Cynthia Vodopivec
Dynegy Midwest Generation, LLC
Luminant
6555 Sierra Dr.
Irving, TX 75039

November 30, 2020

Sent via email

Mr. Andrew R. Wheeler, EPA Administrator
Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Mail Code 5304-P
Washington, DC 20460

Re: Baldwin Power Station Revised Alternative Closure Demonstration

Dear Administrator Wheeler:

Dynegy Midwest Generation, LLC (Dynegy) hereby submits this request to the U.S. Environmental Protection Agency (EPA) for approval of a site-specific alternative deadline to initiate closure pursuant to 40 C.F.R. § 257.103(f)(2) for the Bottom Ash Pond located at the Baldwin Power Station near Baldwin, Illinois. Dynegy is requesting an extension pursuant to 40 C.F.R. § 257.103(f)(2) so that the Bottom Ash Pond may continue to receive CCR and non-CCR wastestreams after April 11, 2021, and complete closure no later than October 17, 2028.

The enclosed demonstration prepared by Burns & McDonnell replaces the demonstration that was previously submitted by Dynegy to EPA on November 19, 2020. This demonstration addresses all of the criteria in 40 C.F.R. § 257.103(f)(2)(i)-(iv) and contains the documentation required by 40 C.F.R. § 257.103(f)(2)(v). As allowed by the agency, in lieu of hard copies of these documents, electronic files were submitted to Kirsten Hillyer, Frank Behan, and Richard Huggins via email. The demonstration is also available on Dynegy's publicly available website: https://www.luminant.com/ccr/

Sincerely,

Cynthia Vodopivec
VP - Environmental Health & Safety

Enclosure

cc: Kirsten Hillyer
Frank Behan
Richard Huggins

CCR Surface Impoundment Demonstration for a Site-Specific Alternative to Initiation of Closure Deadline

Dynegy Midwest Generation, LLC

Baldwin Power Station
Project No. 122702

Revision 2
11/30/2020

CCR Surface Impoundment Demonstration for a Site-Specific Alternative to Initiation of Closure Deadline

prepared for

Dynegy Midwest Generation, LLC
Baldwin Power Station
Baldwin, Illinois

Project No. 122702

Revision 2
11/30/2020

prepared by

Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

INDEX AND CERTIFICATION

Dynegy Midwest Generation, LLC
CCR Surface Impoundment
Demonstration for a Site-Specific Alternative to Initiation of Closure Deadline
Project No. 122702

Report Index

Certification

I hereby certify, as a Professional Engineer in the state of Illinois, that the information in this document as noted in the above Report Index was assembled under my direct personal charge. This report is not intended or represented to be suitable for reuse by the Dynegy Midwest Generation, LLC or others without specific verification or adaptation by the Engineer.

Edward T Tohill

Edward T. Tohill, P.E. (Illinois License No. 062-056915)

Date: 11/30/20

LICENSED PROFESSIONAL ENGINEER
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062-056915
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11/30/20
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11/30/21

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LIST OF ABBREVIATIONS

Abbreviation	Term/Phrase/Name
ASD	Alternate Source Demonstration
Baldwin	Baldwin Power Station
CCR	Coal Combustion Residual
CFR	Code of Federal Regulations
Dynegy	Dynegy Midwest Generation, LLC
ELG Rule	Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category
EPA	Environmental Protection Agency
Illinois EPA	Illinois Environmental Protection Agency
POTW	Publicly Owned Treatment Works
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation and Recovery Act
SWPPP	Stormwater Pollution Prevention Plan
TSS	total suspended solids

1.0 EXECUTIVE SUMMARY

Dynegy Midwest Generation, LLC (Dynegy) submits this request to the U.S. Environmental Protection Agency (EPA) for approval of a site-specific alternative deadline to initiate closure pursuant to 40 C.F.R. § 257.103(f)(2) —"Permanent Cessation of a Coal-Fired Boiler(s) by a Date Certain"— for the Bottom Ash Pond located at the Baldwin Energy Complex (Baldwin) in Illinois. The Bottom Ash Pond is a 177-acre CCR surface impoundment used to manage CCR and non-CCR wastestreams at Baldwin. As discussed herein, the remaining two coal-fired boilers at the station will cease coal-fired operations no later than December 31, 2025, and the impoundment will complete closure no later than October 17, 2028. Therefore, Dynegy is requesting an extension pursuant to 40 C.F.R. § 257.103(f)(2) from EPA so that the Bottom Ash Pond may continue to receive CCR and non-CCR wastestreams after April 11, 2021, and complete closure no later than October 17, 2028.

2.0 INTRODUCTION

Baldwin is a 1,185-megawatt coal-fueled electric generating station near Baldwin, Illinois. The Baldwin facility includes two CCR units: the Bottom Ash Pond and the Fly Ash Pond system. The Bottom Ash Pond is seeking an extension pursuant to this demonstration. Baldwin utilizes the 177-acre Bottom Ash Pond to manage sluiced bottom ash/boiler slag, economizer ash, SCR ash, air heater ash, dry fly ash (when not hauled offsite for beneficial use), and non-CCR wastewaters. The impoundment was constructed in the 1960's and has been in service for the life of the plant. Units 1 and 2 remain in operation, and Unit 3 has already ceased operation. Units 1 and 2 will cease operation no later than December 31, 2025. The various non-CCR wastewaters routed to the Bottom Ash Pond originate from the Unit 1 boiler room sump, Unit 1 boiler low point drains, oil/water separator, demineralizer regeneration flows, SDA emergency discharge, floor drains, water treatment system wastes, chemical metal cleaning waste pond, nonchemical metal cleaning wastewater (including boiler wash water), sewage treatment plant, Unit 1 and 2 polisher precoat system wastewater and stormwater sources. All fly ash is now handled dry. The Fly Ash Pond system, which includes the Old East, East, and West Fly Ash Ponds, is no longer active and has been closed under an Illinois Environmental Protection Agency (Illinois EPA) approved closure plan with CCR material in place; therefore, it is not subject to this demonstration request. A site plan is provided on Figure 1 in Appendix A, and the plant water balance diagram is included in Appendix B. Note that the Bottom Ash Pond is referred to as the Primary Slag Field on the water balance diagram.

On April 17, 2015, the Environmental Protection Agency (EPA) issued the federal Coal Combustion Residual (CCR) Rule, 40 C.F.R. Part 257, Subpart D, to regulate the disposal of CCR materials generated at coal-fueled units. The rule is being administered under Subtitle D of the Resource Conservation and Recovery Act (RCRA, 42 U.S.C. § 6901 et seq.). On August 28, 2020, the EPA Administrator issued revisions to the CCR Rule that require all unlined surface impoundments to initiate closure by April 11, 2021, unless an alternative deadline is requested and approved. 40 C.F.R. § 257.101(a)(1) (85 Fed. Reg. 53,516 (Aug. 28, 2020)). Specifically, owners and operators of a CCR surface impoundment may continue to receive CCR and non-CCR wastestreams if the facility will cease operation of the coal-fired boiler(s) and complete closure of the impoundments within certain specified timeframes. 40 C.F.R. § 257.103(f)(2). To qualify for an alternative closure deadline under § 257.103(f)(2), a facility must meet the following four criteria:

1. **§ 257.103(f)(2)(i)** – No alternative disposal capacity is available on-site or off-site. An increase in costs or the inconvenience of existing capacity is not sufficient to support qualification.

2. **§ 257.103(f)(2)(ii) -** Potential risks to human health and the environment from the continued operation of the CCR surface impoundment have been adequately mitigated;
3. **§ 257.103(f)(2)(iii) -** The facility is in compliance with the CCR rule, including the requirement to conduct any necessary corrective action; and
4. **§ 257.103(f)(2)(iv) -** The coal-fired boilers must cease operation and closure of the impoundment must be completed within the following timeframes:
    a. For a CCR surface impoundment that is 40 acres or smaller, the coal-fired boiler(s) must cease operation and the CCR surface impoundment must complete closure no later than October 17, 2023.
    b. For a CCR surface impoundment that is larger than 40 acres, the coal-fired boiler(s) must cease operation, and the CCR surface impoundment must complete closure no later than October 17, 2028.

Section 257.103(f)(2)(v) sets out the documentation that must be provided to EPA to demonstrate that the four criteria set out above have been met. Therefore, this demonstration is organized based on the documentation requirements of §§ 257.103(f)(2)(v)(A) – (D).

3.0 DOCUMENTATION OF NO ALTERNATIVE DISPOSAL CAPACITY

To demonstrate that the criteria in § 257.103(f)(2)(i) has been met, the following provides documentation that no alternative disposal capacity is currently available on-site or off-site for each CCR and non-CCR wastestream that Dynegy seeks to continue placing into the Bottom Ash Pond after April 11, 2021. Consistent with the regulations, neither an increase in costs nor the inconvenience of existing capacity was used to support qualification under this criteria. Instead, as EPA explained in the preamble to the proposed Part A revisions, "it would be illogical to require [] facilities [ceasing power generation] to construct new capacity to manage CCR and non-CCR wastestreams." 84 Fed. Reg. 65,941, 65,956 (Dec. 2, 2019). EPA again reiterated in the preamble to the final revisions that "[i]n contrast to the provision under § 257.103(f)(1), the owner or operator does not need to develop alternative capacity because of the impending closure of the coal fired boiler. Since the coal-fired boiler will shortly cease power generation, it would be illogical to require these facilities to construct new capacity to manage CCR and non-CCR wastestreams." 85 Fed. Reg. at 53,547. Thus, new construction or the development of new alternative disposal capacity was not considered a viable option for any wastestream discussed below.

3.1 Site-Layout and Wastewater Processes

The Bottom Ash Pond receives all the CCR sluice flows and many of the non-CCR wastewater flows onsite, as shown on the water balance diagram included in Appendix B. The remaining impoundments onsite (cooling pond, coal pile runoff pond, metal cleaning waste pond, sewage treatment ponds, cove pond, secondary pond, and tertiary pond) are not authorized to receive the CCR material. These wastestreams are discussed in more detail in the following sections.

There is no on-site CCR landfill that is permitted to receive the dry fly ash. The Fly Ash Pond system is no longer active and has been closed under an approved closure plan.

3.2 CCR Wastestreams

Dynegy evaluated each CCR wastestream placed in the Bottom Ash Pond at Baldwin. For the reasons discussed below in, each of the following CCR wastestreams must continue to be placed in the Bottom Ash Pond due to lack of alternative capacity both on and off-site.

Table 3-1: Baldwin CCR Wastestreams

CCR Wastestreams	Estimated Average Flow (MGD)	Alternative Disposal Capacity Available? YES/NO	Details
Unit 1 & 2 dry fly ash	NA (Dry) 69,200 tons/year based on 2019 rates	NO	The fly ash is collected dry and is currently conditioned and beneficially used on-site. The conditioned fly ash is placed in the Bottom Ash Pond, which will facilitate pond closure in the near future. This beneficial reuse of the fly ash will be reflected in the Bottom Ash Pond final closure plan. Dynegy does not have a CCR landfill or another CCR surface impoundment located onsite that would be available to accept this material. Consequently, there are no on-site alternatives for this wastestream, and alternative capacity would need to be designed, permitted, and installed. Currently, off-site alternative capacity is not available as discussed below.
Unit 1 & 2 bottom ash sluice	2.8	NO	Currently, alternative capacity is not available. On-site alternative capacity would need to be designed, permitted, and installed. Off-site alternative capacity would include development of on-site temporary tanks and transporting of this sluice material offsite for disposal.
Unit 1 & 2 SCR ash, air heater ash, and economizer ash sluice	0.03	NO	Currently, alternative capacity is not available. On-site alternative capacity would need to be designed, permitted, and installed. Off-site alternative capacity would include development of on-site temporary tanks and transporting of this sluice material offsite for disposal

Dynegy evaluated the following on-site and off-site alternative capacity options for these CCR wastestreams:

- Dry fly ash (Approx. 69,200 tons/year handled dry in 2019):
  - On-site alternative capacity is currently not available and would need to be developed. There is no on-site CCR landfill that is permitted to receive the dry fly ash. The Fly Ash Pond system is no longer active and has been closed under an approved closure plan.
  - On-site alternative capacity would require the design, permitting, and installation of a new CCR impoundment. The environmental permitting would include a general NPDES stormwater construction permit (includes threatened and endangered species and historic preservation assessments), a construction & operating permit under the Illinois CCR rule (35 IAC 845), and a Stormwater Pollution Prevention Plan (SWPPP) at a minimum. Based on our experience with environmental permitting, this effort could require three to four years.
  - Off-site alternative capacity is currently not available and would need to be developed. Developed off-site alternative capacity for fly ash would consist of off-site transportation to a contracted landfill. The fly ash is normally conditioned (@ 10% moisture) in an on-site pug mill due to fugitive dusting concerns. This low-sulfur Powder River Basin Class C fly ash develops cementitious characteristics when conditioned with water rather quickly. Because of this, off-site transportation must be limited to less than a one-hour haul time, or within 40 miles of the station, to prevent the fly ash from setting up and hardening and causing adverse disposal / unloading issues at the offsite landfill. There are three landfills within approximately 40 miles of the station (see Figure 2 in Appendix A), so Dynegy is continuing to have discussions with these offsite landfills to determine if they have the capacity and the infrastructure to handle this daily quantity of fly ash. This will also include efforts to characterize the waste. Dynegy will update EPA in forthcoming progress reports if offsite disposal capacity becomes available. Off-site alternative capacity would consist of off-site transportation utilizing approximately 11 trucks daily. The daily truck traffic would result in increased potential for safety and noise impacts and further increases in fugitive dust, greenhouse gas emissions and carbon footprint which may require a Prevention of Significant Deterioration (PSD) permit and modification under the Clean Air Act Permit Program if the calculated increases in emissions is over the PSD limits.
- Bottom ash, economizer ash, and non-CCR mil rejects sluice (2.8 MGD average):
  - On-site alternative capacity is currently not available and would need to be developed. The cooling pond, coal pile runoff pond, metal cleaning waste pond, sewage treatment ponds,

cove pond, secondary pond, and tertiary pond are not CCR surface impoundments and cannot receive CCR materials.

