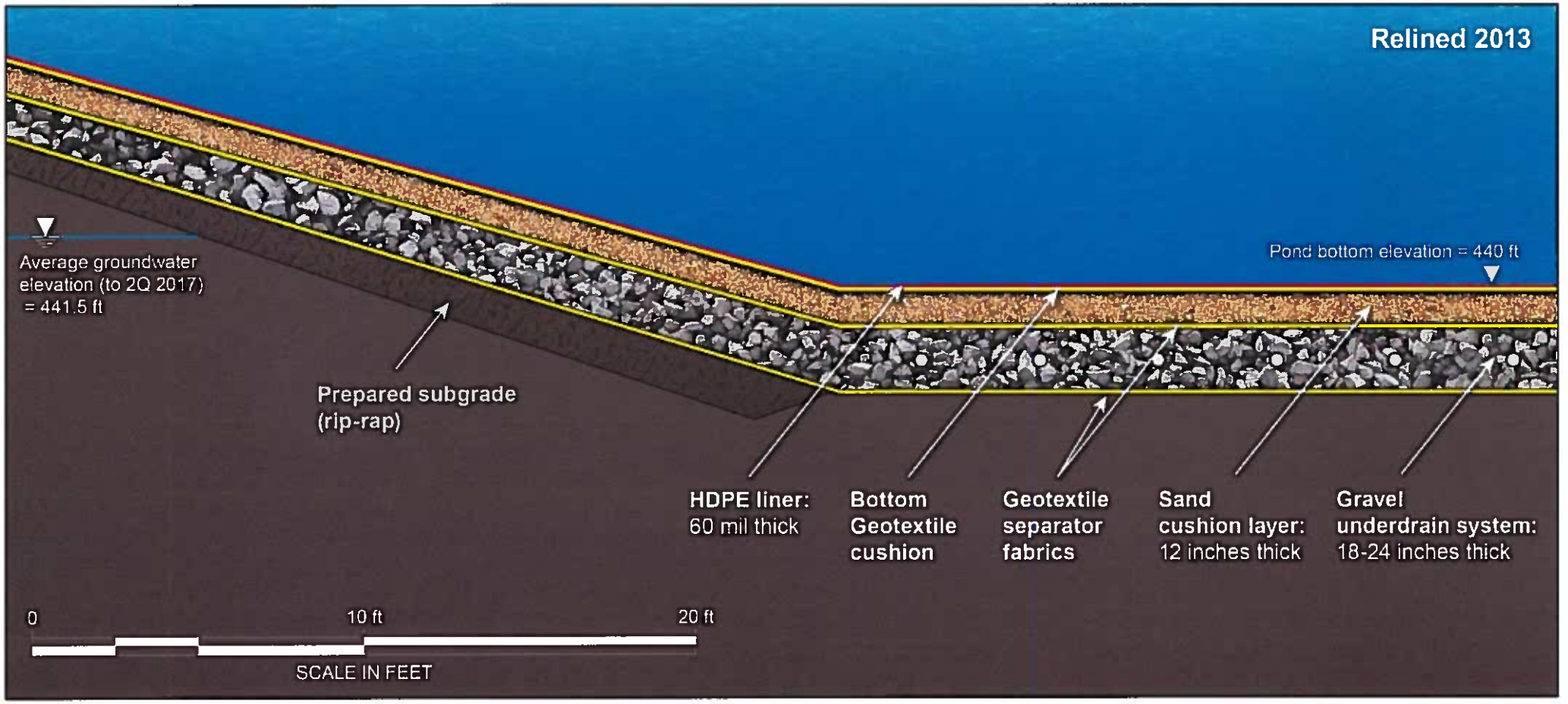
Powerton – Ash Surge Basin

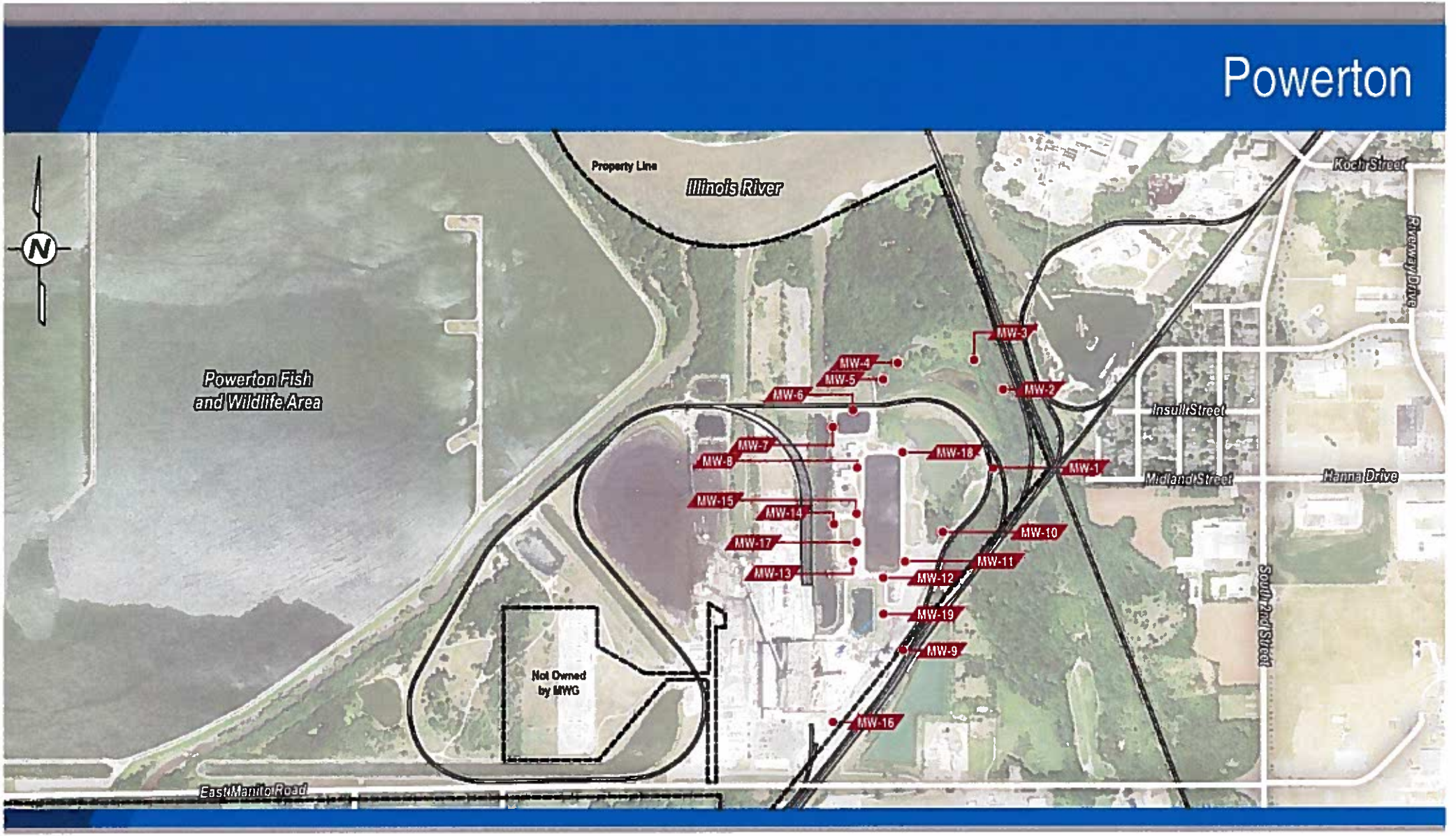


Powerton – Ash Bypass Basin



Powerton – Secondary Basin




Powerton
Property Line
Illinois River
Powerton Fish and Wildlife Area
Not Owned by MWG
East Manito Road
Koch Street
Riverway Drive
Insull Street
Midland Street
Hanna Drive
South 2nd Street
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-8
MW-9
MW-10
MW-11
MW-12
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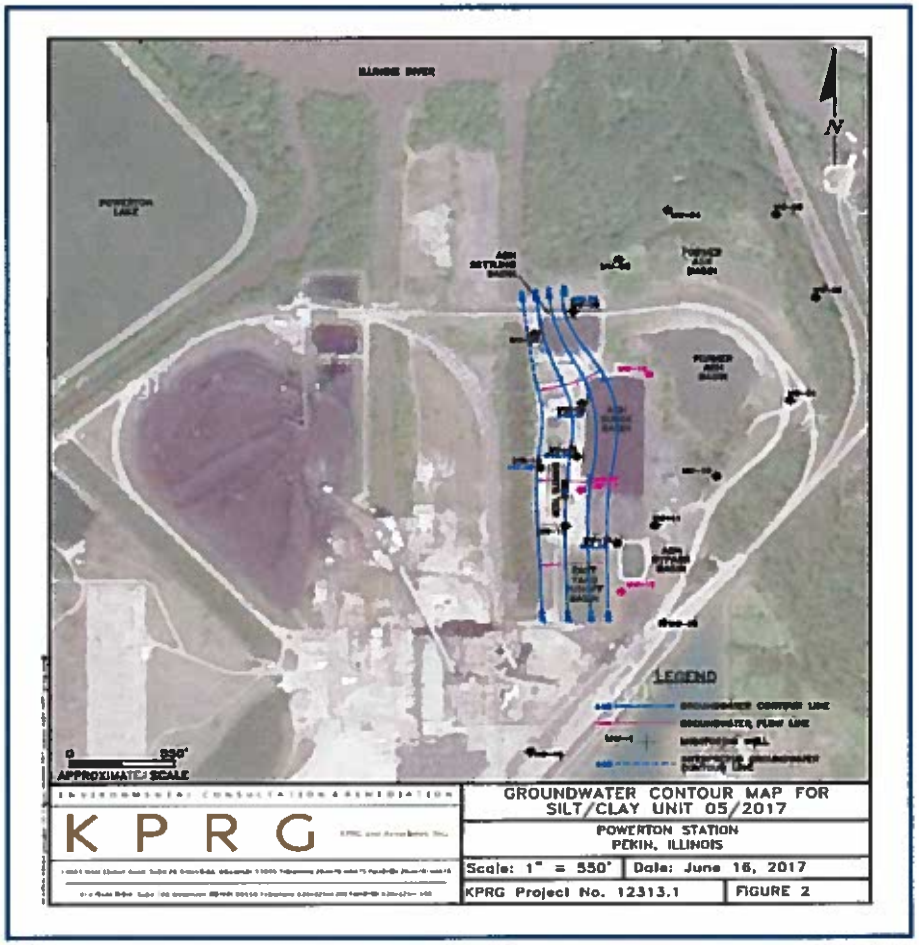
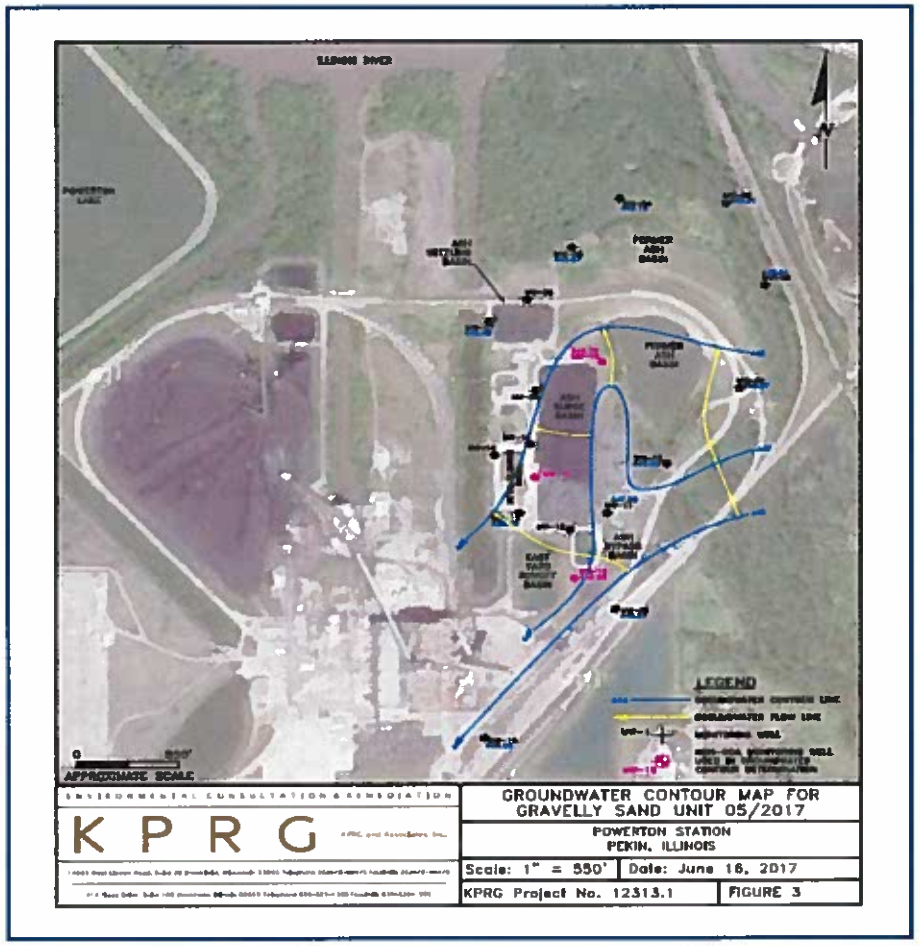
MW-14
MW-15
MW-16
MW-17
MW-18
MW-19

Shallow Silty Clay Unit GQ Flow – 2Q 2017



Deeper Gravelly Sand Unit – 2Q 2017



Powerton – Updated Table 5-5

Quarterly Groundwater Monitoring (2016-Q3 to 2017-Q2) Compared to Indicators in Impoundments/ponds (MWG site specific analyses)

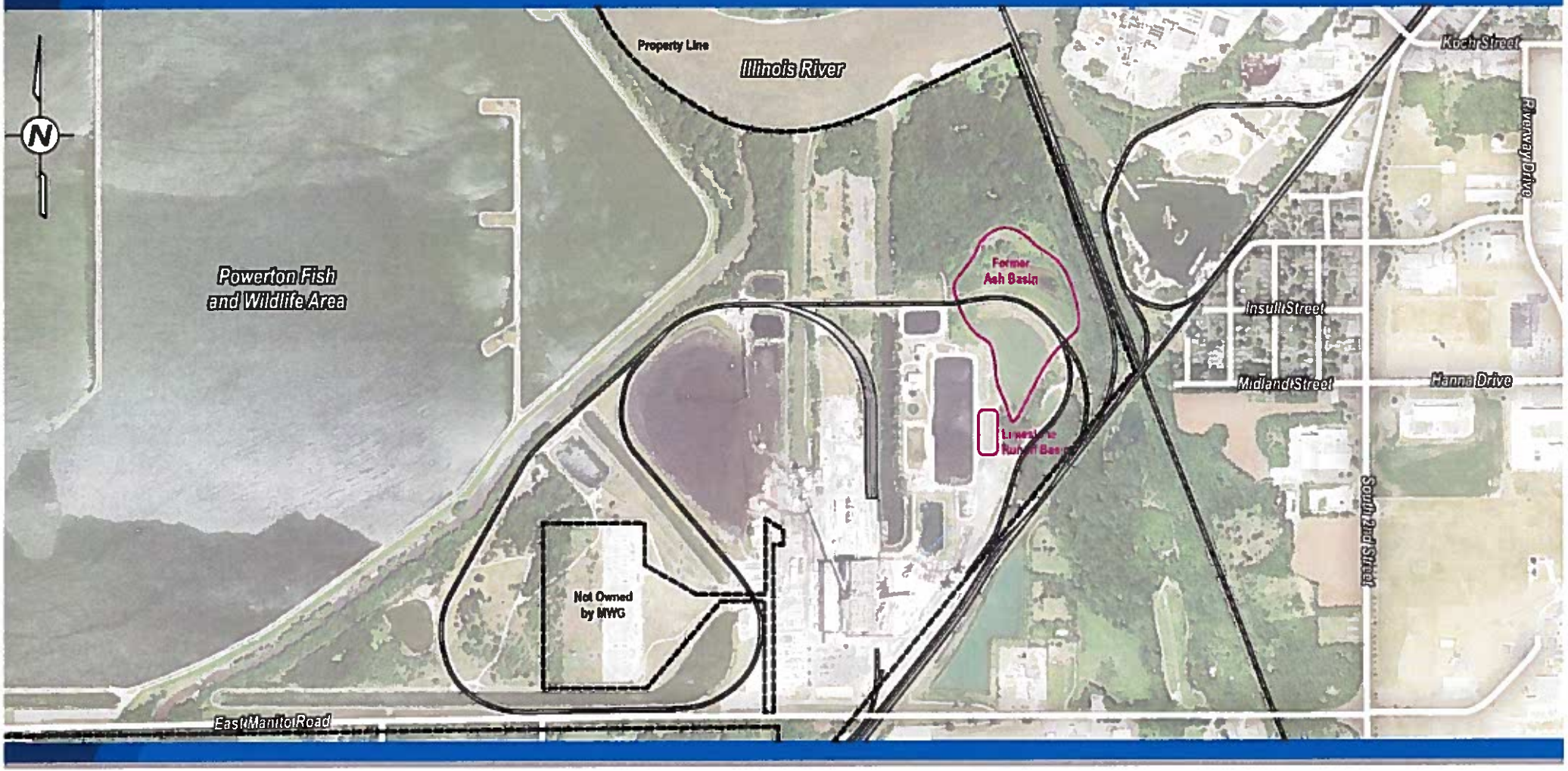
Constituent	Constituent is an Indicator of Leachate from Ash Currently Stored in Impoundments [1]	Constituents Detected during Most Recent Year (2016-Q3 to 2017-Q2) of Quarterly Groundwater Monitoring [2]														
		Powerton Generating Station														
		MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	MW-14	MW-15	MW-16
Arsenic			x				x	x	x			x	x	x	x	x	
Barium	Yes (Table 5-1)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Boron	Yes (Table 5-1)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Cadmium															x		
Cobalt								x			x	X			x		
Copper					x						x						
Iron							x	x	x		x	x	x	x	x	x	
Lead											x						
Manganese		x			x	x	x	x	x	x	x	x	x	x	x	x	x
Nickel					x			x	x		x	x	x		x	x	
Selenium				x	x					x	x			x	x	x	
Sulfate	Yes (Table 5-1)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Number of Observed Constituents that are not Consistent with Indicators of Leachate from Ash Currently Stored in Impoundments [3]		1	1	1	3	2	3	5	4	2	7	5	4	4	8	5	1
Percentage of Observed Constituents that are not Consistent with Indicators of Leachate from Ash Currently Stored in Impoundments [4]		25%	25%	25%	50%	40%	50%	63%	57%	40%	70%	63%	57%	57%	73%	63%	25%

Powerton – Updated Table 5-4

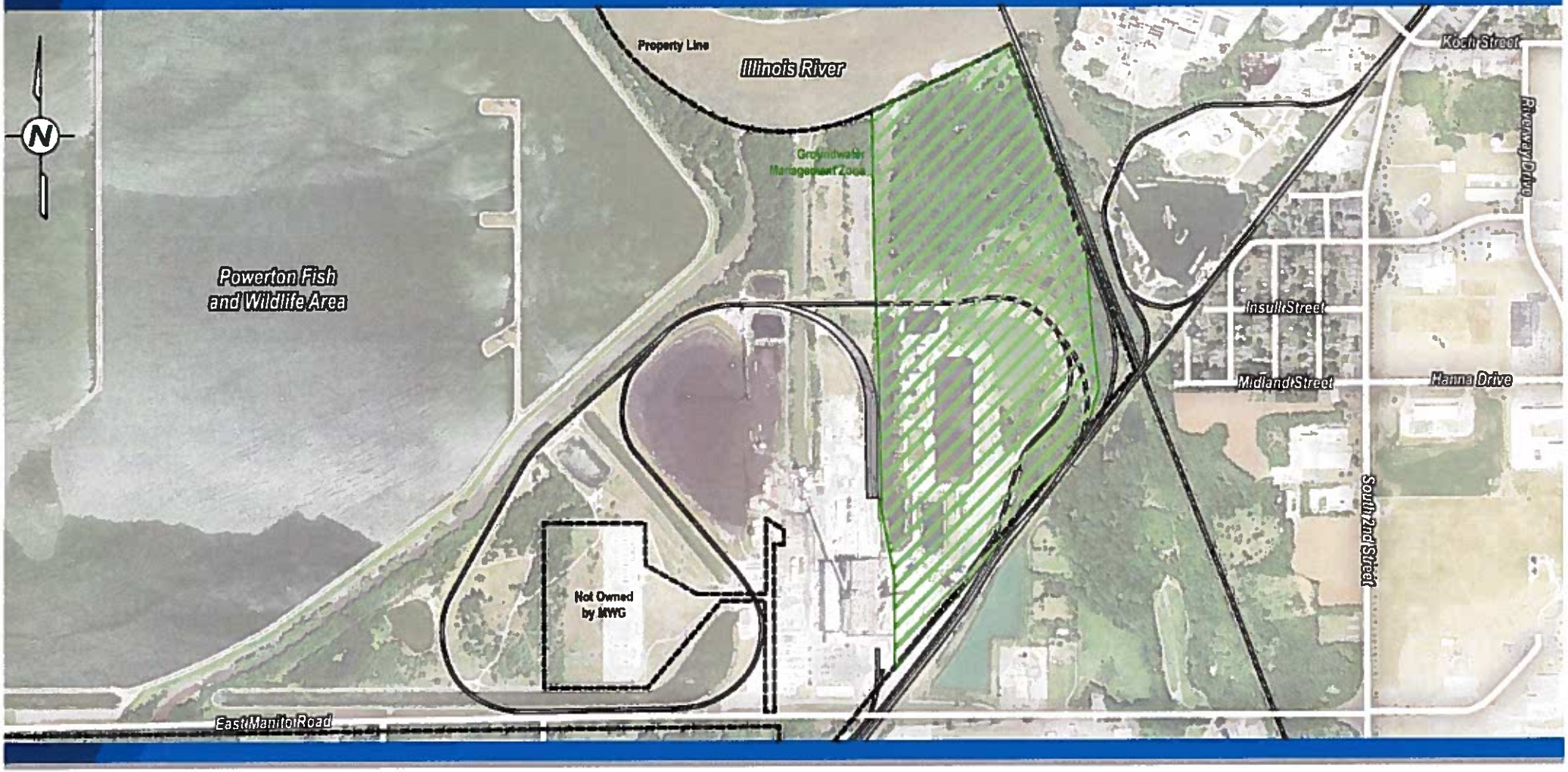
Quarterly Groundwater Monitoring (2016-Q3 to 2017-Q2) Compared to Indicators in Impoundments/ponds (EPRI, 2006)

Constituent	Constituent is an Indicator of Leachate from Ash in Impoundments [1]	Constituents Detected During Most Recent Year (2016-Q3 to 2017-Q2) of Quarterly Groundwater Monitoring [2] — Powerton Generating Station															
		MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	MW-14	MW-15	MW-16
Antimony	Yes (Table 5-2)																
Arsenic	Yes (Table 5-2)		x				x	x	x			x	x	x	x	x	
Barium	Yes (Table 5-2)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Boron	Yes (Table 5-2)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Cadmium	Yes (Table 5-2)														x		
Chromium	Yes (Table 5-2)																
Cobalt	Yes (Table 5-2)							x			x	x			x		
Copper	Yes (Table 5-2)				x						x						
Iron							x	x	x		x	x	x	x	x	x	
Lead	Yes (Table 5-2)										x						
Manganese	Yes (Table 5-2)	x			x	x	x	x	x	x	x	x	x	x	x	x	x
Mercury	Yes (Table 5-2)																
Nickel	Yes (Table 5-2)					x		x	x		x	x	x		x	x	
Selenium	Yes (Table 5-2)			x	x					x	x			x	x	x	
Sulfate	Yes (Table 5-2)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Zinc	Yes (Table 5-2)																
Number of Observed Constituents that are not Consistent with Indicators of Leachate from Ash in Impoundments [3]		11	11	11	9	10	11	9	10	10	7	9	10	10	8	9	11
Percentage of Observed Constituents that are not Consistent with Indicators of Leachate from Ash in Impoundments [4]		69%	69%	69%	56%	63%	69%	56%	63%	63%	44%	56%	63%	63%	50%	56%	69%