- Development of on-site alternative capacity would require the design, permitting, and installation of a new treatment system including CCR ponds, clarifiers, and/or storage tank(s), to provide the necessary retention time to meet the NPDES permit limits. The environmental permitting would include a modification to the current individual NPDES permit (to allow for the rerouting of this wastestream to another outfall), a general NPDES stormwater construction permit (includes threatened and endangered species and historic preservation assessments), a construction & operating permit under the Illinois CCR rule (35 IAC 845), and a SWPPP at a minimum which would require a minimum of three years to implement.
- Off-site alternative capacity is currently not available and would need to be developed. Developed off-site alternative capacity would consist of both temporary on-site wet storage (frac tanks) and off-site transportation via tanker trucks. With an average daily flow of 2.8 MGD of sluice water, approximately 134 frac tanks and 374 daily tanker trucks (~7,500 gallons per truck to maintain DOT weight restrictions) would be required, if a local POTW could be identified to receive it. The daily tanker truck traffic would result in increased potential for safety and noise impacts and further increases in fugitive dust, greenhouse gas emissions and carbon footprint which may require a PSD permit and modification under the Clean Air Act Permit Program if the calculated increases in emissions are over the PSD limits. Setting up arrangements for a local POTW to accept the wastewater would prove to be difficult since this amount of wastewater would most likely upset their treatment systems causing them to exceed their NPDES discharge limits. The potential for leaks/spills from the tank system or transportation of the wastewater offsite does exist. Furthermore, the temporary wet storage needed to accommodate off-site disposal would require reconfiguration, design, installation, and associated environmental permitting which would require a minimum of two years to implement. For all of these reasons, Dynegy has determined that offsite disposal is not feasible for these flows at Baldwin.

As stated previously, because Dynegy has elected to pursue the option to permanently cease coal-fired operations of the two remaining boilers at the station by no later than December 31, 2025, developing alternative disposal capacity is “illogical,” to use EPA’s words, and also counterproductive to the work to cease coal-fired operations of the boilers and close the impoundment. As long as Dynegy continues to wet handle the bottom ash material and Unit 1 and 2 SCR ash, air heater ash and economizer ash material, there are no other on-site CCR impoundments available to receive and treat these flows. The remaining impoundments onsite (cooling pond, coal pile runoff pond, metal cleaning waste pond, sewage treatment ponds, cove pond, secondary pond, and tertiary pond) are not authorized to receive the CCR material. Also, it is not feasible to dispose of the wet-generated material off-site. As EPA explained in the preamble of the 2015 rule, it is not possible for sites that sluice CCR material to an impoundment to eliminate the impoundment and dispose of the material offsite. *See* 80 Fed. Reg. 21,301, 21,423 (Apr. 17, 2015) ("[W]hile it is possible to transport dry ash off-site to [an] alternate disposal facility that is simply not feasible for wet-generated CCR. Nor can facilities immediately convert to dry handling systems."). As a result, the conditions at Baldwin satisfy the demonstration requirement in § 257.103(f)(2)(i).

Consequently, in order to continue to operate and generate electricity, Baldwin must continue to use the 177-acre CCR surface impoundment to manage the CCR wastestreams discussed above. Dynegy is working with nearby offsite landfills to characterize waste and determine potential for offsite disposal, which currently does not exist. Accordingly, the fly ash must be placed in the only available onsite disposal location (i.e., the Bottom Ash Pond) unless alternative offsite capacity can be established.

3.3 Non-CCR Wastestreams

Dynegy evaluated each non-CCR wastestream placed in the Bottom Ash Pond at Baldwin. For the reasons discussed below in Table 3-2, each of the following non-CCR wastestreams must continue to be placed in the Bottom Ash Pond due to lack of alternative capacity both on and off-site.

Table 3-2: Baldwin Non-CCR Wastestreams

Non-CCR Wastestreams	Estimated Average Flow (MGD)	Alternative Disposal Capacity Currently Available? YES/NO	Details
Non-Chemical Metal Cleaning Wastewater	Intermittent (6.0 during discharge)	NO	Currently, alternative capacity is not available nor is there a feasible option for all these wastestreams as discussed below. On-site alternative capacity would need to be designed, permitted, and installed. Off-site alternative capacity would include development of on-site temporary tanks and transporting of this sluice material offsite for disposal.
Sewage Treatment Plant Effluent	Intermittent (0.028)	NO	
Unit 2 Polisher Precoat System Wastewater	Intermittent (0.01)	NO	
Cove Area Discharge *	Intermittent (0.5)	NO	
Regen Wastewater	Intermittent (0.03)	NO	

Non-CCR Wastestreams	Estimated Average Flow (MGD)	Alternative Disposal Capacity Currently Available? YES/NO	Details
Chemical Metal Cleaning Wastewater	Intermittent	YES	This wastewater can be and has been transported offsite for disposal.

* Includes Unit 1 boiler room sump, Unit 1 boiler low point drains, oil/water separator, SDA emergency discharge, water treatment system, Unit 1 Polisher Precoat system, and floor drains

Dynegy evaluated on-site and off-site alternative capacity options for the non-CCR wastestreams. Development of on-site alternative capacity would require the design, permitting, and installation of a new treatment system including non-CCR ponds, clarifiers, and/or storage tank(s) to provide the necessary retention time for TSS removal to meet the NPDES permit limits. The environmental permitting would include a modification to the current individual NPDES permit (to allow for the rerouting of this wastestream to another outfall), general NPDES stormwater construction permit (includes threatened and endangered species and historic preservation assessments), a construction & operating permit, and a SWPPP at a minimum which would require a minimum of three years to implement.

Development of off-site alternative capacity would consist of both temporary on-site wet storage (frac tanks) and off-site transportation via tanker trucks assuming a local POTW could be identified to receive these streams. The required daily frac tanks and tanker trucks (~7,500 gallons per truck to maintain DOT weight restrictions) for each wastestream during each sluicing event is provided in Table 3-3. The daily tanker truck traffic would result in increased potential for safety and noise impacts and further increases in fugitive dust, greenhouse gas emissions and carbon footprint which may require a PSD permit and modification under the Clean Air Act Permit Program if the calculated increases in emissions are over the PSD limits. Setting up arrangements for a local POTW to accept this wastewater could prove to be difficult if this amount of wastewater would upset their treatment systems, causing them to exceed their NPDES discharge limits. Dynegy is continuing to have discussions with local POTW's to determine if they have the capacity and the infrastructure to handle these daily volumes of wastewater. This will also include efforts to characterize the waste. Dynegy will update EPA in forthcoming progress reports if offsite disposal capacity becomes available. The potential for leaks/spills from the tank system or transportation of the wastewater offsite does also exist. Furthermore, the temporary wet storage needed to accommodate off-site disposal would require reconfiguration, design, installation, and associated environmental permitting which would require a minimum of one year to implement. For all of these reasons, Dynegy has determined that offsite disposal is not feasible for these flows at Baldwin at this time.

Table 3-3: Non-CCR Wastestream Offsite Disposal

Non-CCR Wastestreams	Estimated Flow (MGD)	No. of Frac Tanks required (21,000 gallons each)	No. of Trucks required per day (7,500 gallons each)
Non-Chemical Metal Cleaning Wastewater	6.0 (during outages)	286	800
Sewage Treatment Plant Effluent	0.028	NA	4
Unit 2 Polisher Precoat System Wastewater	0.01	1	2
Cove Area Discharge	0.5	NA	67
Regen Wastewater	0.03	2	4
Total		**289**	**877**

As stated previously, because Dynegy has elected to pursue the option to permanently cease the use of the two remaining coal fired boilers at the station by no later than December 31, 2025, developing the above-referenced alternative disposal capacity methods is "illogical," to use EPA's words, and also counterproductive to the work to cease coal-fired operations of the boilers and close the impoundment. There is no currently available infrastructure at the plant to support reroute of these flows. For the reasons discussed above, each of the non-CCR wastestreams must continue to be placed in the Bottom Ash Pond due to lack of alternative capacity both on and off-site. Consequently, in order to continue to operate and generate electricity, Baldwin must continue to use the 177-acre Bottom Ash Pond to manage the non-CCR wastestreams discussed above.

4.0 RISK MITIGATION PLAN

To demonstrate that the criteria in § 257.103(f)(2)(ii) has been met, Dynegy has prepared and attached a Risk Mitigation Plan for the Baldwin Bottom Ash Pond (see Attachment 1). Per § 257.103(f)(2)(v)(B), this Risk Mitigation Plan is only required for the specific CCR Unit(s) that are seeking an extension pursuant to this demonstration.

5.0 DOCUMENTATION AND CERTIFICATION OF COMPLIANCE

In the Part A rule preamble, EPA reiterates that compliance with the CCR rule is a prerequisite to qualifying for an alternative closure extension, as it "provides some guarantee that the risks at the facility are properly managed and adequately mitigated." 85 Fed. Reg. at 53,543. EPA further stated that it "must be able to affirmatively conclude that facility meets this criterion prior to any continued operation." 85 Fed. Reg. at 53,543. Accordingly, EPA "will review a facility's current compliance with the requirements governing groundwater monitoring systems." 85 Fed. Reg. at 53,543. In addition, EPA will also "require and examine a facility's corrective action documentation, structural stability documents and other pertinent compliance information." 85 Fed. Reg. at 53,543. Therefore, EPA is requiring a certification of compliance and specific compliance documentation be submitted as part of the demonstration. 40 C.F.R. § 257.103(f)(2)(v)(C).

The Baldwin facility includes two CCR units: the Bottom Ash Pond and the Fly Ash Pond system. The Bottom Ash Pond is the only unit seeking an extension pursuant to this demonstration. The Fly Ash Pond system has been closed in accordance with the CCR Rule; however, Dynegy has included compliance documents for both units as part of this submittal for the Baldwin facility.

To demonstrate that the criteria in § 257.103(f)(2)(iii) has been met, Dynegy is submitting the following information as required by § 257.103(f)(2)(v)(C):

5.1 Owner's Certification of Compliance - § 257.103(f)(2)(v)(C)(1)

I hereby certify that, based on my inquiry of those persons who are immediately responsible for compliance with environmental regulations for Baldwin, the facility is in compliance with all of the requirements contained in 40 C.F.R. Part 257, Subpart D – Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. The Baldwin CCR compliance website is up-to-date and contains all the necessary documentation and notification postings.

On behalf of Dynegy:

Cynthia E Vodopivec

Cynthia Vodopivec
VP - Environmental Health & Safety
November 30, 2020

5.2 Visual representation of hydrogeologic information - § 257.103(f)(2)(v)(C)(2)

Consistent with the requirements of § 257.103(f)(2)(v)(C)(2)(i) – (iii), Dynegy has attached the following items to this demonstration:

- Map(s) of groundwater monitoring well locations in relation to the CCR units (see Attachment 2 for the Bottom Ash Pond and Attachment 6 Hydrogeologic Monitoring Plan Figure 1 for the Fly Ash Pond system)
- Well construction diagrams and drilling logs for all groundwater monitoring wells (Attachment 3)
- Maps that characterize the direction of groundwater flow accounting for seasonal variations (see Attachment 4 for the Bottom Ash Pond and Attachment 6 Hydrogeologic Monitoring Plan Figures 5-7 for the Fly Ash Pond system)

5.3 Groundwater monitoring results - § 257.103(f)(2)(v)(C)(3)

Tables summarizing constituent concentrations at each groundwater monitoring well through the first 2020 semi-annual monitoring period are included as Attachment 5. Samples were taken for the second 2020 semi-annual monitoring period, but results are still under review.

5.4 Description of site hydrogeology including stratigraphic cross-sections - § 257.103(f)(2)(v)(C)(4)

A description of site hydrogeology and stratigraphic cross-sections of both the Bottom Ash Pond and Fly Ash Pond systems are included in the Baldwin Hydrogeologic Monitoring Plan, as Attachment 6. Refer to Section 2 of the Hydrogeologic Monitoring Plan for a comprehensive discussion of site hydrogeology and Figures 4A-4E and Appendix A for geologic cross sections.

5.5 Corrective measures assessment - § 257.103(f)(2)(v)(C)(5)

Background sampling at Baldwin began in late 2015 and continued for eight consecutive quarters. The first semiannual detection monitoring samples were collected in November 2017. The first assessment monitoring samples were collected in June 2018.

The results from the 2020 monitoring period indicated a potential SSL for Lithium, an Appendix IV constituent for the Bottom Ash Pond. However, successful Alternate Source Demonstrations (ASDs) were completed for the March 2019, September 2019, and March 2020 sampling events. The Bottom Ash Pond remains in assessment monitoring, with no exceedances of the Appendix IV parameters. Accordingly, an assessment of corrective measures is not currently required for the Bottom Ash Pond. Baldwin will continue to conduct groundwater monitoring in accordance with all state and federal requirements.

The most recent ASD was completed in accordance with 40 C.F.R. § 257.95(g)(3)(ii) on October 26, 2020 for a sampling event that took place on March 26, 2020. The sampling event indicated a potential SSL for Lithium. The following two lines of evidence were used to demonstrate that another source was responsible for the SSL:

- The median lithium concentration in the Bottom Ash Pond porewater is lower than the median concentrations observed in background and downgradient groundwater.
- The Bottom Ash Pond porewater has a different ionic composition than groundwater.

The complete ASD is available in Attachment 1.