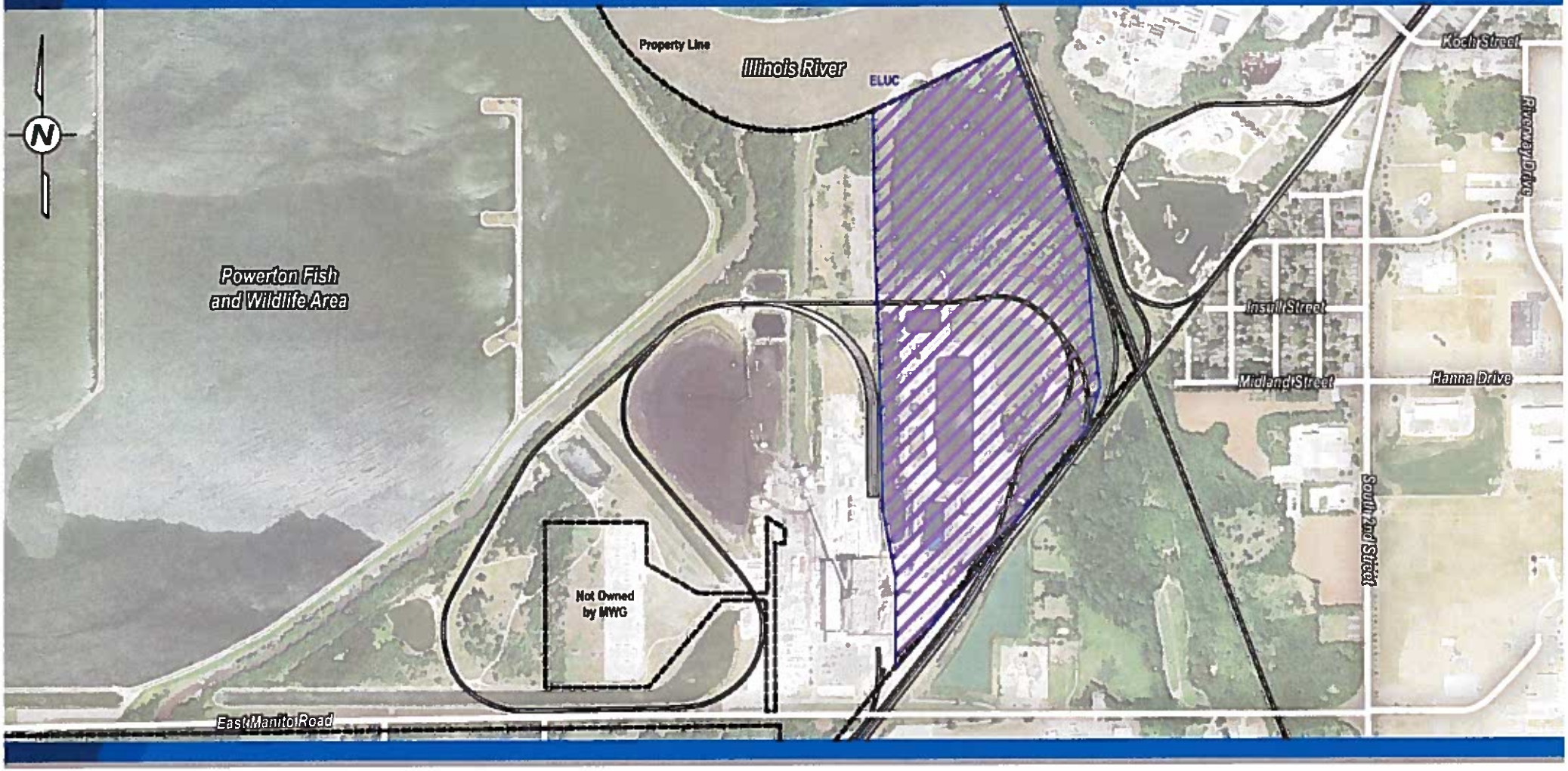
Powerton


Property Line
Illinois River
Powerton Fish and Wildlife Area
Former Ash Basin
Not Owned by MWG
East Manito Road
Koch Street
Powerway Drive
Insull Street
Midland Street
Hanna Drive
South 2nd Street

Powerton

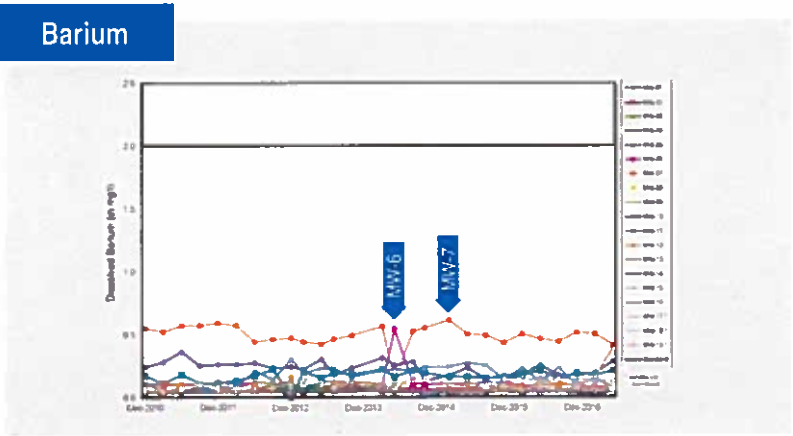

Property Line
Illinois River
Groundwater Management Zone
Powerton Fish and Wildlife Area
Not Owned by MWG
East Manito Road
Koch Street
Riverway Drive
Insull Street
Midland Street
Hanna Drive
South 2nd Street

Powerton

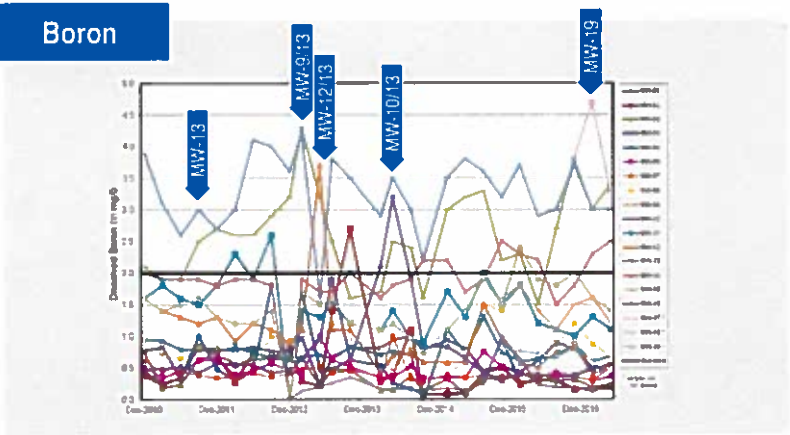

Property Line
Illinois River
ELUC
Koch Street
Riverway Drive
Powerton Fish
and Wildlife Area
Instill Street
Midland Street
Hanna Drive
South 2nd Street
Not Owned
by MWG
East Manito Road

Powerton

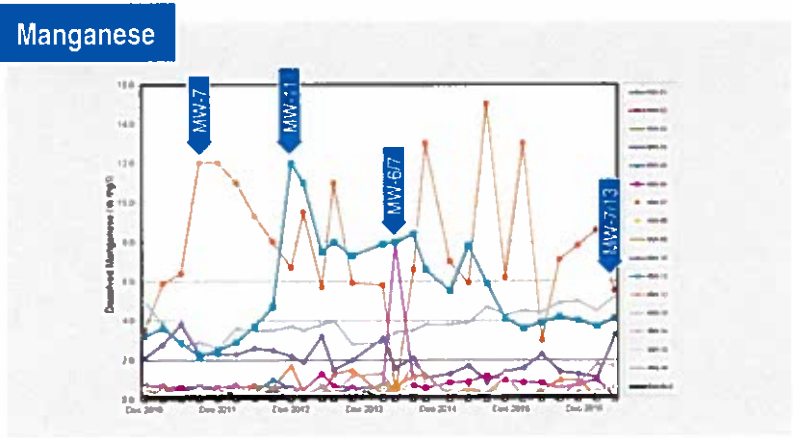
Barium



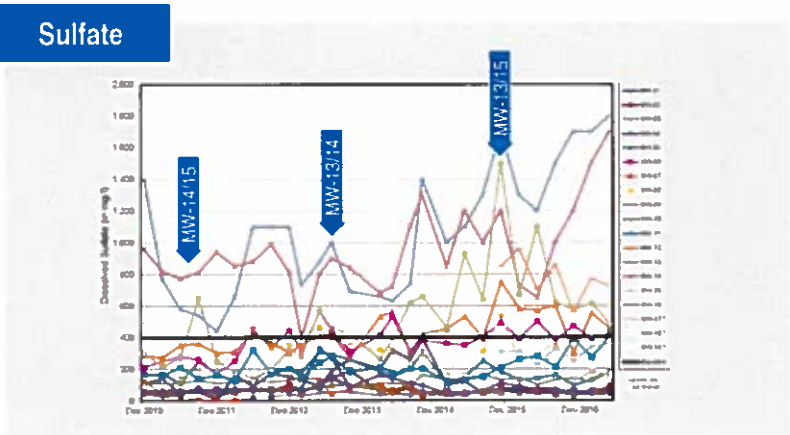
Boron



Manganese



Sulfate



Powerton

Updated Groundwater Constituent Temporal Trend Testing Results

Monitoring Well	Barium		Boron		Manganese		Sulfate	
	Trend Direction [a]	Slope (mg/L/yr)	Trend Direction [a]	Slope (mg/L/yr)	Trend Direction [a]	Slope (mg/L/yr)	Trend Direction [a]	Slope (mg/L/yr)
MW-01	No conclusion	--	Decreasing	-0.086	No conclusion	--	No conclusion	--
MW-02	No conclusion	--	Decreasing	-0.065	No conclusion	--	No conclusion	--
MW-03	No conclusion	--	Decreasing	-0.057	No conclusion	--	No conclusion	--
MW-04	Decreasing	-0.0049	No conclusion	--	Decreasing	-0.079	No conclusion	--
MW-05	Decreasing	-0.0018	No conclusion	--	Decreasing	-0.11	No conclusion	--
MW-06	No conclusion	--	Decreasing	-0.024	No conclusion	--	Increasing	29
MW-07	Decreasing	-0.011	No conclusion	--	No conclusion	--	Increasing	3.5
MW-08	Decreasing	-0.004	Increasing	0.062	Increasing	0.026	Increasing	12
MW-09	Decreasing	-0.0012	Increasing	0.076	Decreasing	-0.039	Increasing	4.2
MW-10	Decreasing	-0.015	No conclusion	--	Decreasing	-0.18	No conclusion	--
MW-11	Increasing	0.006	Decreasing	-0.094	No conclusion	--	Increasing	19
MW-12	Decreasing	0.00	Decreasing	-0.15	No conclusion	--	Increasing	40
MW-13	Increasing	0.012	No conclusion	--	Increasing	0.23	Increasing	140
MW-14	Increasing	0.004	Increasing	0.056	Increasing	0.073	Increasing	66
MW-15	No conclusion	--	Increasing	0.056	No conclusion	--	Increasing	92
MW-16	Decreasing	-0.340	No conclusion	--	Decreasing	-0.0013	No conclusion	--

Powerton

Updated Temporal Trend Testing of Groundwater Concentrations for Site-Specific Indicators of Ash in Ponds

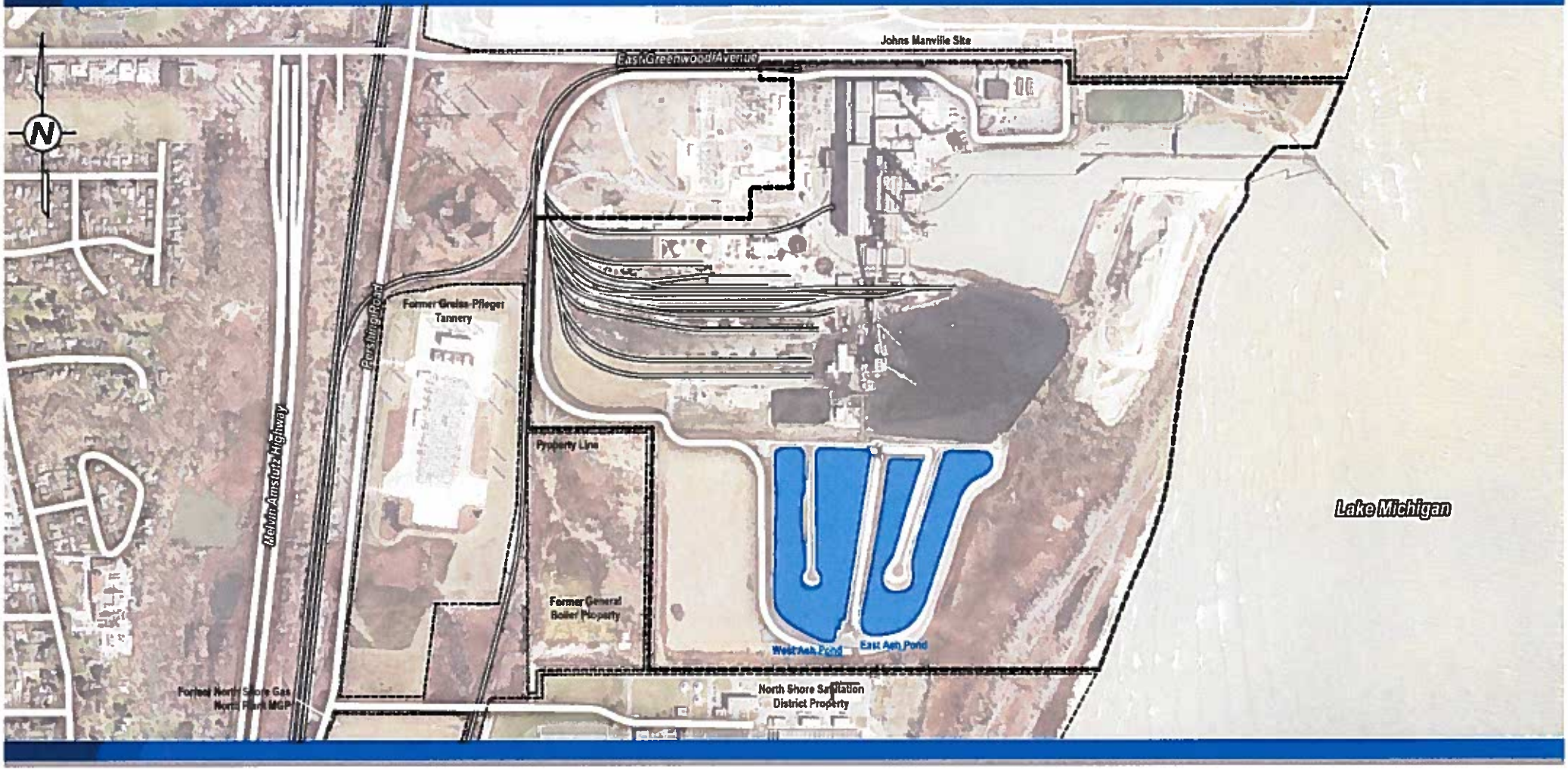
Trend	Barium	Boron	Manganese	Sulfate
Increasing	2 wells	4 wells	3 wells	9 wells
Decreasing	8 wells	6 wells	5 wells	No wells
No conclusion	5 wells	6 wells	8 wells	7 wells

- Overall, it appears that groundwater concentrations are neither increasing nor decreasing because:
  - The indicators are increasing at 3 to 9 wells out of 16 wells
  - Three indicators show decreasing trends at 5 to 8 wells out of 16 wells
  - No conclusions could be made at 5 to 7 wells out of 16 wells

Waukegan – Site History and Surroundings

- Operating for 75 years before MWG (1923)
- **Review of Impoundments/Ponds**
  - Ponds lined with Hypalon® in 1977
  - Relined by MWG (2003-2004)
- Pond ash sample results (2004 both ponds)
- Historic areas
- Off site impacts
- Administrative controls/ELUCs
- No potable water wells/no risk to receptors

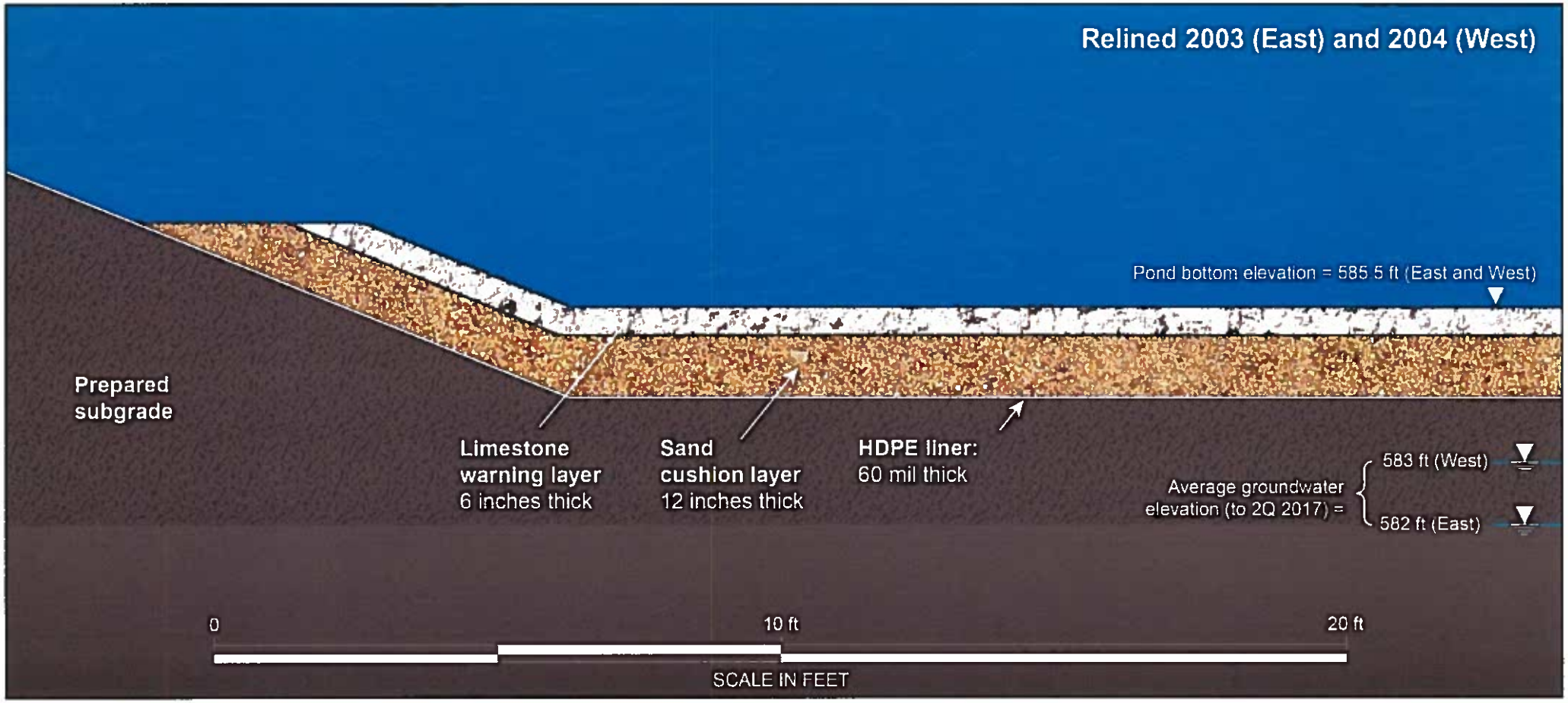
Waukegan


Johns Manville Site
East Greenwood Avenue
N
Former Greiss-Pfleger Tannery
Pershing Road
Melvin Amstutz Highway
Property Line
Former General Boiler Property
West Ash Pond
East Ash Pond
North Shore Sanitation District Property
Lake Michigan