The Baldwin Fly Ash Pond System consists of three unlined surface impoundments: the East Fly Ash Pond, Old East Fly Ash Pond, and West Fly Ash Pond, with a combined surface area of approximately 232 acres. Closure of the Fly Ash Pond System was recently completed in accordance with a closure plan approved by the Illinois Environmental Protection Agency (IEPA) on August 16, 2016. The Assessment of Corrective Measures Report was completed on September 5, 2019 and updated on November 30, 2020 and is attached as Attachment 7. The groundwater plume associated with the Fly Ash Pond System was modeled and does not come into contact with the Kaskaskia River.

5.6 Remedy selection progress report - § 257.103(f)(2)(v)(C)(6)

As noted above, an assessment of corrective measures and the resulting selection of remedy are not currently required for the Bottom Ash Pond.

The remedy selection progress reports for the Fly Ash Pond System from March and September 2020 are included as Attachment 8.

5.7 Structural stability assessment - § 257.103(f)(2)(v)(C)(7)

Pursuant to § 257.73(d), the initial structural stability assessment for the Bottom Ash Pond was prepared in October 2016 and is included as Attachment 9. Since the closure of the Fly Ash Pond System was initiated concurrently with the deadline to publish the initial structural stability assessment, Dynegy never developed this document for the Fly Ash Pond System. The Fly Ash Pond System completed closure on November 17, 2020.

5.8 Safety factor assessment - § 257.103(f)(2)(v)(C)(8)

Pursuant to § 257.73(e), the initial safety factor assessment for the Bottom Ash Pond was prepared in October 2016 and is included as Attachment 10. Since the closure of the Fly Ash Pond System was initiated concurrently with the deadline to publish the initial safety factor assessment, Dynegy never developed this document for the Fly Ash Pond System. The Fly Ash Pond System completed closure on November 17, 2020.

6.0 DOCUMENTATION OF CLOSURE COMPLETION TIMEFRAME

To demonstrate that the criteria in § 257.103(f)(2)(iv) has been met, "the owner or operator must submit the closure plan required by § 257.102(b) and a narrative that specifies and justifies the date by which they intend to cease receipt of waste into the unit in order to meet the closure deadlines." The closure plan for the Bottom Ash Pond, along with an addendum, is included as Attachment 11.

In order for a CCR surface impoundment over 40 acres to continue to receive CCR and non-CCR wastestreams after the initial April 11, 2021 deadline, the coal-fired boiler(s) at the facility must cease operation and the CCR surface impoundment must complete closure no later than October 17, 2028. As discussed below, Baldwin will begin construction of the Bottom Ash Pond closure by April 17, 2025, the remaining two boilers will cease coal-fired operations no later than December 31, 2025, and Baldwin will cease placing wastestreams into the Bottom Ash Pond by July 17, 2027 in order for closure to be completed by this deadline.

Table 6-1 is included below to summarize the major tasks and durations associated with closing the Bottom Ash Pond in place. These durations are consistent with the durations experienced with the closure of approximately 500 acres of other CCR impoundments already completed by Dynegy and its affiliates to date as noted below:

- Baldwin Fly Ash Pond System – 230 acres closed in-place with an approximate 30-month construction schedule
- Hennepin West Ash Ponds System – 35 acres closed in-place with an approximate 24-month construction schedule (includes closure by removal of an adjacent 6-acre settling pond and installing a sheet pile wall)
- Hennepin East Ash Ponds 2 and 4 – 25 acres closed in-place with an approximate 6-month construction schedule
- Coffeen Ash Pond 2 – 60 acres closed in-place with an approximate 24-month construction schedule
- Duck Creek Ash Ponds 1 and 2 – 130 acres closed in-place with an approximate 24-month construction schedule

Each CCR impoundment closure indicated above utilized a closely coordinated passive or gravity dewatering method, which consisted of the use of trenches excavated to lower the phreatic surface in portions of the impoundment to obtain a stable ash surface to permit the safe construction of the final cover system. The phreatic water in the trenches flows by gravity to sumps constructed within the impoundment.

The major benefit associated with this passive or gravity dewatering method is that the sumps are designed to provide holding time to allow the TSS to settle within the impoundment prior to discharge (an active dewatering method with wells would result in potential discharges of unsettled TSS). After solids settling, the water is discharged through the NPDES outfall in compliance with permitted limits.

Construction progressed sequentially as the dewatering of an area stabilized the ash surface. The CCR was graded to subgrade level, then overlain with the compacted clay layers and/or geomembrane liners. Vegetative soil cover was then placed on top of the infiltration layer. As each section of the impoundment was closed, this sequencing progressed to the completion of the pond closure. A similar process will be utilized to close the Baldwin Bottom Ash Pond in order to allow the final open section of the impoundment to be large enough for the impoundment to remain in operation until the pond ceases the receipt of waste on July 17, 2027. This would provide sufficient time for closure to be completed by October 17, 2028.

The first construction effort will involve modifying the pond operations by relocating the influent lines, minimizing the pond water levels, and isolating flow to a smaller portion of the current 177-acre impoundment that can be closed during the last two construction seasons. The smaller active portion of the pond will remain in operation while Dynegy begins dewatering and closing the impoundment as described above. This reduction in footprint may require the addition of chemical feeds to provide adequate treatment but that has not been the case at our other sequenced closures. This approach simultaneously allows for continued operation of the plant to maintain generating capacity for the MISO markets and minimizes the risk to the environment both by minimizing the pond size and the potential for any impacts to groundwater and by opening up a significant portion of the remaining impoundment to allow for dewatering, grading, and closure (in Phase 1).

Table 6-1 provides estimates for the durations required to close a portion of pond footprint after the date noted to begin closure (Phase 1), as well as the estimates for the closure of the active area (Phase 2, remaining 40-50 acres). In order to dewater the closure area, Dynegy will likely release pond water through the existing Outfall 001.

Table 6-1: Baldwin Bottom Ash Pond Closure Schedule

Action	Estimated Timeline (Months)
Spec, bid, and Award Engineering Services for CCR Impoundment Closure	3
Finalize CCR unit closure plan and seek IEPA approval for CCR unit closure	12
Obtain environmental permits (based on IEPA approval of closure plan): • State Waste Pollution Control Construction/Operating Permit • NPDES Industrial Wastewater Permit Modification (*modification would be required to allow the associated ponded and subsurface free liquids generated before the pond closure to be discharged to Waters of the US and to allow reconfiguration of the various wastestreams to either other NPDES-permitted outfalls or newly-constructed NPDES-permitted outfalls*) • General NPDES Permit for Storm Water Discharges from Construction Site Activities and a SWPPP • Proposed 35 Ill. Admin Code 845 operating permit application is due NLT September 2021. Construction permit application is anticipated to be due NLT July 2023.	21
Spec, bid, and Award Construction Services for CCR Impoundment Closure	3
Begin Construction of Closure	April 17, 2025
Minimize Active Area of Impoundment / Dewater Phase 1 Area	6
Cease Coal-Fired Operations of Remaining Two Boilers Onsite (No Later Than)	December 31, 2025
Regrade CCR Material in Phase 1 Area	18
Install Cover System – Phase 1 Area*	13
Establish Vegetation – Phase 1 Area**	2
Cease Placement of Waste (No Later Than, allowing for plant cleanup and dredging of other impoundments following coal pile and plant closure)	July 17, 2027

Action	Estimated Timeline (Months)
Dewater Impoundment – Phase 2 Area	3
Regrade CCR Material – Phase 2 Area	6
Install Cover System – Phase 2 Area	5
Establish Vegetation, Perform Site Restoration Activities, Complete Closure, and Initiate Post-Closure Care**	2
Total Estimated Time to Complete Closure	81 months (including design, permitting, and procurement)
Date by Which Closure Must be Complete	October 17, 2028

* Activity expected to overlap with grading operations, finishing 2 months after grading is completed

** Activity expected to overlap with cover system installation, finishing 1 month after cover installation is completed

7.0 CONCLUSION

Based upon the information included in and attached to this demonstration, Dynegy has demonstrated that the requirements of 40 C.F.R. § 257.103(f)(2) are satisfied for the 177-acre Baldwin Pond System. This CCR surface impoundment is needed to continue to manage the CCR and non-CCR wastestreams identified in Section 3.2 and 3.3 above, is larger than 40 acres, and the remaining two boilers at the station will cease coal-fired operation no later than December 31, 2025 and the Bottom Ash Pond will be closed by the October 17, 2028 deadline. Therefore, this CCR unit qualifies for the site-specific alternative deadline for the initiation of closure authorized by 40 C.F.R. § 257.103(f)(2).

Therefore, it is requested that EPA approve Dynegy's demonstration and authorize the Bottom Ash Pond at Baldwin to continue to receive CCR and non-CCR wastestreams notwithstanding the deadline in § 257.101(a)(1) and to grant the alternative deadline of October 17, 2028, by which to complete closure of the impoundment.

APPENDIX A – SITE PLAN AND NEARBY LANDFILLS

BURNS McDONNELL

date 03/18/2020

designed A. MYERS

LUMINANT

BALDWIN ENERGY COMPLEX

SITE PLAN

project 122702

contract -

dwg **FIGURE 1** -

4/1/2020

Z:\Clients\ENR\VistraEnergy\122702_ALTuseDisposal\Design\Civil\Dwgs\Sketches\Baldwin_Figure 1.dgn

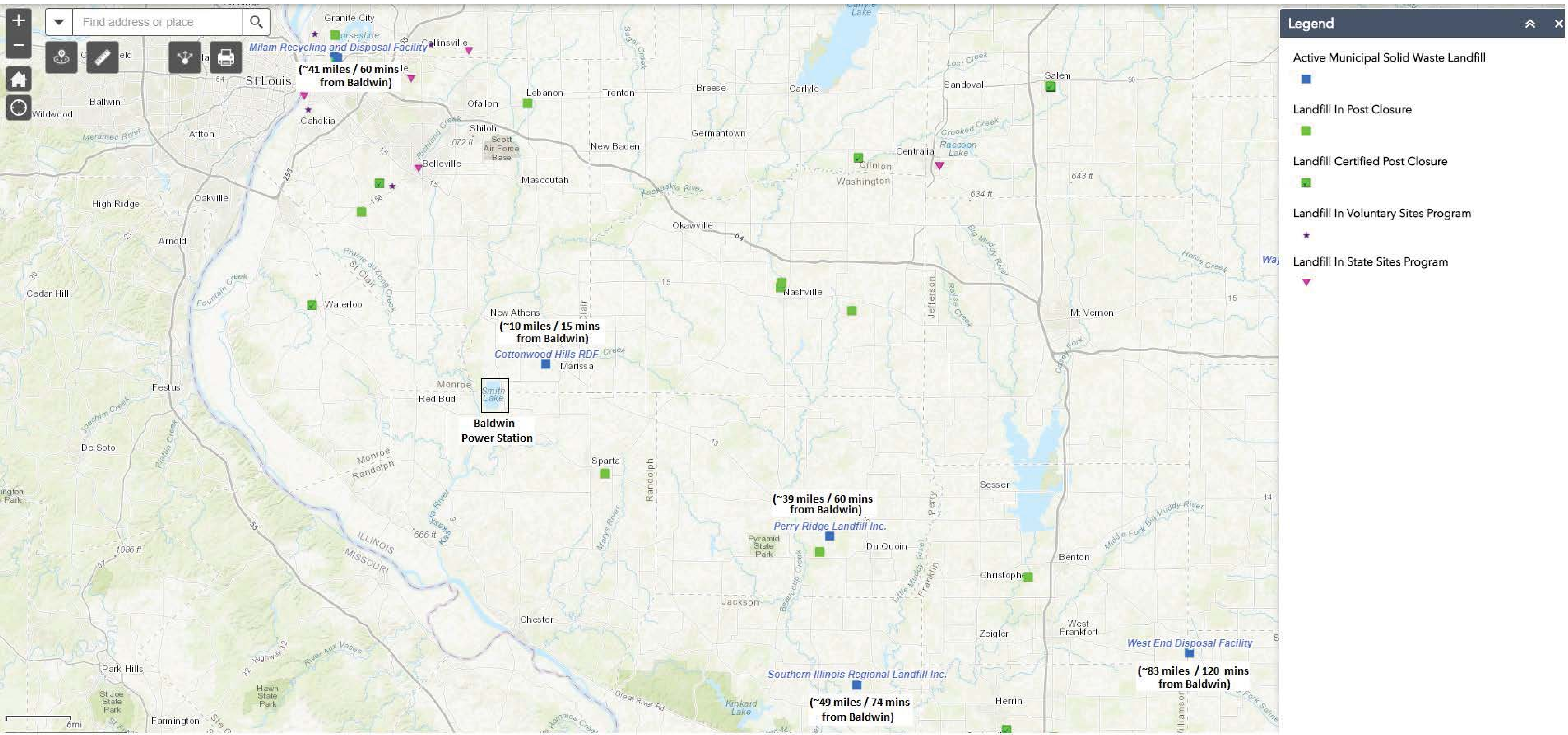
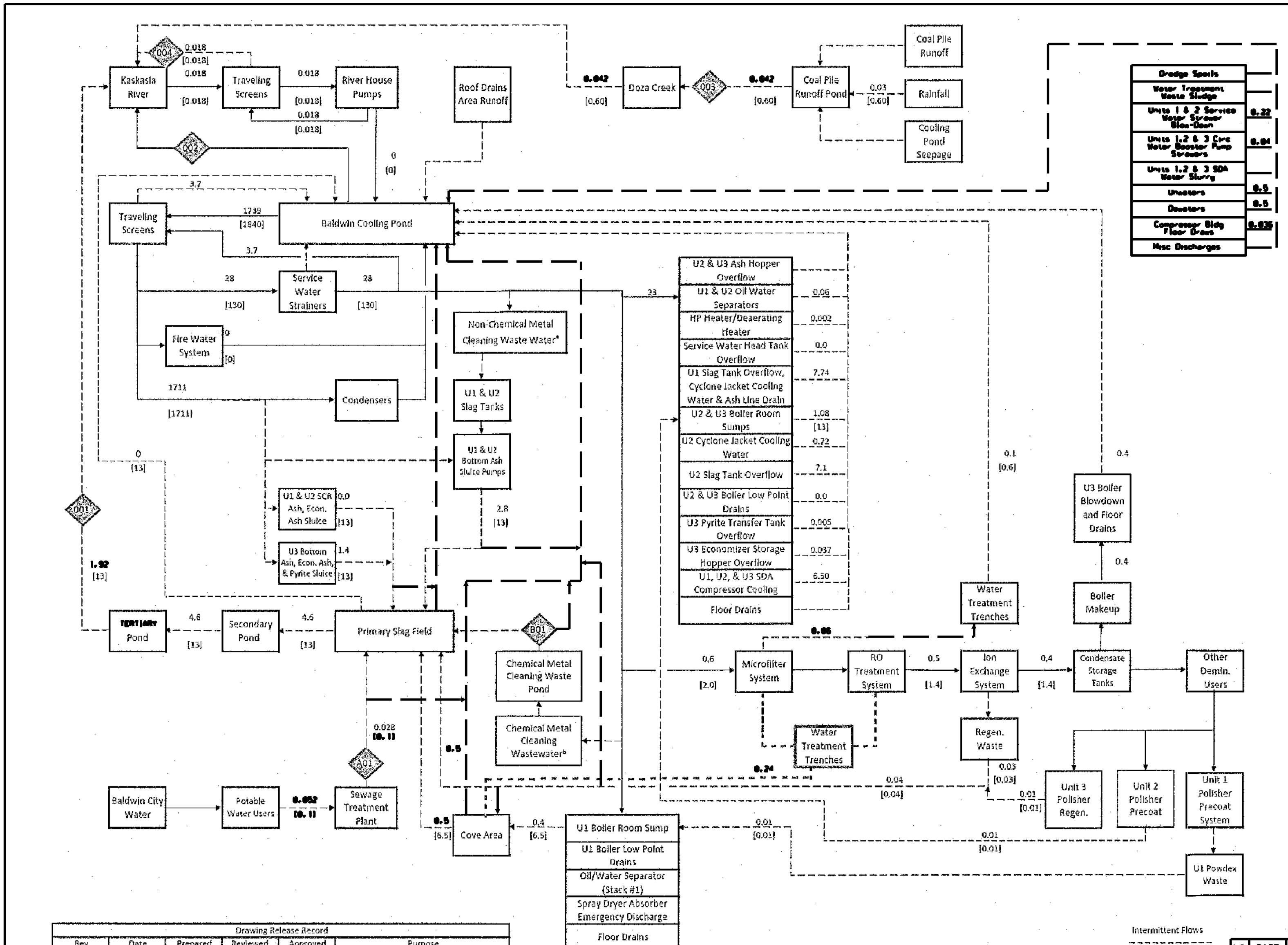

Legend
Active Municipal Solid Waste Landfill
Landfill In Post Closure
Landfill Certified Post Closure
Landfill In Voluntary Sites Program
Landfill In State Sites Program
Find address or place
Milam Recycling and Disposal Facility
(~41 miles / 60 mins from Baldwin)
Cottonwood Hills RDF
(~10 miles / 15 mins from Baldwin)
Baldwin Power Station
Perry Ridge Landfill Inc.
(~39 miles / 60 mins from Baldwin)
Southern Illinois Regional Landfill Inc.
(~49 miles / 74 mins from Baldwin)
West End Disposal Facility
(~83 miles / 120 mins from Baldwin)
Granite City
Collinsville
St Louis
Ballwin
Wildwood
Cahokia
Affton
Lebanon
Trenton
Breese
Carlyle
Sandoval
Salem
Ofallon
Shiloh
Scott Air Force Base
Belleville
New Baden
Germantown
Centralia
Clinton
Washington
Mascoutah
Okawville
Oakville
High Ridge
Arnold
Cedar Hill
Waterloo
Nashville
Mt Vernon
New Athens
Marissa
Monroe
Red Bud
Festus
De Soto
Sparta
Sesser
Pyramid State Park
Du Quoin
Benton
Christopher
Jackson
Chester
West Frankfort
Zeigler
Herrin
Park Hills
St Joe State Park
Hawn State Park
Farmington
Kinkaid Lake
ILLINOIS
MISSOURI
6mi

FIGURE 2

APPENDIX B – WATER BALANCE DIAGRAM



Notes:

1 Flows shown as: Average (Maximum)

2 Flow units = Million Gallons per Day

3 Average Outfall 001 Discharge based on DMR records from **4/3/2018 through 3/19/2019.**

4 Pretreatment Filter and RO Wastewater is based on total pretreatment microfilter and RO wastewater flows indicated on Drawing BAL-M1204-1.

5 **Demineralizer Regeneration Waste based on three 3-Bed Demineralizer Train regenerations once per month, three Mixed Bed regenerations every 3 weeks and three Strong Anion regenerations once every 4 days.**

6 Non-chemical metal cleaning waste (boiler fire side cleaning and air heater wash water) is delivered to the ash ponds with the bottom ash sluicing system.

7 Outfall 002 does not normally discharge

8 Contributors to Cove Area, based on instantaneous maximum flow from one U1 Boiler Room Sump Pump

9 Average Outfall 003 Discharge based on DMR records from **4/20/2018** through **3/19/2019.**

10 Outfall 004 Travelling Screen Washwater flow from DMR records from **1/31/2018** through **11/26/2018.**

11 Average Outfall A01 Sewage Treatment Plant Effluent Flow from DMR records from **5/31/2018 through 4/30/2019**

12 Maximum Circulating Water Pump Flow is based on nine (3 per unit) 132,000 gpm circulating water pumps operating simultaneously. Pump flows from Unit Engineering Data Books.

13 Maximum Service Water Pump Flow is based on six (2 per unit) 15,000 gpm circulating water pumps operating simultaneously. Pump flows from Unit Engineering Data Books.

14 Unit 2 Boiler Room Sump pump capacities are one 4500 gpm and one 1500 gpm pump from Engineering Data Book

15 Unit 3 Boiler Room Sump pump capacities are 2 1500 gpm pumps from Engineering Data Book

16 Source of flows not otherwise indicated is the Baldwin NPDES Permit, effective January 1, 2015.

17 Components representing Unit 1 and Unit 2 bottom ash stack, and U3 bottom ash ponds have been added between bottom ash sluicing and the secondary ash ponds.

a. Non-Chemical Metal Cleaning Waste Water Includes:
Boiler Fire-side Water Washing
Economizer Cleaning
U1 & U2 Air Heater Cleaning
Condenser Tube Cleaning
Misc. Non-Chemical Metal Cleaning Waste Water

b. Chemical Metal Cleaning Waste Water
Boiler Tube Cleaning
Misc. Chemical Metal Cleaning Waste Water

Drawing Release Record

Rev	Date	Prepared	Reviewed	Approved	Purpose
A0	4-Sep-15	M. Heermann	M. Rosen	A. Baker	Initial Issue
A1	16-Oct-15	M. Heermann	M. Rosen	A. Baker	Client Comments Incorporated
A2	9-Nov-15	M. Heermann	M. Rosen	A. Baker	Plant Comments Incorporated

NO	DATE	REVISIONS	E	C	A
1	05-22-09	FIELD REVISIONS			
2	9/29/17	FIELD REVISIONS BY [illegible]	CWB		KE
3	10/5/17	FIELD REVISIONS BY [illegible]	CWB		PM
4	6/25/19	FIELD REVISIONS BY [illegible]	CWB		TA

ILLINOIS POWER COMPANY
BALDWIN POWER STATION

PROJECT NO. 1244 | WASTEWATER TREATMENT

EXISTING WASTEWATER
INVENTORY DIAGRAM

PLOTTED 02-07-91
CHICAGO, ILLINOIS | DATE 08-10-88 | DWG NO. CE-BAL1-M2001

ATTACHMENT 1 – RISK MITIGATION PLAN (BOTTOM ASH POND)

RISK MITIGATION PLAN - 40 C.F.R. § 257.103(f)(2)(v)(B)

INTRODUCTION

To demonstrate that the criteria in 40 C.F.R. § 257.103(f)(2)(ii) has been met, Dynegy Midwest Generation, L.L.C. (DMG) has prepared this Risk Mitigation Plan for the Baldwin Energy Complex (BEC) Bottom Ash Pond.

- EPA is requiring a risk mitigation plan to "address the potential risk of continued operation of the CCR surface impoundment while the facility moves towards closure of their coal-fired boiler(s), to be consistent with the court's holding in *USWAG* that RCRA requires EPA to set minimum criteria for sanitary landfills that prevent harm to either human health or the environment." 85 Fed. Reg. at 53,516, 53,548 (Aug. 28, 2020).

As required by § 257.103(f)(2)(v)(B), the Risk Mitigation Plan must describe the "measures that will be taken to expedite any required corrective action," and contain the three following elements:

- First, "a discussion of any physical or chemical measures a facility can take to limit any future releases to groundwater during operation." § 257.103(f)(2)(v)(B)(1). In promulgating this requirement, EPA explained that this "might include stabilization of waste prior to disposition in the impoundment or adjusting the pH of the impoundment waters to minimize solubility of contaminants [and that] [t]his discussion should take into account the potential impacts of these measures on Appendix IV constituents." 85 Fed. Reg. at 53,548.

- Second, "a discussion of the surface impoundment's groundwater monitoring data and any found exceedances; the delineation of the plume (if necessary based on the groundwater monitoring data); identification of any nearby receptors that might be exposed to current or future groundwater contamination; and how such exposures could be promptly mitigated." § 257.103(f)(2)(v)(B)(2).

- Third, "a plan to expedite and maintain the containment of any contaminant plume that is either present or identified during continued operation of the unit." § 257.103(f)(2)(v)(B)(3). In promulgating this final requirement, EPA explained that "the purpose of this plan is to demonstrate that a plume can be fully contained and to define how this could be accomplished in the most accelerated timeframe feasible to prevent further spread and eliminate any potential for exposures." 85 Fed. Reg. at 53,549. In addition, EPA stated that "this plan will be based on relevant site data, which may include groundwater chemistry, the variability of local hydrogeology, groundwater elevation and flow rates, and the presence of any surface water features that would influence rate and direction of contamination movement. For example, based on the rate and direction of groundwater flow and potential for diffusion of the plume, this plan could identify the design and spacing of extraction wells necessary to prevent further downgradient migration of contaminated groundwater." 85 Fed. Reg. at 53,549.

Consistent with these requirements and guidance, Dynegy plans to continue to mitigate the risks to human health and the environment from the BEC Bottom Ash Pond as detailed in this Risk Mitigation Plan.

1 OPERATIONAL MEASURES TO LIMIT FUTURE RELEASES TO GROUNDWATER – 40 C.F.R. § 257.101(F)(2)(V)(B)(1)

The BEC Bottom Ash Pond is a 177-acre CCR surface impoundment. Consistent with the requirements of the CCR rule, compliance documents on Baldwin's CCR public website reflect the characterization of the BEC Bottom Ash Pond as a single unit for purposes of groundwater monitoring and closure activities.

The Baldwin CCR surface impoundment receives CCR transport waters from bottom ash, economizer ash, SCR ash and air heater Ash plus non-CCR process waters onsite before discharging to the Baldwin Cooling Pond via Outfall 002 or the Tertiary Pond via Outfall 001 in accordance with NPDES Permit No. IL0004171.

At Baldwin, none of the Appendix IV parameter have reported statistically significant levels (SSLs) above their respective Ground Water Protection Standards (GWPSs), as sampled and analyzed per the facility's groundwater monitoring program. Therefore, Baldwin's current physical treatment operation adequately limits potential risks to human health and the environment during operation. Baldwin will continue this treatment process for the CCR surface impoundment until such time as closure is required per 40 CFR 257. The facility's current physical treatment process is discussed below, followed by a discussion of other treatment processes that could be implemented, as required per § 257.103(f)(2)(v)(B)(1).

1.1 CURRENT OPERATION OF PHYSICAL TREATMENT

Fly ash is captured dry. Therefore, current operations do not add fly ash transport waters to the CCR Impoundment.

As part of normal operations, bottom ash, economizer ash, SCR ash and air heater ash are transported through the sluice lines into the CCR surface impoundment where it is dewatered and transported offsite for beneficial reuse. The CCR surface impoundment is also a wastewater treatment settling system which allows the solids to settle.

Therefore, since fly ash transport water is not conveyed to the impoundment and bottom ash solids are removed from the impoundment, the current operation of Edwards' CCR impoundment limits future releases to groundwater during operation, and consequently no potential safety impacts or exposure to human health or environmental receptors are expected to result.

If Appendix IV releases are discovered per the facility's groundwater monitoring program, DMG will test, evaluate, and implement a chemical treatment method (i.e. pH adjustment, coagulation, precipitation, or other method as determined) for the Baldwin CCR Impoundment to limit potential risks to human health and the environment during operation.

2 GROUNDWATER IMPACTS, RECEPTORS, AND POTENTIAL EXPOSURE MITIGATION - 40 C.F.R. § 257.101(F)(2)(V)(B)(2)

The Baldwin Bottom Ash Pond is currently in assessment monitoring, with the first SSLs with GWPS exceedances reported in August 2019. As seen on Table 1, SSL exceedances have been reported for lithium at one monitoring well - MW-370 (see Figure 1 for well locations). Alternate Source Demonstrations (ASDs) have been completed for lithium following each SSL determination (see Appendix A of Attachment 1, 2019 Annual Groundwater Monitoring and Corrective Action Report, Baldwin Bottom Ash Pond [Ramboll, 2020], Attachment 2, Alternate Source Demonstration Baldwin Ash Pond [Ramboll, Oct. 2020]). The latest ASD for lithium was completed in October 2020 and will be included in the 2020 Annual Groundwater Monitoring and Corrective Action Report, due in January 2021.