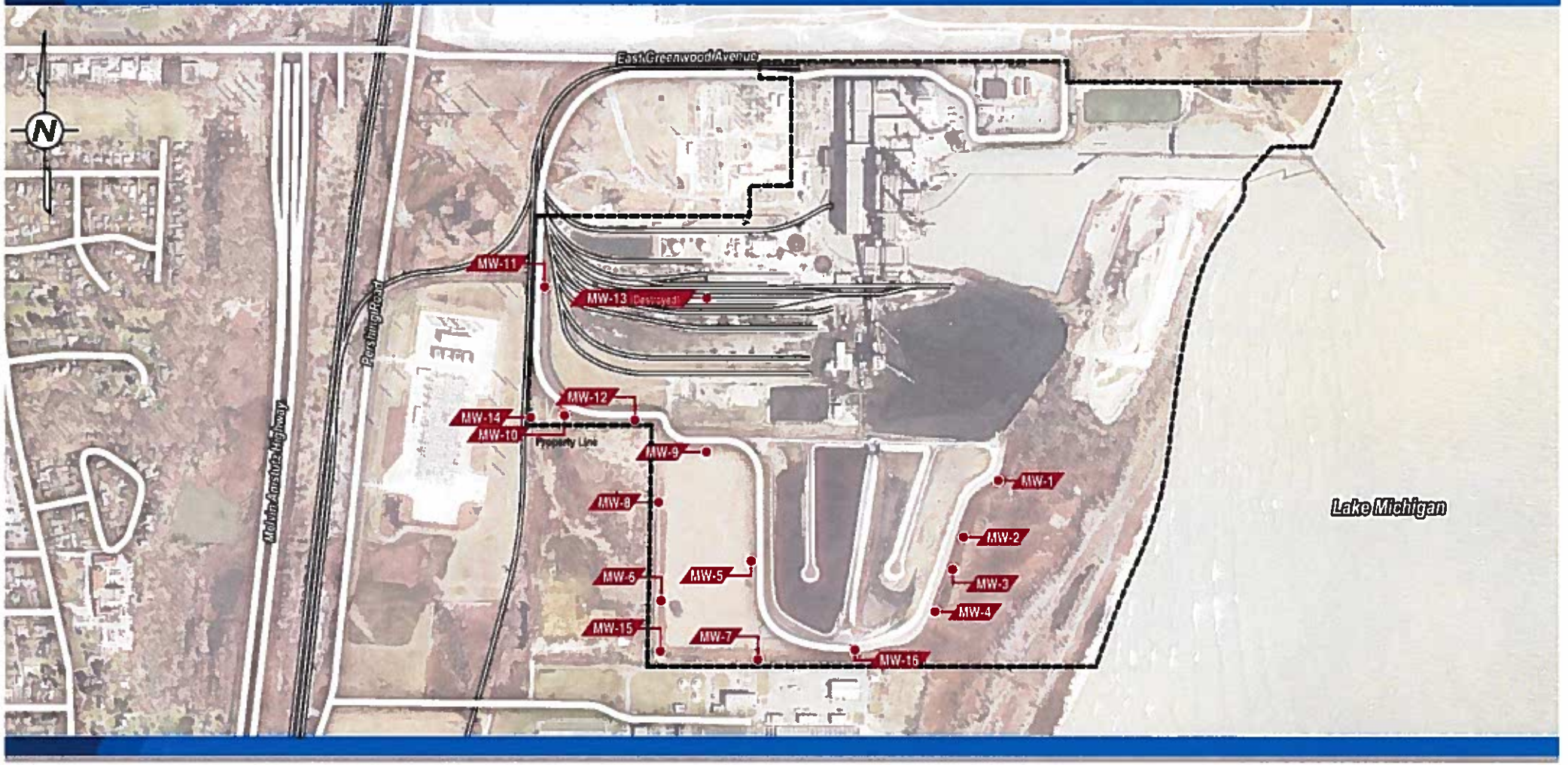
Waukegan – Impoundments

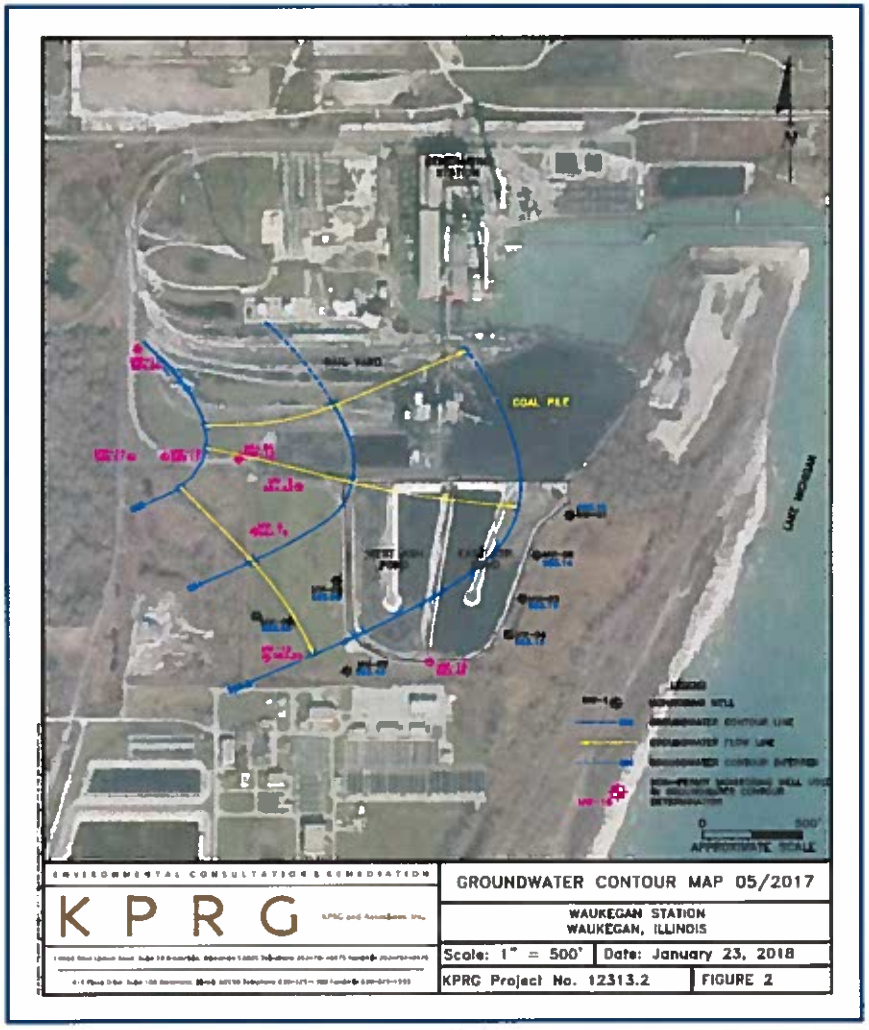
Station	Ash Pond	Date Constructed -Liners	Date Relined With HDPE	Scheduled Ash Removal
Waukegan	East Ash Pond	1977 Hypalon®	2003 Prepared subgrade; HDPE; sand cushion; warning layer	3-4 yrs (prev. 2 yrs)* Bottom area only; inlet side
	West Ash Pond	1977 Hypalon®	2004 Prepared subgrade; HDPE; sand cushion; warning layer	3-4 yrs (prev. 2 yrs)

Waukegan – East and West Ash Ponds



Waukegan


East Greenwood Avenue
MW-11
MW-13 (Destroyed)
Pershing Road
MW-12
MW-14
MW-10
Property Line
MW-9
MW-8
MW-6
MW-5
MW-15
MW-7
MW-16
MW-1
MW-2
MW-3
MW-4
Lake Michigan
Melvin A. Sykes Highway


COAL PILE
LAKE MICHIGAN
APPROXIMATE SCALE
ENVIRONMENTAL CONSULTATION & REMEDIATION
K P R G
GROUNDWATER CONTOUR MAP 05/2018
WAUKEGAN STATION
WAUKEGAN, ILLINOIS
Scale: 1" = 500'
Date: January 23, 2018
KPRG Project No. 12313.2
FIGURE 2

Waukegan – Updated Table 5-5

Quarterly Groundwater Monitoring (2016-Q3 to 2017-Q2) Compared to Indicators in Impoundments/ponds (MWG site specific analyses)

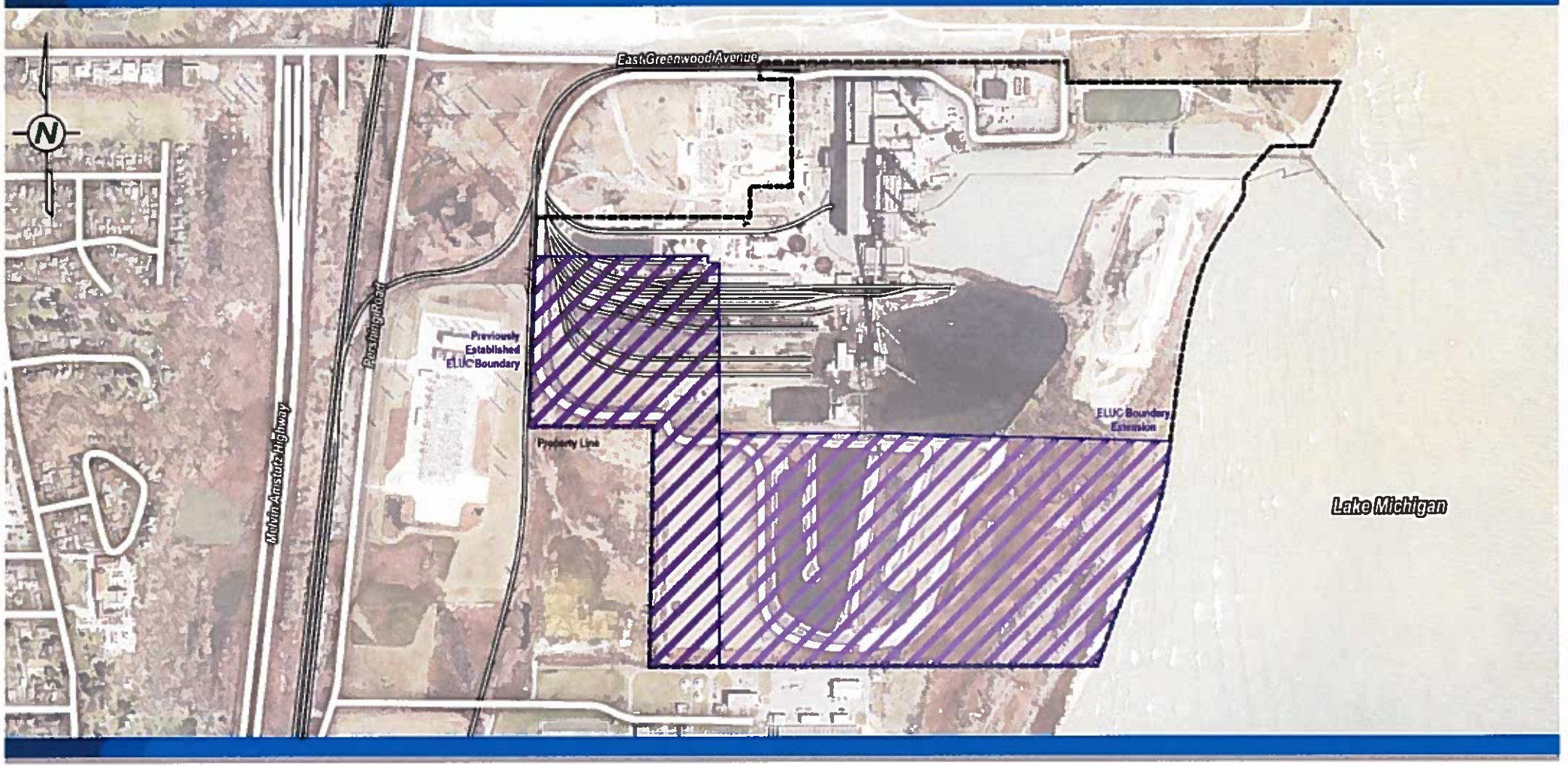
Constituent	Constituent is an Indicator of Leachate from Ash Currently Stored in Impoundments [1]	Constituents Detected During Most Recent Year (2016-Q3 to 2017-Q2) of Quarterly Groundwater Monitoring [2]						
		Waukegan Generating Station						
		MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-07
Arsenic		x	x	x	x	x	x	x
Barium	Yes (Table 5-1)	x	x	x	x	x	x	x
Boron	Yes (Table 5-1)	x	x	x	x	x	x	x
Copper								x
Iron					x	x	x	x
Lead								x
Manganese			x	x	x	x	x	x
Nickel						x		
Selenium		x	x	x	x	x	x	
Sulfate	Yes (Table 5-1)	x	x	x	x	x	x	x
Number of Observed Constituents that are not Consistent with Indicators of Leachate from Ash Currently Stored in Impoundments [3]		2	3	3	4	5	4	5
Percentage of Observed Constituents that are not Consistent with Indicators of Leachate from Ash Currently Stored in Impoundments [4]		40%	50%	50%	57%	63%	57%	63%

Waukegan – Updated Table 5-4

Quarterly Groundwater Monitoring (2016-Q3 to 2017-Q2) Compared to Indicators in Impoundments/ponds (EPRI, 2006)

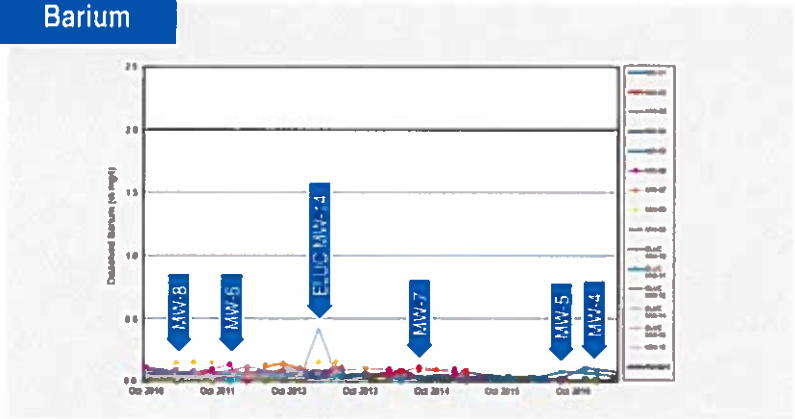
Constituent	Constituent is an Indicator of Leachate from Ash in Impoundments [1]	Constituents Detected during Most Recent Year (2016-Q3 to 2017-Q2) of Quarterly Groundwater Monitoring [2]						
		Waukegan Generating Station						
		MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7
Antimony	Yes (Table 5-2)							
Arsenic	Yes (Table 5-2)	x	x	x	x	x	x	x
Barium	Yes (Table 5-2)	x	x	x	x	x	x	x
Boron	Yes (Table 5-2)	x	x	x	x	x	x	x
Cadmium	Yes (Table 5-2)							
Chromium	Yes (Table 5-2)							
Cobalt	Yes (Table 5-2)							
Copper	Yes (Table 5-2)							x
Iron					x	x	x	x
Lead	Yes (Table 5-2)							x
Manganese	Yes (Table 5-2)		x	x	x	x	x	x
Mercury	Yes (Table 5-2)							
Nickel	Yes (Table 5-2)					x		
Selenium	Yes (Table 5-2)	x	x	x	x	x	x	
Sulfate	Yes (Table 5-2)	x	x	x	x	x	x	x
Zinc	Yes (Table 5-2)							
Number of Observed Constituents that are not Consistent with Indicators of Leachate from Ash in Impoundments [3]		10	9	9	10	9	10	9
Percentage of Observed Constituents that are not Consistent with Indicators of Leachate from Ash in Impoundments [4]		63%	56%	56%	63%	56%	63%	56%