Since there have been no SSL exceedances of GWPS(s)for any Appendix IV constituents attributable to the Bottom Ash Pond to date, plume delineation has not been required. However, if one or more Appendix IV constituents are detected at SSLs above the GWPS(s), the nature and extent of the release would be characterized to delineate the contaminant plume. The existing conceptual site model and description of site hydrogeology provides site characterization data that will be used as the basis for executing supplemental plume delineation activities. A demonstration may also be made that a source other than the CCR unit caused the contamination, or that the SSL resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (§257.95(g)(3)(ii)).

<u>Receptors</u>

For constituents of potential concern (COPCs) found in groundwater to pose a risk to human health or the environment, a complete exposure pathway must be present to a receptor with elevated concentrations of COPCs via that pathway.

Should a release of one or more Appendix IV parameters from the Baldwin Bottom Ash Pond to groundwater occur in the future, the two primary risks to human health and environmental receptors are via groundwater exposure and surface water exposure. Groundwater exposure would be via ingestion or dermal contact, both of which are likely an incomplete pathway for the reasons discussed below. Impacted groundwater potentially migrating to nearby surface water bodies – specifically the Kaskaskia River to the west and the Baldwin Plant Cooling Lake to the north is another potential exposure pathway; however, this is also likely incomplete for the reasons discussed below.

Ambient groundwater flow in the Uppermost Aquifer (Pennsylvanian and Mississippian bedrock; mainly shale and interbedded non-karst limestone) and overlying unlithified materials (clay, silt, and intermittent sand lenses) beneath the Bottom Ash Pond is generally to the west and southwest. Changes in groundwater elevation near the Bottom Ash Pond generally mimic bedrock surface topography. General groundwater flow direction is west and southwest toward the Kaskaskia River (i.e., regional discharge area) with localized flow toward bedrock surface lows, specifically the former bedrock valley feature beneath the non-CCR Secondary Pond and Tertiary Pond. The hydraulic gradient beneath the impoundments (Bottom Ash Pond and closed/capped Fly Ash Ponds) has ranged from 0.01 to 0.02 ft/ft as groundwater flows from east to west, with a flow velocity of approximately 0.0005 to 0.001 ft/day based on a bedrock hydraulic conductivity of 5 x 10-6 cm/s and a median effective porosity of 30 percent (refer to the description of hydrogeology attached to the alternative closure demonstration letter).

There are no potable industrial, commercial or domestic use water wells located in a downgradient or cross-gradient groundwater flow direction relative to the Bottom Ash Pond that are at risk of impacts from a release to groundwater. Two shallow Community Water Supply (CWS) wells for the villages of Baldwin and Red Bud, installed in sand and gravel alluvial deposits, are located along the opposite bank of the Kaskaskia River downstream from the BEC. The closest CWS well is located approximately 6,500 feet (1.2 miles) from the Bottom Ash Pond and 3,000 feet downstream from the BEC's outfall to the Kaskaskia River. Neither of these CWS wells are considered at risk because of their hydrogeologic location relative to the BEC property, including the Bottom Ash Pond.

The southerly-flowing Kaskaskia River is located approximately 1,110 feet west of the BEC property at its closest point and approximately 5,000 feet (0.95 miles) from the Bottom Ash Pond. There is one CWS surface water intake for the village of Sparta (i.e., Sparta intake), located within a meander of the Kaskaskia River approximately 1,200 feet southwest of the nearest site boundary, approximately 4,800 feet (~0.9 mile) feet southwest of the Bottom Ash Pond, and 2,200 feet downstream from the NPDES permitted outfall for the ash pond system. The Sparta intake was studied by the Illinois State Water Survey (ISWS,1995). Based upon comprehensive field sampling and analysis of water from the Kaskaskia River, Sparta intake, and BEC's outfall, followed by modeling, statistical analysis, and risk-assessment analyses of the data, the ISWS concluded that the probability of the river standard for boron of 1.0 milligrams per Liter (mg/L) being exceeded was "small", with a proposed adjusted surface water quality standard of 1.23 mg/L being exceeded only once every 25 years downstream of BEC's outfall. Groundwater flow is to the southwest and away from the Baldwin Plant Cooling Lake, therefore the risk to the lake via a groundwater pathway from the Bottom Ash Pond is considered very low.

Since there have been no SSLs above the GWPS attributable to the Bottom Ash Pond to date, there is no risk to ecological receptors located near the Baldwin Bottom Ash Pond. If a release to groundwater were to occur, ecological receptors could potentially be exposed to COPCs through ingestion or direct contact with impacted groundwater; however, should any surface water or sediment come into contact with impacted groundwater, the risk of exposure is likely low due to expected attenuation and dilution. Depending on the magnitude of the release and other factors, it may or may not be possible to estimate potential increases in COPC concentrations in surface water using mixing calculations.

Although current conditions do not pose a risk concern to human health or the environment, measures presented in the Contaminant Plume Containment Plan (Section 3.1 of this RMP) would address any future potential exposures and risks by containing potential groundwater impacts and mitigating impacts to potential receptors.

If one or more Appendix IV parameters are detected and confirmed in groundwater at a SSL above GWPS(s), and the SSL is not attributed to an alternate source, via an alternate source demonstration (ASD), the first steps to mitigating risk will involve the immediate implementation of source control, which, if necessary, could include installation and operation of a groundwater extraction well or recovery trench system. This immediate source control would allow for capture of impacted groundwater and prevention of further plume migration towards the principal potential receptors. Furthermore, to characterize the nature and extent of the release, plume delineation wells will be installed as necessary to define the magnitude and limits of the groundwater impacts.

Exposure Mitigation

Mitigation of future potential exposures to groundwater contamination from continued operation of the Bottom Ash Pond is discussed in detail in the following section.

3 CONTAMINANT PLUME CONTAINMENT: OPTIONS EVALUATION AND PLAN - 40 C.F.R. § 257.101(F)(2)(V)(B)(3)

Appropriate corrective measure(s) to address future potential impacted groundwater associated with the Bottom Ash Pond are based on impacts to the Uppermost Aquifer (shale and non-karst limestone bedrock) and overlying unlithified materials. The shallow bedrock yields water through interconnected secondary porosity features (e.g. cracks, fractures, crevices, joints, bedding planes and other secondary openings). The shallow bedrock is the only water-bearing unit that is continuous across the Site. Groundwater in the Pennsylvanian and Mississippian-aged bedrock mainly occurs under semi-confined to confined conditions with the overlying unlithified unit behaving as the upper confining unit to the Uppermost Aquifer. Based on field testing, the geometric mean horizontal hydraulic conductivity for the Uppermost Aquifer (Bedrock Unit) was 5.0 x 10-6 cm/s (refer to the description of hydrogeology attached to the alternative closure demonstration letter).

If one or more Appendix IV parameters are detected and confirmed in groundwater at a SSL above GWPS(s), and the SSL is not attributed to an alternate source, via an alternate source demonstration (ASD), the first steps to mitigating risk will involve the immediate implementation of source control, which, if necessary, could include installation and operation of a groundwater extraction well or recovery trench system. This immediate source control would allow for capture of impacted groundwater and prevention of further plume migration towards the principal potential receptors. Furthermore, to characterize the nature and extent of the release, plume delineation wells will be installed as necessary to define the magnitude and limits of the groundwater impacts. If applicable, notifications will be made to all persons who own the land or reside on the land that directly overlies any part of the groundwater plume. Additional soil and groundwater data will be collected as necessary to support a Corrective Measures Assessment (CMA), which will be initiated within 90 days of detecting the SSL. Further discussion of short-term and long-term corrective measures is further discussed in Section 3.1.

Since there has been no release of Appendix IV parameters to groundwater above GWPS(s), which would trigger a Corrective Measures Assessment (CMA) under 40 C.F.R. § 257.96 based on specific parameter concentrations and contaminant plume dimensions, several options are evaluated to address potential future plume containment. The evaluation criteria for assessing remedial options are the following: performance; reliability; ease of implementation; potential impacts of the remedies (safety, cross-media, and control of exposure to residual contamination); time required to begin and complete the remedy; and, institutional requirements that may substantially affect implementation of the remedy(s), such as permitting, environmental or public health requirements.

Although future potential source control measures (e.g. closure in place, closure by removal to off-site landfill, in-situ solidification/stabilization) are typically considered as part of a CMA process, the shorter-term options considered for mitigating groundwater impacts relative to a potential future release of one or more Appendix IV constituents at Baldwin are as follows:

- Groundwater Extraction
- Groundwater Cutoff Wall
- Permeable Reactive Barrier
- In-Situ Chemical Treatment
- Monitored Natural Attenuation (MNA)

These same groundwater remedial corrective measures will be evaluated for all Appendix IV constituents that present a future risk to human health or the environment.

Groundwater Extraction

This corrective measure includes installation of one or more groundwater pumping wells or trenches to control and extract impacted groundwater. Groundwater extraction captures and contains impacted groundwater and can limit plume expansion and/or off-site migration. Construction of a groundwater extraction system typically includes, but is not limited to, the following primary project components:

- Designing and constructing a groundwater extraction system consisting of a series of extraction wells or trenches located around the perimeter of the contaminant plume and operating at a rate to allow capture of CCR impacted groundwater.
- Designing a system to manage extracted groundwater, which may include modification to the existing NPDES permit, including treatment prior to discharge, if necessary.
- Ongoing inspection and maintenance of the groundwater extraction system.

Installation of a groundwater extraction system, whether wells or trenches, can be expedited with the assumption that there is a good conceptual site model (CSM) of the hydrogeological system around the CCR unit, groundwater flow and transport model, and aquifer testing. Upon notification of an SSL exceedance of a GWPS for one or more Appendix IV parameters, an aquifer test will be conducted, and groundwater model developed for designing a groundwater extraction system for optimization of contaminant plume capture.

Implementation of a groundwater extraction system presents design challenges due to the low permeability and heterogeneous lithology of the Uppermost Aquifer. Details of the bedrock bedding planes, fracture distribution and density, as well as the contaminant distribution within the fracture system, would be needed to effectively design the extraction system. Extracted groundwater would need to be managed, which may include modification to the existing NPDES permit and treatment prior to discharge, if necessary. Additional data collection and analyses would be required to design an extraction system. Construction could be completed within 1 year.

A schematic of a typical groundwater extraction well is shown on Figure 2. Based on site specific hydrogeology and future potential plume width and depth, a groundwater extraction system would likely consist of one to three extraction wells with pitless adapter's manifolded together with HDPE conveyance pipe to a common tank or lined collection vault prior to treatment, if necessary, and discharge.

Groundwater Cutoff Wall

Vertical cutoff walls are used to control and/or isolate impacted groundwater. Low permeability cutoff walls can be used to prevent horizontal off-site migration of potentially impacted groundwater. Cutoff walls act as barriers to migration of impacted groundwater and can isolate soils that have been impacted by CCR to prevent contact with unimpacted groundwater. Cutoff walls are often used in conjunction with an interior pumping system to establish a reverse gradient within the cutoff wall. The reverse gradient imparted by the pumping system maintains an inward flow through the wall, keeping it from acting as a groundwater dam and controlling potential end-around or breakout flow of contaminated groundwater.

A commonly used cutoff wall construction technology is the slurry trench method, which consists of excavating a trench and backfilling it with a soil-bentonite mixture, often created with the soils excavated from the trench. The trench is temporarily supported with bentonite slurry that is pumped into the trench as it is excavated. Excavation for cutoff walls is conducted with conventional hydraulic excavators, hydraulic excavators equipped with specialized booms to extend their reach (*i.e.*, long-stick excavators), or chisels and clamshells, depending upon the depth of the trench and the material to be excavated.

Cutoff walls could be used in combination with groundwater extraction. The strength of the bedrock and the required cutoff wall design depth are not known; verifying whether a cutoff wall could be constructed in the Uppermost Aquifer would be necessary. The effectiveness of a cutoff wall as a hydraulic barrier also relies on the contrast between the hydraulic conductivity of the aquifer and the cutoff wall. The most effective barriers have hydraulic conductivity values that are several orders of magnitude lower than the aquifer that it is in contact with. A cutoff wall designed with hydraulic conductivity of 1x10-7 cm/sec would be less than two orders of magnitude lower than the aquifer with a mean conductivity of 5x10-6 cm/sec.

Additional data collection and analyses would be required to design a cutoff wall. Construction could be completed within 2 to 3 years following characterization, design, permitting and construction. To attain GWPS, cutoff walls require a separate groundwater corrective measures to operate in concert with the hydraulic barriers. Cutoff walls are commonly coupled with MNA and/or groundwater extraction as groundwater corrective measures. The time to attain GWPS is dependent on the selected groundwater corrective measure or measures that are coupled with the cutoff walls. Cutoff walls require approval by the Illinois Environmental Protection Agency (IEPA) to be implemented.

Permeable Reactive Barrier

Chemical treatment via a Permeable Reactive Barrier (PRB) is defined as an emplacement of reactive materials in the subsurface designed to intercept a contaminant plume, provide a flow path through the reactive media, and transform or otherwise render the contaminant(s) into environmentally acceptable forms to attain remediation concentration goals downgradient of the barrier (EPRI, 2006).

As groundwater passes through the PRB under natural gradients, dissolved constituents in the groundwater react with the media and are transformed or immobilized. A variety of media have been used or proposed for use in PRBs. Zero-valent iron has been shown to effectively immobilize CCR constituents, including arsenic, chromium, cobalt, molybdenum, selenium, and sulfate. Zero-valent iron has not been proven effective for boron, antimony, or lithium (EPRI, 2006).

System configurations include continuous PRBs, in which the reactive media extends across the entire path of the contaminant plume; and funnel-and-gate systems, where barrier walls are installed to control groundwater flow through a permeable gate containing the reactive media. Continuous PRBs intersect the entire contaminant plume and do not materially impact the groundwater flow system. Design may or may not include keying the PRB into a low-permeability unit at depth. Funnel-and-gate systems utilize a system of barriers to groundwater flow (funnels) to direct the contaminant plume through the reactive gate. The barriers, typically some form of cutoff wall, are keyed into a low-permeability unit at depth to prevent short circuiting of the plume. Funnel-and-gate design must consider the residence time to allow chemical reactions to occur. Directing the contaminant plume through the reactive gate can significantly increase the flow velocity, thus reducing residence time.

The Uppermost Aquifer is a Bedrock Unit consisting mainly of limestone and shale overlain by unlithified, fine-grained soil deposits of variable thickness. Constructing an effective PRB system, including emplacement of reactive media, within the bedrock of the Uppermost Aquifer would be difficult, and may not be possible. In addition, CCR constituents in the Uppermost Aquifer that could potentially exceed their GWPS(s) may not be amenable to transformation or immobilization using reactive media. Therefore, PRB is not retained as a viable corrective measure to address future potential SSLs above GWPS(s) in the Uppermost Aquifer.

<u>In-Situ Chemical Treatment</u>

In-situ chemical treatment for inorganics are being tested and applied with increasing frequency. In-situ chemical treatment includes the targeted injection of reactive media into the subsurface to mitigate groundwater impacts. Inorganic contaminants are typically remediated through immobilization by reduction or oxidation followed by precipitation or adsorption (EPRI, 2006). Chemical reactants that have been applied or are in development for application in treating inorganic contaminants include ferrous sulfate, nanoscale zero-valent iron, organo-phosphorus nutrient mixture (PrecipiPHOS™) and sodium dithionite (EPRI, 2006). Zero-valent iron has been shown to effectively immobilize cobalt and molybdenum.

The Uppermost Aquifer is a Bedrock Unit consisting mainly of limestone and shale overlain by unlithified, fine-grained soil deposits of variable thickness. Constructing an effective PRB system, including emplacement of reactive media, within the bedrock of the Uppermost Aquifer would be difficult, and may not be possible. In addition, CCR constituents in the Uppermost Aquifer that could potentially exceed their GWPS(s) may not be amenable to transformation or immobilization using reactive media. Therefore, in-situ chemical treatment is not retained as a viable corrective measure to address future potential SSLs above GWPS(s) in the Uppermost Aquifer.

<u>Monitored Natural Attenuation (MNA)</u>

Upon notification of a release of one or more Appendix IV parameter(s) to groundwater, MNA will be evaluated with site-specific characterization data and geochemical analysis as a long term remedial option, combined with source control measures, through application of the USEPA's tiered approach to MNA (USEPA 1999, 2007 and 2015):

1. Demonstrate that the area of groundwater impacts is not expanding.
2. Determine the mechanisms and rates of attenuation.
3. Determine that the capacity of the aquifer is sufficient to attenuate the mass of constituents in groundwater and that the immobilized constituents are stable and will not remobilize.
4. Design a performance monitoring program based on the mechanisms of attenuation and establish contingency remedies (tailored to site-specific conditions) should MNA not perform adequately.

MNA is not regarded as a short-term remedial option for contaminant plume containment, but as a potential long- term option following implementation of shorter term control measures.

3.1 Containment Plan

Based on the options evaluated for containment of a future potential groundwater contaminant plume originating from the Baldwin Bottom Ash Pond for one or more Appendix IV constituents exceeding their GWPS(s), the most viable short-term option of those evaluated is a groundwater extraction system, which would allow for capture of impacted groundwater and prevent further plume migration towards the principal receptor, which is the Kaskaskia River to the west and southwest.

In circumstances where there is not an immediate concern of endangerment to human health or the environment, other longer-term corrective measures may be more viable and will be further evaluated at the Baldwin Bottom Ash Pond.

Depending on the location, depth, and plume geometry of any future potential Appendix IV exceedances of GWPSs, the specific parameter(s) with exceedances, and distance from potential receptors, other groundwater corrective measures discussed as part of the corrective options evaluation – groundwater cutoff wall and MNA -- are secondary remedial alternatives available for consideration following the current primary option of groundwater extraction for short-term application.

4 REFERENCES

Electric Power Research Institute (EPRI), 2006. Groundwater Remediation of Inorganic Constituents at Coal Combustion Product Management Sites, Overview of Technologies, Focusing on Permeable Reactive Barriers. Electric Power Research Institute, Palo Alto, California. Final Report 1012584, October 2006.

Illinois State Water Survey (ISWS), 1995. Illinois Power Company – Baldwin Power Plant Ash-Pond Effluent Boron Mixing with the Kaskaskia River. Office of River Water Quality, Peoria, IL and Office of Surface Water Resources, Champaign, IL; ISWS Contract Report 588. October 1995.

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USEPA, 2015. Use of Monitored Natural Attenuation for Inorganic Contaminants in Groundwater at Superfund Sites. Directive No. 9283.1-36. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. August 2015.

TABLES

Table 1 - Assessment Monitoring Program Summary, Baldwin Bottom Ash Pond

Sampling Dates	Analytical Data Receipt Date	Parameters Collected	SSL(s) Appendix IV	SSL(s) Determination Date	ASD Completion Date	CMA Completion / Status
June 26-27, 2018	August 22, 2018	Appendix III Appendix IV	NA	NA	NA	NA
September 26, 2018	October 24, 2018	Appendix III Appendix IV Detected[1]	Lithium (MW-370)	January 7, 2019	April 8, 2019	NA
March 19-20, 2019	April 15, 2019	Appendix III Appendix IV	Lithium (MW-370)	July 15, 2019	October 14, 2019	NA
September 24-25, 2019	October 24, 2019	Appendix III Appendix IV Detected[1]	Lithium (MW-370)	January 22, 2020	April 21, 2020	NA
March 25-26, 2020	April 28, 2020	Appendix III Appendix IV Detected	Lithium (MW-370)	July 27, 2020	TBD	TBD

[O: RAB 9/11/20; C: EJT 9/14/20]

Notes:
CMA = Corrective Measures Assessment
NA = Not Applicable
TBD = To Be Determined
1. Groundwater sample analysis was limited to Appendix IV parameters detected in previous events in accordance with 40 C.F.R. Part 257.95(d)(1).

FIGURES

Y:\Mapping\Projects\22\2285_Baldwin\MXD\ASD\Figure 1_MW and BAP Water Sam Loc_ASD.mxd

PROJECT: 169000XXXX | DATED: 4/16/2020 | DESIGNER: galarnmc

- BOTTOM ASH POND DOWNGRADIENT CCR MONITORING WELL LOCATION
- BOTTOM ASH POND BACKGROUND CCR MONITORING WELL LOCATION
- BOTTOM ASH POND POREWATER SAMPLE LOCATION
- BOTTOM ASH POND UNIT BOUNDARY

0 400 800 Feet

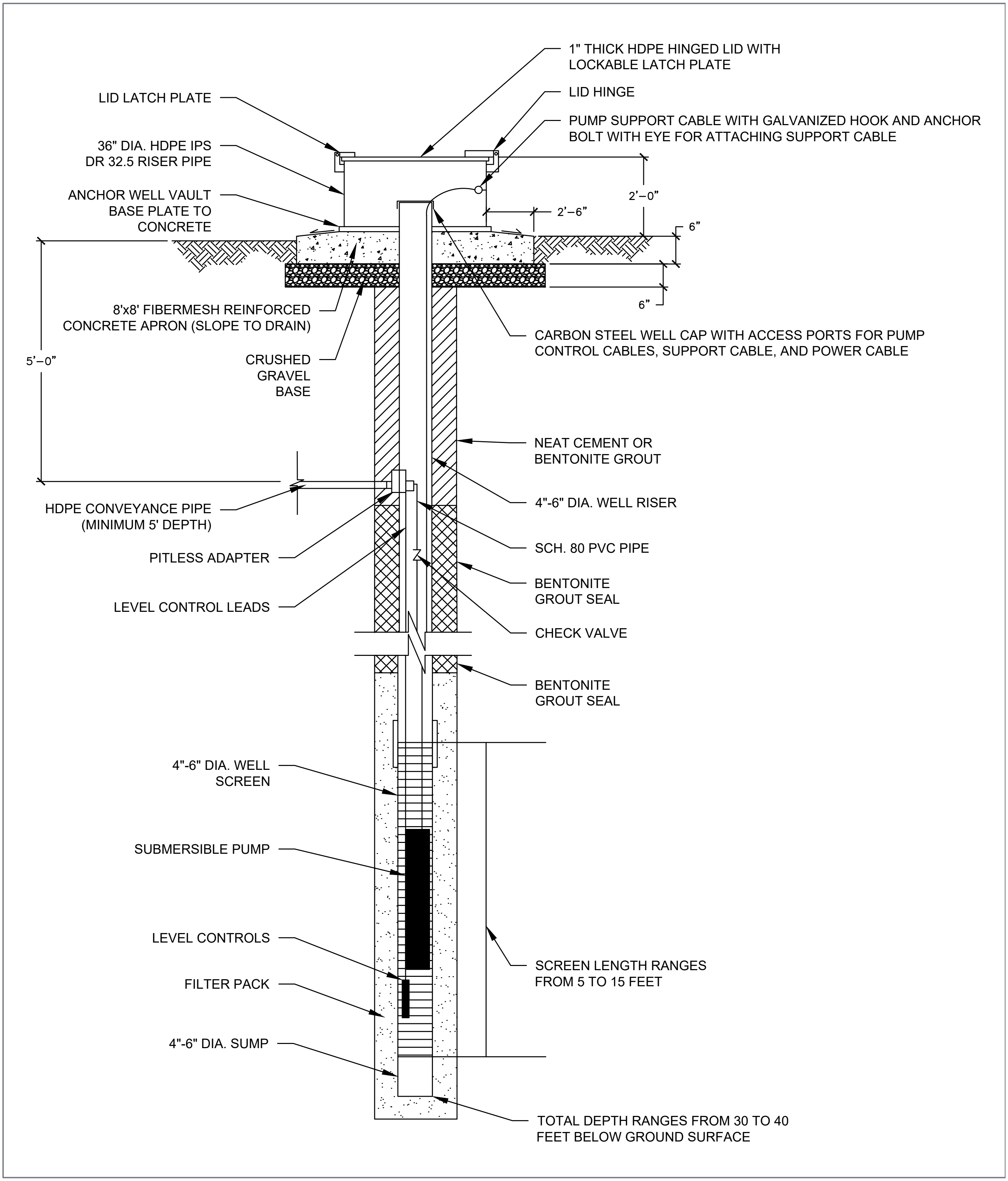
MONITORING WELL AND BOTTOM ASH POND WATER SAMPLE LOCATION MAP

BALDWIN BOTTOM ASH POND (UNIT ID: 601)
ALTERNATE SOURCE DEMONSTRATION
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

FIGURE 1

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL



NOTES

1. NOT TO SCALE

TYPICAL HYDRAULIC GRADIENT CONTROL WELL DETAIL

FIGURE 2

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

DYNEGY MIDWEST GENERATION L.L.C
BALDWIN BOTTOM ASH POND
BALDWIN, ILLINOIS

ATTACHMENT 1

Prepared for

Dynegy Midwest Generation, LLC

Document type

2019 Annual Groundwater Monitoring and Corrective Action Report

Date

January 31, 2020

2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

BALDWIN BOTTOM ASH POND, BALDWIN ENERGY COMPLEX

RAMBOLL Bright ideas. Sustainable change.

2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT BALDWIN BOTTOM ASH POND, BALDWIN ENERGY COMPLEX

Project name	**Baldwin Energy Complex**
Project no.	**72751**
Recipient	**Dynegy Midwest Generation, LLC**
Document type	**Annual Groundwater Monitoring and Corrective Action Report**
Version	**FINAL**
Date	**January 31, 2020**
Prepared by	**Kristen L. Theesfeld**
Checked by	**Jacob J. Walczak**
Approved by	**Eric J. Tlachac**
Description	**Annual Report in Support of the CCR Rule Groundwater Monitoring Program**

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ACRONYMS AND ABBREVIATIONS

ASD	Alternate Source Demonstration
BAP	Bottom Ash Pond
CCR	Coal Combustion Residuals
GWPS	Groundwater Protection Standard
SAP	Sampling and Analysis Plan
SSI	Statistically Significant Increase
SSL	Statistically Significant Level

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 Baldwin Bottom Ash Pond (BAP) located at Baldwin Energy Complex near Baldwin, Illinois.

Groundwater is being monitored at Baldwin BAP in accordance with the Assessment Monitoring Program requirements specified in 40 C.F.R. § 257.95.

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

The following Statistically Significant Levels (SSLs) of 40 C.F.R. Part 257 Appendix IV parameters were determined during one or more sampling events in 2019:

- Lithium at well MW-370

Alternate Source Demonstrations (ASDs) were completed for the SSLs referenced above and Baldwin BAP remains in the Assessment Monitoring Program.

1. INTRODUCTION

This report has been prepared by Ramboll on behalf of Dynegy Midwest Generation, LLC, to provide the information required by 40 C.F.R.§ 257.90(e) for Baldwin BAP located at Baldwin Energy Complex near Baldwin, 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 Baldwin BAP 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 Baldwin BAP remains in the Assessment Monitoring Program in accordance with 40 C.F.R. § 257.95.

3. KEY ACTIONS COMPLETED IN 2019

The Assessment Monitoring Program is summarized in Table A. The groundwater monitoring system, including the CCR unit and all background and downgradient monitoring wells, is presented in Figure 1. No changes were made to the monitoring system in 2019 (no wells were installed or decommissioned). In general, one groundwater sample was collected from each background and downgradient well during each monitoring event. All samples were collected and analyzed in accordance with the Sampling and Analysis Plan (SAP) (NRT/OBG, 2017a). All monitoring data obtained under 40 C.F.R. §§ 257.90 through 257.98 (as applicable) in 2019 are presented in Tables 1 and 2. Analytical data were evaluated in accordance with the Statistical Analysis Plan (NRT/OBG, 2017b) to determine any SSLs of Appendix IV parameters over Groundwater Protection Standards (GWPSs).