Waukegan

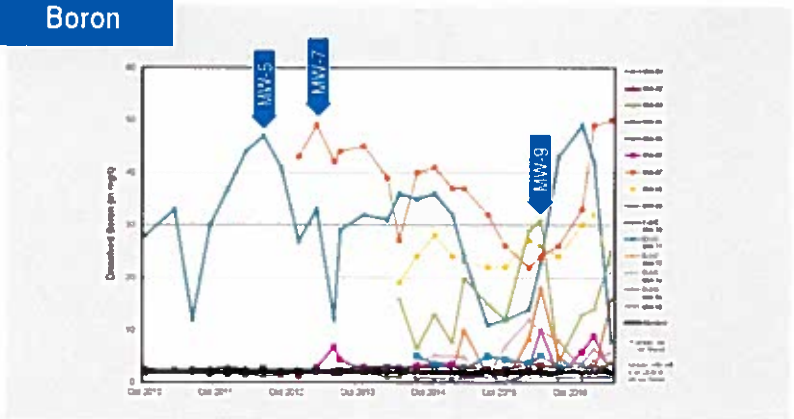

East Greenwood Avenue
Pershing Road
Melvin Arnstutz Highway
Previously Established ELUC Boundary
Property Line
ELUC Boundary Extension
Lake Michigan

Waukegan

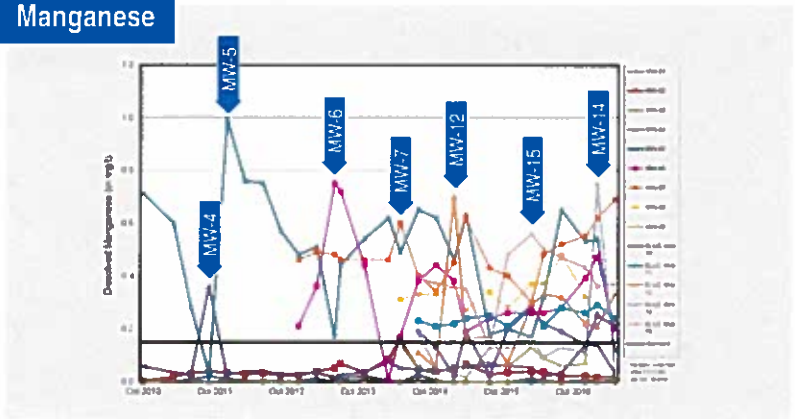
Barium



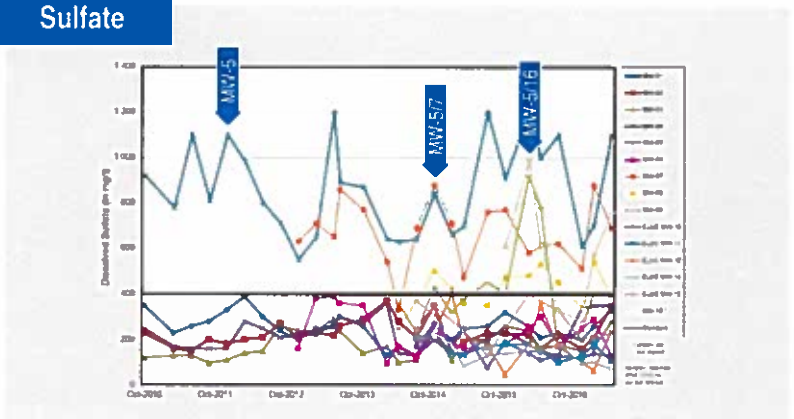
Boron



Manganese



Sulfate



Waukegan

Updated Groundwater Constituent Temporal Trend Testing Results

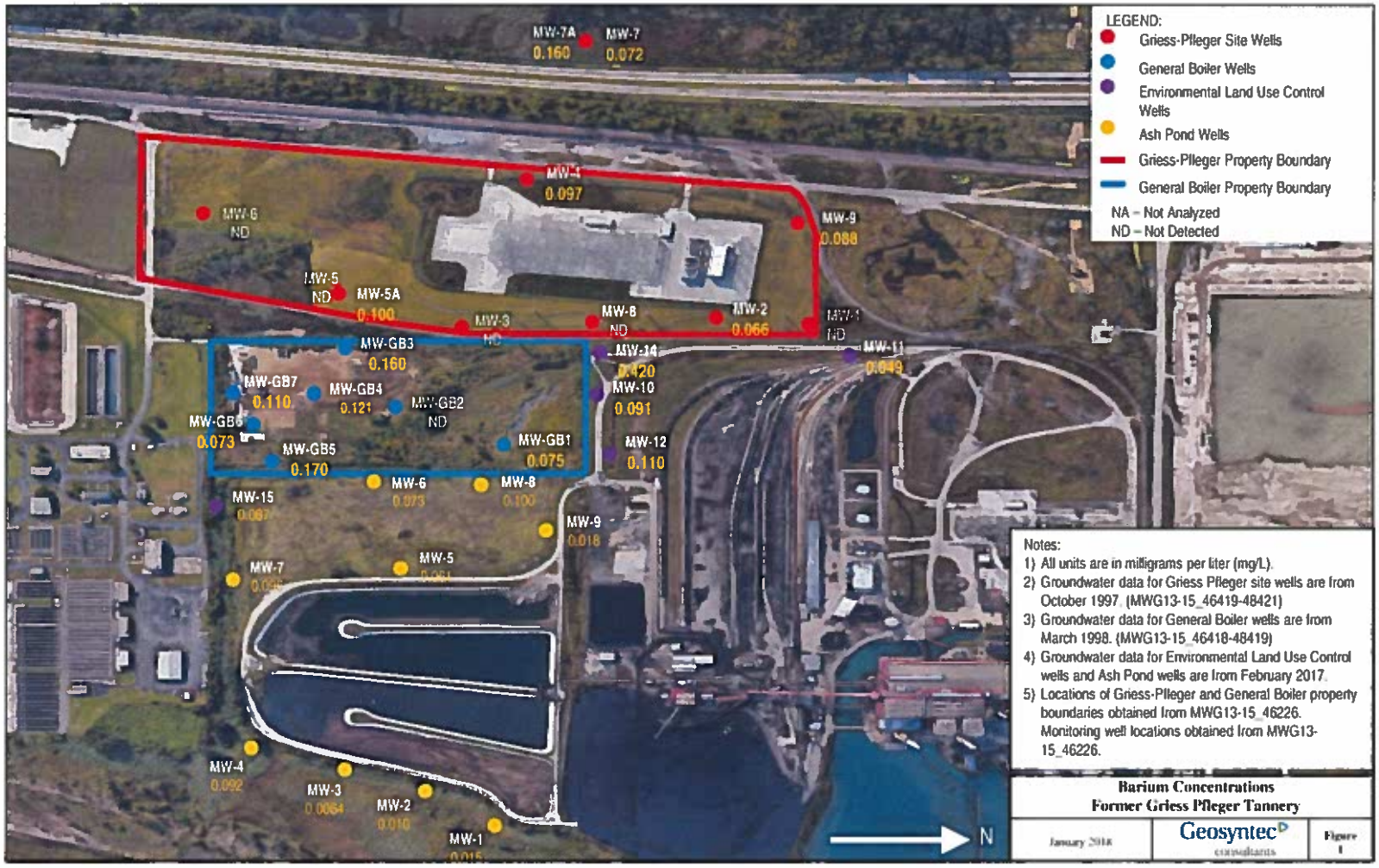
Monitoring Well	Barium		Boron		Manganese		Sulfate	
	Trend Direction [a]	Slope (mg/L/yr)	Trend Direction [a]	Slope (mg/L/yr)	Trend Direction [a]	Slope (mg/L/yr)	Trend Direction [a]	Slope (mg/L/yr)
MW-01	Decreasing	-0.0026	Decreasing	-0.093	Decreasing	-0.0010	Decreasing	-8.3
MW-02	No conclusion	--	Increasing	0.22	No conclusion	--	No conclusion	--
MW-03	No conclusion	--	Increasing	0.11	No conclusion	--	Increasing	10
MW-04	Increasing	0.0048	No conclusion	--	No conclusion	--	No conclusion	--
MW-05	Decreasing	-0.0019	No conclusion	--	Decreasing	-0.035	No conclusion	--
MW-06	No conclusion	--	Increasing	0.49	Decreasing	-0.033	Decreasing	-19
MW-07	No conclusion	--	Decreasing	-2.1	Increasing	0.022	No conclusion	--
MW-08	No conclusion	--	No conclusion	--	No conclusion	--	No conclusion	--
MW-09	No conclusion	--	No conclusion	--	No conclusion	--	No conclusion	--

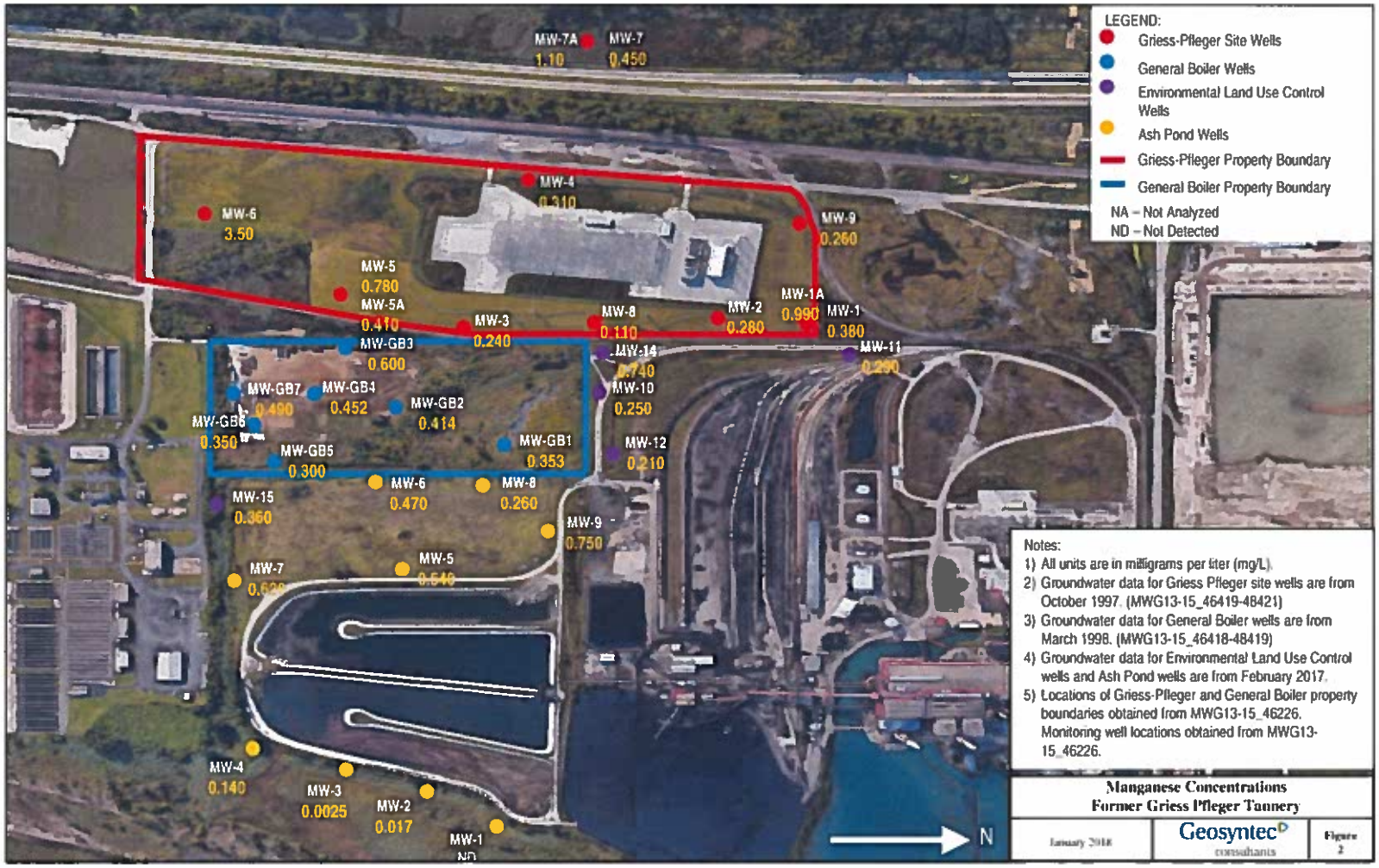
Waukegan

Updated Temporal Trend Testing of Groundwater Concentrations for Site-Specific Indicators of Ash in Ponds