Statistical background values are provided in Table 3 and GWPSs in Table 4.

Analytical results for the June and September 2018 sampling events 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. § 257.95(g)(3)(ii). ASDs were completed and certified by a qualified professional engineer. The dates the ASDs were completed are provided in Table A. The ASDs completed in 2019 are included in Appendix A.

Table A – 2018-2019 Assessment Monitoring Program Summary

Sampling Dates	Analytical Data Receipt Date	Parameters Collected	SSL(s)	SSL(s) Determination Date	ASD Completion Date
June 26-27, 2018	August 22, 2018	Appendix III Appendix IV	NA	NA	NA
September 26, 2018	October 24, 2018	Appendix III Appendix IV Detected [1]	Lithium (MW-370)	January 7, 2019	April 8, 2019
March 19-20, 2019	April 15, 2019	Appendix III Appendix IV	Lithium (MW-370)	July 15, 2019	October 14, 2019
September 24-25, 2019	October 24, 2019	Appendix III Appendix IV Detected [1]	NA	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 Assessment 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 GWPSs to determine whether an SSL of Appendix IV parameters has occurred.
- If an SSL is identified, potential alternate sources (i.e., a source other than the CCR unit caused the SSL or that that SSL 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 SSL, a written demonstration will be completed within 90 days of SSL 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 SSL, the applicable requirements of 40 C.F.R. §§ 257.94 through 257.98 (e.g., assessment of corrective measures) as may apply in 2020 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, Baldwin Bottom Ash Pond, Baldwin Energy Complex, Baldwin, Illinois, Project No. 2285, Revision 0, October 17, 2017.

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

TABLES

TABLE 1.

2019 ANALYTICAL RESULTS - GROUNDWATER ELEVATION AND APPENDIX III PARAMETERS

2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

BALDWIN ENERGY COMPLEX

UNIT ID 601 - BALDWIN BOTTOM ASH POND

BALDWIN, ILLINOIS

ASSESSMENT 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												
MW-304	38.188332	-89.853441	3/20/2019 15:03	9.33	446.16	1.82	13.7	148	1.88	7.7	177	1390
			9/25/2019 13:11	9.30	446.19	1.84	18.4	152	1.74	7.9	169	1350
MW-306	38.201117	-89.846747	3/20/2019 14:16	16.98	436.19	0.174	50.4	62	0.65	11.4	32	330
			9/25/2019 14:22	18.10	435.07	0.166	46.0	62	0.59	11.0	37	318
Downgradient Monitoring Wells												
MW-356	38.198963	-89.869578	3/19/2019 10:51	2.65	424.95	2.12	11.7	31	2.18	7.8	43	678
			9/24/2019 10:32	3.02	424.58	2.04	11.6	29	2.00	7.7	38	644
MW-369	38.196986	-89.870258	3/19/2019 10:09	19.44	403.27	1.96	70.7	92	1.48	7.3	98	732
			9/24/2019 9:50	13.10	409.61	0.948	85.0	101	1.08	6.7	90	788
MW-370	38.195603	-89.869669	3/19/2019 11:30	17.50	403.35	2.01	46.7	1280	3.45	7.7	224	2950
			9/24/2019 11:10	18.98	401.87	1.95	47.0	1290	3.00	7.5	237	2830
MW-382	38.194540	-89.868044	3/19/2019 12:26	15.42	415.77	1.86	21.5	36	3.30	7.6	426	1180
			9/24/2019 12:10	16.23	414.96	1.78	20.5	34	2.85	7.7	388	1150

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

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.
2019 ANALYTICAL RESULTS - APPENDIX IV PARAMETERS
2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
BALDWIN ENERGY COMPLEX
UNIT ID 601 - BALDWIN BOTTOM ASH POND
BALDWIN, ILLINOIS
ASSESSMENT MONITORING PROGRAM

Well Identification Number	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Date & Time Sampled	40 C.F.R. Part 257 Appendix IV														
				Antimony, total (mg/L)	**Arsenic, total (mg/L)**	**Barium, total (mg/L)**	**Beryllium, total (mg/L)**	**Cadmium, total (mg/L)**	**Chromium, total (mg/L)**	**Cobalt, total (mg/L)**	**Fluoride, total (mg/L)**	**Lead, total (mg/L)**	**Lithium, total (mg/L)**	**Mercury, total (mg/L)**	**Molybdenum, total (mg/L)**	**Radium 226/228, Combined (pCi/L)**	**Selenium, total (mg/L)**	**Thallium, total (mg/L)**
				6020A[1]	6020A[1]	6020A[1]	6020A[1]	6020A[1]	6020A[1]	6020A[1]	6020A[1]	6020A[1]	6020A[1]	7470A[1]	6020A[1]	903/904[1]	6020A[1]	6020A[1]
Background / Upgradient Monitoring Wells																		
MW-304	38.188332	-89.853441	3/20/2019 15:03	<0.0010	0.0029	0.0214	<0.0010	<0.0010	<0.0015	<0.0010	1.88	<0.0010	0.0833	<0.00020	0.0019	0.55	<0.0010	<0.0020
			9/25/2019 13:11[2]	<0.0010	0.0017	0.0211	<0.0010	<0.0010	<0.0015	<0.0010	1.74	<0.0010	0.0836	<0.00020	0.0017	0.42	<0.0010	<0.0020
MW-306	38.201117	-89.846747	3/20/2019 14:16	<0.0010	0.0030	0.0192	<0.0010	<0.0010	<0.0015	<0.0010	0.65	<0.0010	0.0143	<0.00020	0.0299	0.74	<0.0010	<0.0020
			9/25/2019 14:22[2]	<0.0010	0.0021	0.0150	<0.0010	<0.0010	<0.0015	<0.0010	0.59	<0.0010	0.0133	<0.00020	0.0267	0.36	<0.0010	<0.0020
Downgradient Monitoring Wells																		
MW-356	38.198963	-89.869578	3/19/2019 10:51	<0.0010	0.0011	0.0322	<0.0010	<0.0010	<0.0015	<0.0010	2.18	<0.0010	0.0578	<0.00020	<0.0015	0.19	<0.0010	<0.0020
			9/24/2019 10:32[2]	NA	<0.0010	0.0307	NA	NA	<0.0015	NA	2.00	NA	0.0580	NA	<0.0015	0.10	NA	NA
MW-369	38.196986	-89.870258	3/19/2019 10:09	<0.0010	0.0021	0.0562	<0.0010	<0.0010	<0.0015	<0.0010	1.48	<0.0010	0.0382	<0.00020	0.0263	0.34	<0.0010	<0.0020
			9/24/2019 9:50[2]	NA	0.0059	0.0849	NA	NA	<0.0015	NA	1.08	NA	0.0259	NA	0.0186	0.84	NA	NA
MW-370	38.195603	-89.869669	3/19/2019 11:30	<0.0010	0.0015	0.0449	<0.0010	<0.0010	<0.0015	<0.0010	3.45	<0.0010	0.147	<0.00020	0.0238	0.61	<0.0010	<0.0020
			9/24/2019 11:10[2]	NA	<0.0010	0.0424	NA	NA	<0.0015	NA	3.00	NA	0.149	NA	0.0188	0.75	NA	NA
MW-382	38.194540	-89.868044	3/19/2019 12:26	<0.0010	0.0012	0.0170	<0.0010	<0.0010	0.0021	<0.0010	3.30	<0.0010	0.0625	<0.00020	0.0019	0.16	<0.0010	<0.0020
			9/24/2019 12:10[2]	NA	0.0012	0.0221	NA	NA	0.0044	NA	2.85	NA	0.0623	NA	0.0025	0.51	NA	NA

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

Notes:

40 C.F.R. = Title 40 of the Code of Federal Regulations

mg/L = milligrams per liter

NA = Not Analyzed

pCi/L = picoCuries per liter

< = concentration is less than 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 Levels (SSLs) over Groundwater Protection Standards.

[1]4-digit numbers represent SW-846 analytical methods and 3-digit numbers represent Clean Water Act analytical methods.

[2]Only the parameters detected during the previous sampling events were analyzed during this sampling event, in accordance with 40 C.F.R. § 257.95(d)(1).

RAMBOLL

TABLE 3.
STATISTICAL BACKGROUND VALUES
2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
BALDWIN ENERGY COMPLEX
UNIT ID 601 - BALDWIN BOTTOM ASH POND
BALDWIN, ILLINOIS
ASSESSMENT MONITORING PROGRAM

Parameter	Statistical Background Value (UPL)
40 C.F.R. Part 257 Appendix III	
Boron (mg/L)	2.11
Calcium (mg/L)	33.5
Chloride (mg/L)	155
Fluoride (mg/L)	1.98
pH (S.U.)	7.8 / 11.2
Sulfate (mg/L)	200
Total Dissolved Solids (mg/L)	1360

[O: RAB 12/22/19, C: KLT 12/23/19]

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

TABLE 4.
GROUNDWATER PROTECTION STANDARDS
2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
BALDWIN ENERGY COMPLEX
UNIT ID 601 - BALDWIN BOTTOM ASH POND
BALDWIN, ILLINOIS
ASSESSMENT MONITORING PROGRAM

Parameter	Groundwater Protection Standard[1]
40 C.F.R. Part 257 Appendix IV	
Antimony (mg/L)	0.006
Arsenic (mg/L)	0.032
Barium (mg/L)	2
Beryllium (mg/L)	0.004
Cadmium (mg/L)	0.005
Chromium (mg/L)	0.10
Cobalt (mg/L)	0.006
Fluoride (mg/L)	4
Lead (mg/L)	0.015
Lithium (mg/L)	0.069
Mercury (mg/L)	0.002
Molybdenum (mg/L)	0.10
Radium 226+228 (pCi/L)	5
Selenium (mg/L)	0.05
Thallium (mg/L)	0.002

[O: RAB 12/22/19, C: KLT 12/23/19]

Notes:
40 C.F.R. = Title 40 of the Code of Federal Regulations
mg/L = milligrams per liter
pCi/L = picoCuries per liter
[1]Groundwater Protection Standard is the higher of the Maximum Contaminant Level / Health-Based Level or background.

FIGURES

Y:\Mapping\Projects\22\2285\MXD\2019_AnnualGWM_CAR\Figure 1_GWS_WellLoc_Baldwin_BAP.mxd

PROJECT: 169000XXXX | DATED: 1/13/2020 | DESIGNER: GALARNMC

DOWNGRADIENT MONITORING WELL LOCATION
UPGRADIENT MONITORING WELL LOCATION
CCR MONITORED UNIT

0 400 800 Feet

MONITORING WELL LOCATION MAP
BALDWIN BOTTOM ASH POND
UNIT ID:601

2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
VISTRA CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

FIGURE 1

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

APPENDIX A
ALTERNATE SOURCE DEMONSTRATIONS

40 C.F.R. § 257.95(g)(3)(ii): ALTERNATE SOURCE DEMONSTRATION
BALDWIN BOTTOM ASH POND
APRIL 8, 2019

April 8, 2019

This alternate source demonstration has been prepared on behalf of Dynegy Midwest Generation, LLC (DMG) by OBG, part of Ramboll (OBG) to provide pertinent information pursuant to 40 CFR § 257.95(g)(3)(ii) for the Baldwin Bottom Ash Pond (BAP) located at Baldwin Energy Complex near Baldwin, Illinois.

Initial background groundwater monitoring consisting of a minimum of eight samples as required under 40 CFR § 257.94(b) was initiated in December 2015 and completed prior to October 17, 2017. Comparison of background groundwater quality with concentrations of parameters in downgradient monitoring wells observed during the November 2017 Detection Monitoring Program sampling event identified a statistically significant increase (SSI) for one or more 40 CFR Part 257 Appendix III parameters at Baldwin BAP. Consequently, and in accordance with 40 CFR § 257.94(e) and 40 CFR § 257.95, an assessment monitoring program was established by April 9, 2018 for the Baldwin BAP.

The first Assessment Monitoring sampling event was completed on June 26, 2018 and June 27, 2018. As stipulated in 40 CFR § 257.95(d)(1), all wells were resampled on September 26, 2018 for all Appendix III parameters and the Appendix IV parameters detected during the first Assessment Monitoring sampling event. Groundwater data collected from the first Assessment Monitoring sampling event and resampling event are available in the 2018 Annual Groundwater Monitoring and Corrective Action Report for Baldwin Bottom Ash Pond completed January 31, 2019 (OBG, 2019). Analytical data from all sampling events from December 2015 through the resampling event were evaluated in accordance with the statistical analysis plan (NRT/OBG, 2017) to determine any SSIs of Appendix III parameters over background concentrations or statistically significant levels (SSLs) of Appendix IV parameters over Groundwater Protection Standards (GWPSs). That evaluation identified SSLs at downgradient monitoring wells as follows:

- Lithium at well MW-370

Per 40 CFR § 257.95(g)(3)(ii), the owner or operator of a CCR unit may complete within 90 days from the date of an SSL determination a written demonstration that a source other than the CCR unit caused the SSL, or that the SSL resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality ("alternate source demonstration"). Pursuant to 40 CFR § 257.95(g)(3)(ii), the following demonstrates that sources other than the Baldwin BAP were the cause of the SSL listed above. This alternate source demonstration (ASD) was completed within 90 days of determination of the SSLs (January 7, 2019) as required by 40 CFR § 257.95(g)(3)(ii).

ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

This ASD is based on the following lines of evidence (LOE):

1. The BAP water has a different ionic composition than groundwater.
2. Lithium concentrations in the BAP water are lower than the concentrations observed in groundwater.

These lines of evidence are described and supported in greater detail below. Monitoring wells and BAP water sample locations are shown Figure 1 (attached).