Trend	Barium	Boron	Manganese	Sulfate
Increasing	1 well	3 wells	1 well	1 well
Decreasing	2 wells	2 wells	3 wells	2 wells
No conclusion	6 wells	4 wells	5 wells	6 wells

- Overall, it appears that groundwater concentrations are neither increasing nor decreasing because:
  - The indicators are increasing at 1 to 3 wells out of 9 wells
  - The indicators are decreasing at 2 to 3 wells out of 9 wells
  - No conclusions could be made at 4 to 6 wells out of 9 wells


MW-7A
0.160
MW-7
0.072
MW-4
0.097
MW-6
ND
MW-9
0.088
MW-5
ND
MW-5A
0.100
MW-3
ND
MW-8
ND
MW-2
0.066
MW-1
ND
MW-GB3
0.160
MW-14
0.420
MW-11
0.049
MW-GB7
0.110
MW-GB4
0.121
MW-GB2
ND
MW-10
0.091
MW-GB6
0.073
MW-GB5
0.170
MW-GB1
0.075
MW-12
0.110
MW-15
0.087
MW-6
0.073
MW-8
0.100
MW-9
0.018
MW-7
0.045
MW-5
0.051
MW-4
0.092
MW-3
0.0064
MW-2
0.010
MW-1
0.015
N
LEGEND:
Griess-Pfleger Site Wells
General Boiler Wells
Environmental Land Use Control Wells
Ash Pond Wells
Griess-Pfleger Property Boundary
General Boiler Property Boundary
NA – Not Analyzed
ND – Not Detected
Notes:
1) All units are in milligrams per liter (mg/L).
2) Groundwater data for Griess Pfleger site wells are from October 1997. (MWG13-15_46419-48421)
3) Groundwater data for General Boiler wells are from March 1998. (MWG13-15_46418-48419)
4) Groundwater data for Environmental Land Use Control wells and Ash Pond wells are from February 2017.
5) Locations of Griess-Pfleger and General Boiler property boundaries obtained from MWG13-15_46226. Monitoring well locations obtained from MWG13-15_46226.
Barium Concentrations
Former Griess Pfleger Tannery
January 2018
Geosyntec consultants
Figure 1


MW-7A
1.10
MW-7
0.450
MW-4
0.310
MW-6
3.50
MW-9
0.260
MW-5
0.780
MW-5A
0.410
MW-3
0.240
MW-8
0.110
MW-2
0.280
MW-1A
0.990
MW-1
0.380
MW-GB3
0.600
MW-14
0.740
MW-11
0.290
MW-GB7
0.490
MW-GB4
0.452
MW-GB2
0.414
MW-10
0.250
MW-GB6
0.350
MW-GB5
0.300
MW-GB1
0.353
MW-12
0.210
MW-15
0.360
MW-6
0.470
MW-8
0.260
MW-9
0.750
MW-7
0.620
MW-5
0.540
MW-4
0.140
MW-3
0.0025
MW-2
0.017
MW-1
ND
N
LEGEND:
Griess-Pfleger Site Wells
General Boiler Wells
Environmental Land Use Control Wells
Ash Pond Wells
Griess-Pfleger Property Boundary
General Boiler Property Boundary
NA – Not Analyzed
ND – Not Detected
Notes:
1) All units are in milligrams per liter (mg/L).
2) Groundwater data for Griess Pfleger site wells are from October 1997. (MWG13-15_46419-48421)
3) Groundwater data for General Boiler wells are from March 1998. (MWG13-15_46418-48419)
4) Groundwater data for Environmental Land Use Control wells and Ash Pond wells are from February 2017.
5) Locations of Griess-Pfleger and General Boiler property boundaries obtained from MWG13-15_46226. Monitoring well locations obtained from MWG13-15_46226.
Manganese Concentrations
Former Griess Pfleger Tannery
January 2018
Geosyntec consultants
Figure 2

Will County – Site History and Surroundings

- Operating for 40+ years before MWG (1955)
- Review of Impoundments/Ponds
  - IN and 1S removed from service/1'water
  - 2S and 3S lined and relined
- Pond ash sample results (2010)
- Historic areas and samples (2015)
- Administrative Controls/ GMZ and ELUC
- No potable water wells/no risk to receptors

Will County

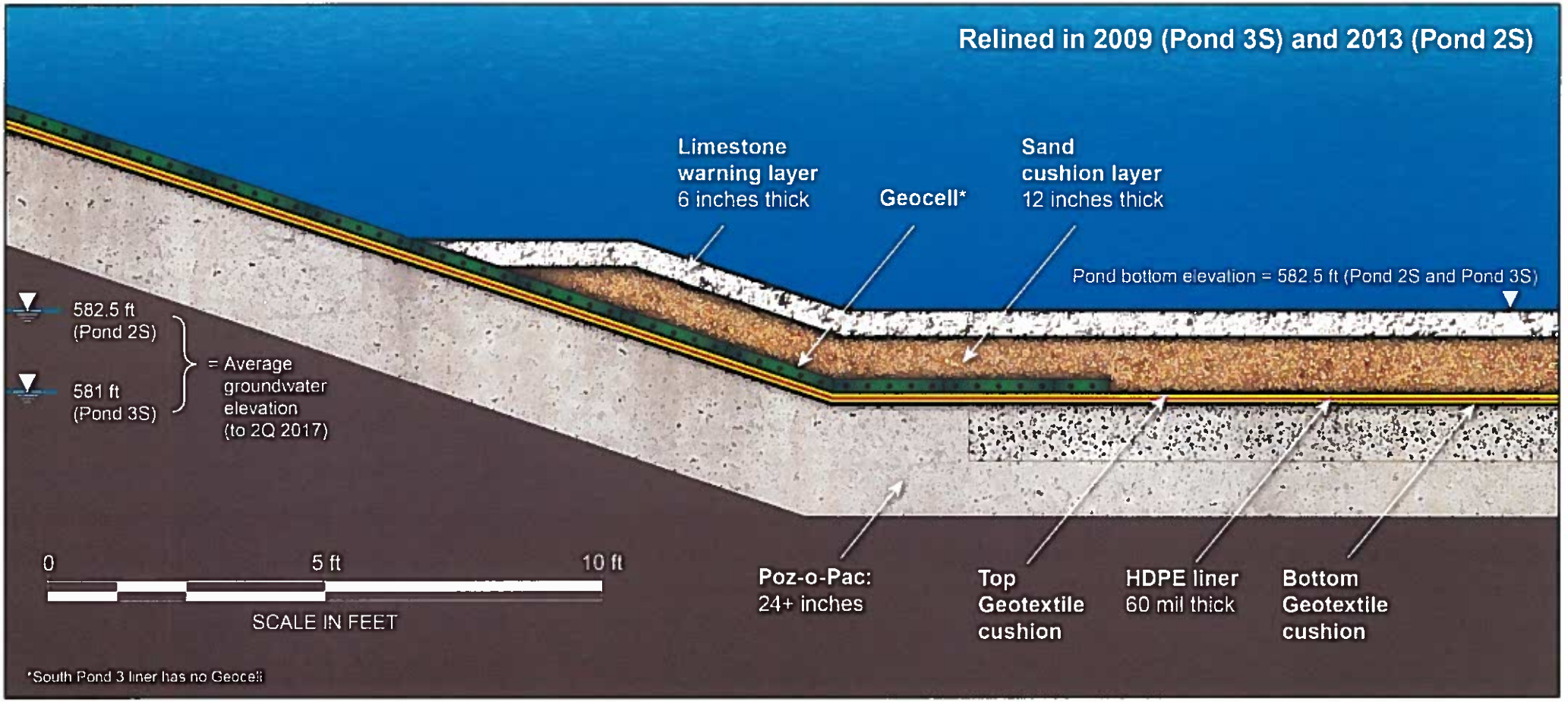

East Romeo Road
Rock Road
Des Plaines River
Pond 1N
CCR Placement Area
Sampled in 2019)
Pond 1S
Ash Pond 2S
Ash Pond 3S
Ash Pond 3S CCR
(Sampled in 2019)
Not Owned
By MWG
New Avenue
Alleged Slag and Bottom Ash
Placement Area
Property Line
Material Road

Will County – Impoundments

Station	Ash Pond	Date Constructed – Liners	Date Relined With HDPE	Scheduled Ash Removal
Will County Only Unit 4 operating Scheduled to close May 2020	Pond 1N and Pond 1S	1977 Poz-o-Pac—36 inches	Removed from service with dewatering systems	NONE 1' remaining water
	Pond 2S	1977 • Bituminous seal coat • Poz-o-Pac—36 inches thick	2013 Poz-o-Pac; geotextile; HDPE; geo-textile; geocell; sand cushion; warning layer	1-2 yrs*
	Pond 3S	1977 • Bituminous seal coat • Poz-o-Pac—36 inches thick	2009 Poz-o-Pac; geotextile; HDPE; geo-textile; sand cushion; warning layer	1-2 yrs

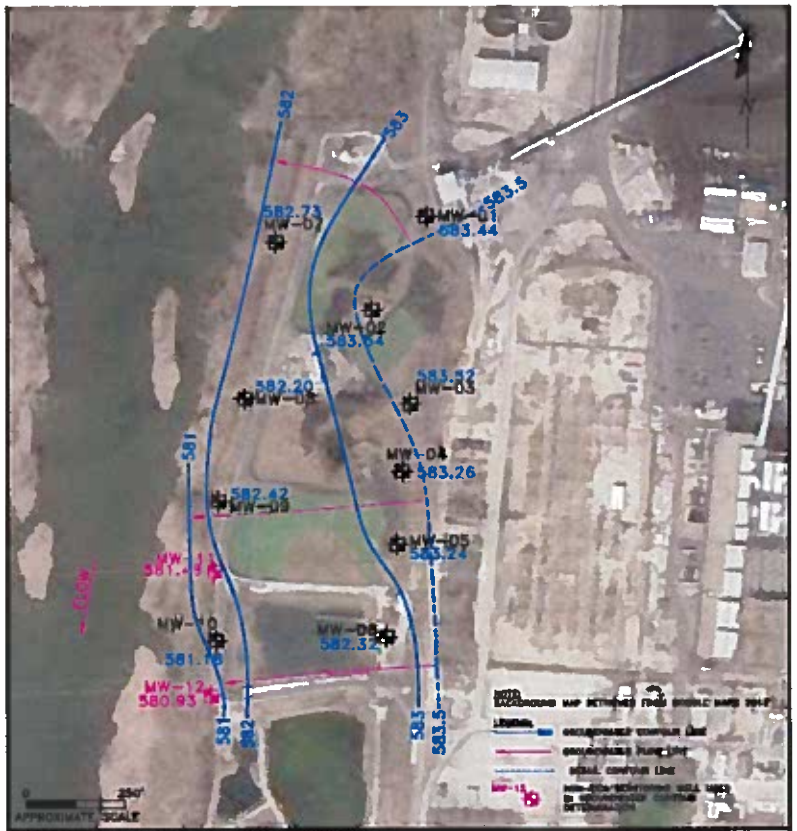
*Maddox testimony

Will County – South Ponds 2 and 3



Will County


East Romeo Road
Rock Road
Des Plaines River
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-8
MW-9
MW-10
MW-11
MW-12
Not Owned By MWG
Property Line
New Avenue
Material Road


582
583
582.73
MW-02
MW-01
583.44
583.5
MW-02
583.64
582.20
MW-08
583.32
MW-03
MW-04
583.26
581
582.42
MW-09
MW-05
583.24
MW-11
581.49
MW-10
581.76
MW-08
582.32
MW-12
580.93
581
582
583
583.5
APPROXIMATE SCALE
KPRG
GROUNDWATER CONTOUR MAP 05/2017
WILL COUNTY STATION
ROMEOVILLE, ILLINOIS
Scale: 1" = 250'
Date: June 22, 2017
KPRG Project No. 12313.3
FIGURE 2

Will County – Updated Table 5-5

Quarterly Groundwater Monitoring (2016-Q3 to 2017-Q2) Compared to Indicators in Impoundments/ponds (MWG site specific analyses)

Constituent	Constituent is an Indicator of Leachate from Ash Currently Stored in Impoundments [1]	Constituents Detected During Most Recent Year (2016-Q3 to 2017-Q2) of Quarterly Groundwater Monitoring [2]									
		Will County Generating Station									
		MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10
Arsenic			x	x		x	x	x	x	x	x
Barium	Yes (Table 5-1)	x	x	x	x	x	x	x	x	x	x
Boron	Yes (Table 5-1)	x	x	x	x	x	x	x	x	x	x
Cobalt				x	x				x		
Iron		x	x		x		x	x	x		x
Lead			x								
Manganese		x	x	x	x	x	x	x	x	x	x
Mercury		x			x						
Nickel		x	x	x	x	x	x	x	x	x	x
Selenium		x			x	x	x	x	x	x	x
Sulfate	Yes (Table 5-1)	x	x	x	x	x	x	x	x	x	x
Number of Observed Constituents that are not Consistent with Indicators of Leachate from Ash Currently Stored in Impoundments [3]		5	5	4	6	4	5	5	6	4	5
Percentage of Observed Constituents that are not Consistent with Indicators of Leachate from Ash Currently Stored in Impoundments [4]		63%	63%	57%	67%	57%	63%	63%	67%	57%	63%

Will County – Updated Table 5-4

Quarterly Groundwater Monitoring (2016-Q3 to 2017-Q2) Compared to Indicators in Impoundments/ponds (EPRI, 2006)

Constituent	Constituent is an Indicator of Leachate from Ash in Impoundments [1]	Constituents Detected During Most Recent Year (2016-Q3 to 2017-Q2) of Quarterly Groundwater Monitoring [2]									
		Will County Generating Station									
		MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10
Antimony	Yes (Table 5-2)										
Arsenic	Yes (Table 5-2)		x	x		x	x	x	x	x	x
Barium	Yes (Table 5-2)	x	x	x	x	x	x	x	x	x	x
Boron	Yes (Table 5-2)	x	x	x	x	x	x	x	x	x	x
Cadmium	Yes (Table 5-2)										
Chromium	Yes (Table 5-2)										
Cobalt	Yes (Table 5-2)			x	x				x		
Copper	Yes (Table 5-2)										
Iron		x	x		x		x	x	x		x
Lead	Yes (Table 5-2)		x								
Manganese	Yes (Table 5-2)	x	x	x	x	x	x	x	x	x	x
Mercury	Yes (Table 5-2)	x			x						
Nickel	Yes (Table 5-2)	x	x	x	x	x	x	x	x	x	x
Selenium	Yes (Table 5-2)	x			x	x	x	x	x	x	x
Sulfate	Yes (Table 5-2)	x	x	x	x	x	x	x	x	x	x
Zinc	Yes (Table 5-2)										
Number of Observed Constituents that are not Consistent with Indicators of Leachate from Ash in Impoundments [3]		9	9	8	8	8	9	9	8	8	9
Percentage of Observed Constituents that are not Consistent with Indicators of Leachate from Ash in Impoundments [4]		56%	56%	50%	50%	50%	56%	56%	50%	50%	56%

Will County


East Romeoville Road
Rock Road
Des Plaines River
Pond 1N
Pond 1S
Ash Pond 2S
Ash Pond 3S
Ash Pond 3S CCR
(Sampled in 2019)
Not Owned
By MWG
Alleged Slag and Bottom Ash
Placement Area
Property Line
Materials Road
New Avenue

Will County

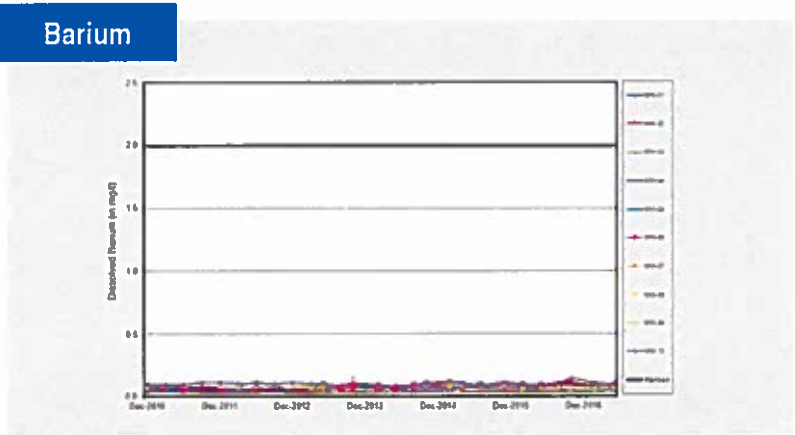

East Romeo Road
Rock Road
Des Plaines River
New Avenue
Property Line
Material Road

Will County

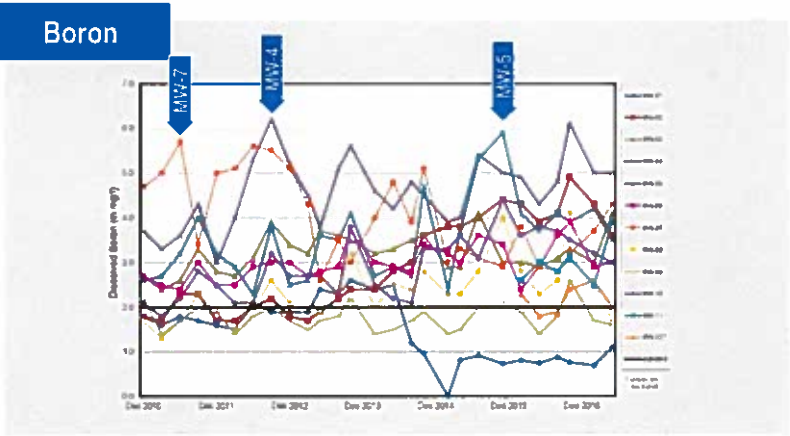

East Romeo Road
Rock Road
Des Plaines River
New Avenue
Not Owned By MWG
ELUC
Property Line
Material Road

Will County

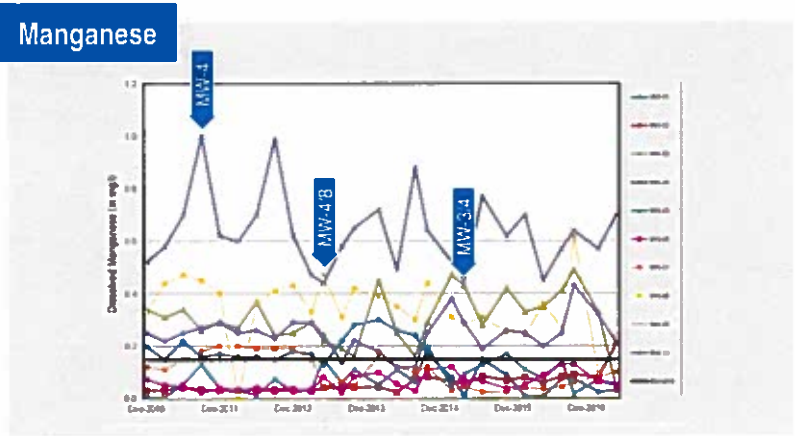
Barium



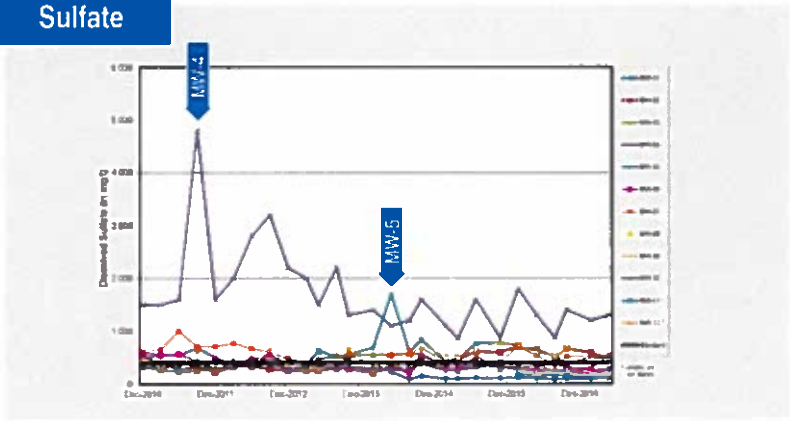
Boron



Manganese



Sulfate



Will County

Updated Groundwater Constituent Temporal Trend Testing Results

Monitoring Well	Barium		Boron		Manganese		Sulfate	
	Trend Direction [a]	Slope (mg/L/yr)	Trend Direction [a]	Slope (mg/L/yr)	Trend Direction [a]	Slope (mg/L/yr)	Trend Direction [a]	Slope (mg/L/yr)
MW-01	Increasing	0.0088	Decreasing	-0.22	Decreasing	-0.026	Decreasing	-61
MW-02	Increasing	0.0065	Increasing	0.49	Increasing	0.014	Increasing	55
MW-03	No conclusion	--	Increasing	0.076	No conclusion	--	No conclusion	--
MW-04	Decreasing	-0.0024	Increasing	0.18	No conclusion	--	Decreasing	-220
MW-05	No conclusion	--	Increasing	0.23	Increasing	0.0098	No conclusion	--
MW-06	Increasing	0.0042	No conclusion	--	Increasing	0.0079	Decreasing	-34
MW-07	Decreasing	-0.0039	Decreasing	-0.3	Decreasing	-0.022	Decreasing	-39
MW-08	Decreasing	-0.0036	Increasing	0.19	Decreasing	-0.016	Increasing	26
MW-09	Increasing	0.00091	No conclusion	--	Increasing	0.00034	Decreasing	-22
MW-10	No conclusion	--	Increasing	0.24	No conclusion	--	Decreasing	-20

Will County

Updated Temporal Trend Testing of Groundwater Concentrations for Site-Specific Indicators of Ash in Ponds

Trend	Barium	Boron	Manganese	Sulfate
Increasing	4 wells	6 wells	4 wells	2 wells
Decreasing	3 wells	2 wells	3 wells	6 wells
No conclusion	3 wells	2 wells	3 wells	2 wells

- Overall, it appears that groundwater concentrations are neither increasing nor decreasing because:
  - The indicators are increasing at 2 to 6 wells out of 10 wells
  - The indicators are decreasing at 2 to 6 wells out of 10 wells
  - No conclusions could be made at 2 to 3 wells out of 10 wells