LOE #1: THE BAP WATER HAS A DIFFERENT IONIC COMPOSITION THAN GROUNDWATER.

Stiff diagrams graphically represent ionic composition of aqueous solutions. Figure 2 shows a series of Stiff diagrams that display the ionic compositions of the BAP water and groundwater from background and downgradient monitoring wells in the monitoring system. Polygons with similar shapes represent solutions with similar ionic compositions, whereas polygons with different shapes indicate solutions with dissimilar ionic compositions.

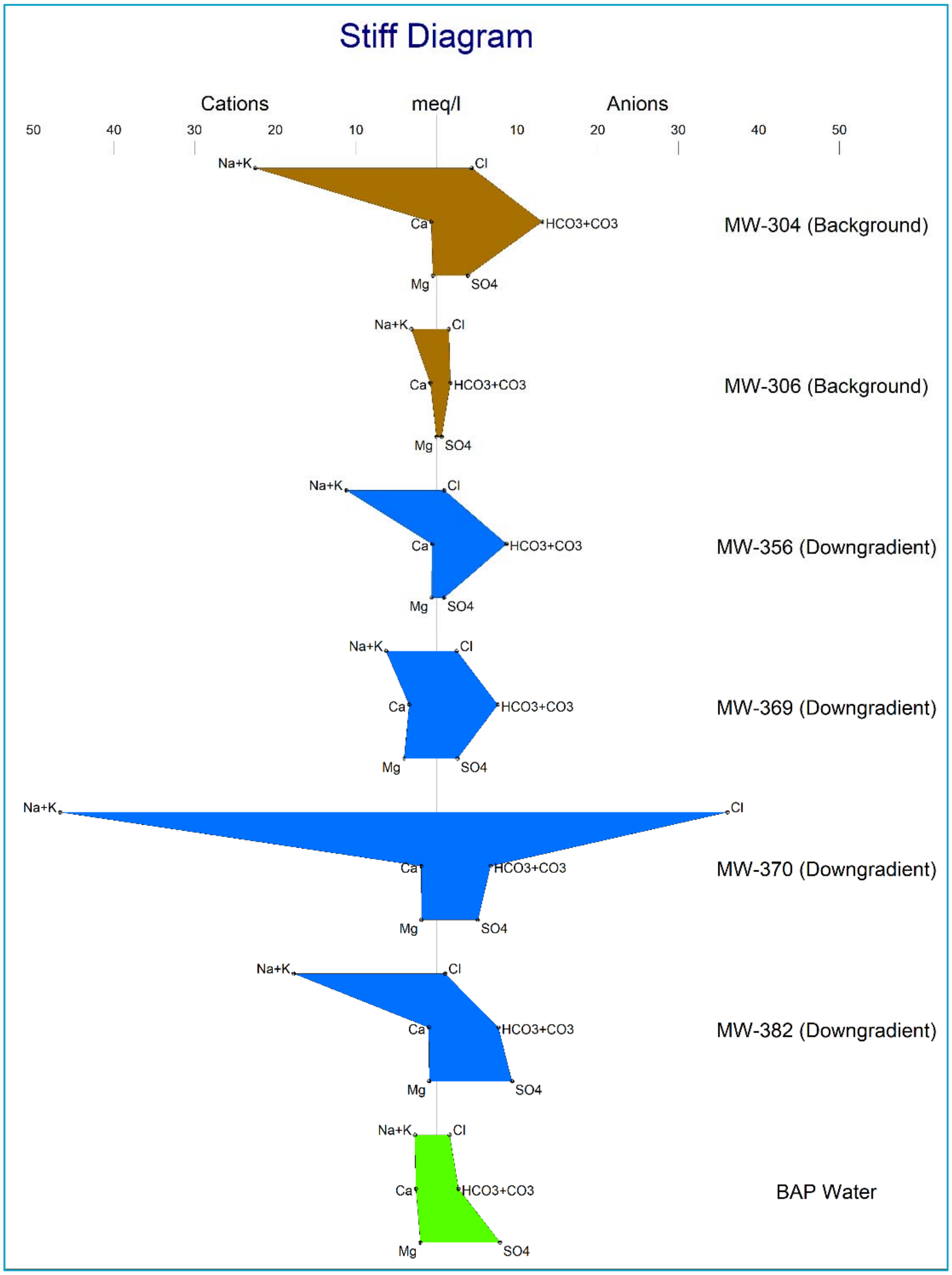


Figure 2. Stiff diagram showing ionic composition of samples of BAP background and downgradient groundwater and BAP water.

The ionic compositions of the BAP water and groundwater represented by Figure 2 are discussed in more detail below.

- The dominant cations in BAP groundwater at background and downgradient monitoring wells are sodium-potassium.
- Figure 2 indicates that MW-369 has a relatively higher proportion of calcium and magnesium cations than other wells in the groundwater monitoring system, although sodium-potassium cations are still dominant.
- The polygon associated with the BAP water sample in Figure 2 is relatively flat on the left side indicating there is no overly dominant cation.
- The dominant anions in most BAP monitoring wells are carbonate-bicarbonate, with the exceptions of downgradient monitoring well locations MW-370 and MW-382.
- MW-370 is the only location analyzed where the major anions are dominated by chloride, this results in a distinct polygon shape when compared to other sample locations as illustrated in Figure 2.
- The dominant anions at MW-382 are sulfate and carbonate-bicarbonate.
- The dominant anion in the BAP water sample is sulfate.

The Stiff diagrams and analysis of ionic composition in the BAP water sample and groundwater indicate the ionic composition of water at MW-370 is not influenced by the BAP.

LOE #2: LITHIUM CONCENTRATIONS IN THE BAP WATER ARE LOWER THAN THE CONCENTRATIONS OBSERVED IN GROUNDWATER

Lithium concentrations in the BAP water, including samples from BAP water and TPZ-164 bottom ash porewater well (see boring log in Attachment A), are lower than lithium concentrations in groundwater. A time-series for lithium concentrations is provided in Figure 3 below.

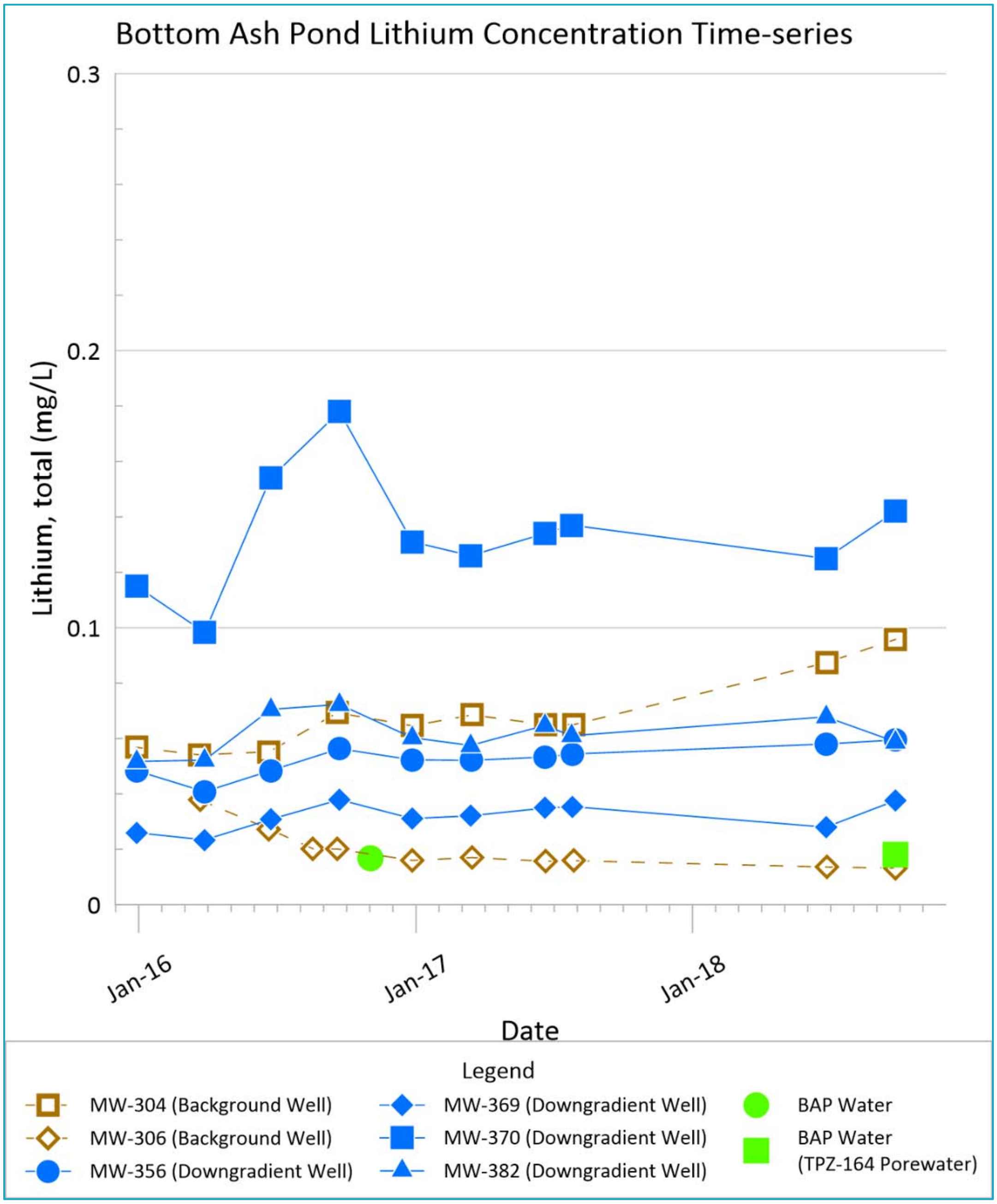


Figure 3. Lithium Concentration Time-series for groundwater samples from the BAP monitoring system and BAP water.

The following observations can be made from Figure 3:

- BAP water ranges from 0.0167 to 0.0182 mg/L of lithium.
- Groundwater from downgradient wells MW-356, MW-369, MW-370 and MW-382 has one to ten times greater lithium concentrations than the maximum lithium concentration (0.0182 mg/L) observed in BAP water.
- Groundwater from background well MW-304 has three to five times greater lithium concentrations than the maximum lithium concentration (0.0182 mg/L) observed in BAP water.

If the BAP were the source of lithium in groundwater, BAP water concentrations would be anticipated to be higher than concentrations of lithium in groundwater monitoring wells. Therefore, the BAP is not the source of the lithium observed in groundwater samples. Background lithium concentrations at MW-304 were also shown to be significantly higher than water in the pond, indicating lithium concentrations are either naturally occurring due to geochemical variations within the Uppermost Aquifer or from upgradient anthropogenic sources.

Based on these two lines of evidence, it has been demonstrated that the Baldwin BAP has not caused the SSL in MW-370.

This information serves as the written alternate source demonstration prepared in accordance with 40 CFR § 257.95(g)(3)(ii) that the SSL observed during the assessment monitoring program was not due to the CCR unit, but was from a combination of naturally occurring conditions and potential upgradient anthropogenic impacts. Therefore, a corrective measures assessment is not required and the Baldwin BAP will remain in assessment monitoring.

Attachment A Boring Log for Porewater Well TPZ-164

REFERENCES

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

O'Brien & Gere Engineers, Inc. (OBG), 2019, 2018 Annual Groundwater Monitoring and Corrective Action Report, Baldwin Bottom Ash Pond – CCR Unit ID 601, Baldwin Energy Complex, Dynegy Midwest Generation, LLC, January 31, 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
OBG, part of Ramboll
Date: April 8, 2019

I, Jacob J. Walczak, 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.

Jacob J. Walczak
Professional Geologist
196-001473
Illinois
OBG, part of Ramboll
Date: April 8, 2019

Figures

DRAWN BY/DATE:
SDS 3/25/19
REVIEWED BY/DATE:
JJW 3/26/19
APPROVED BY/DATE:
JJW 3/27/19

MONITORING WELL AND
BOTTOM ASH POND WATER SAMPLE LOCATION MAP
BALDWIN BOTTOM ASH POND

ALTERNATE SOURCE DEMONSTRATION
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 70093

FIGURE NO: 1

OBG
Part of Ramboll

Y:\Mapping\Projects\22\2285_Baldwin\MXD\Figure 1_Baldwin_MW MAP Water Samps_ASD.mxd Author: stolzsd; Date/Time: 4/4/2019, 11:12:05 AM

Attachment A

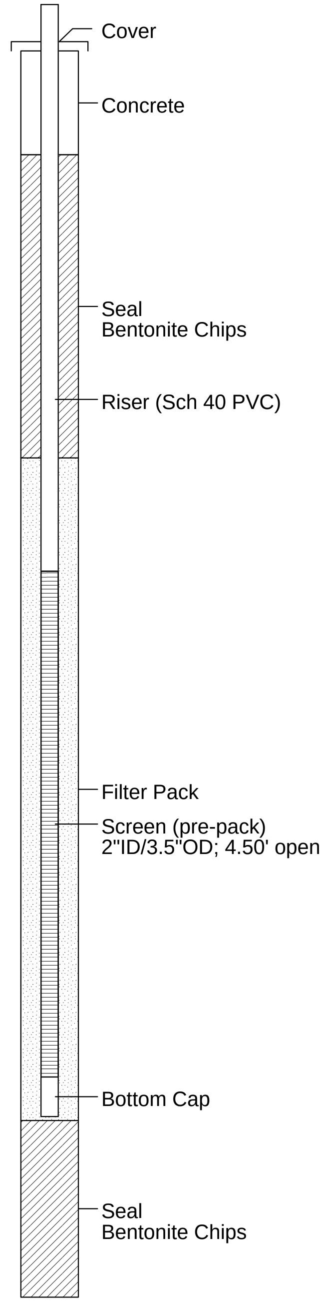
Boring Log for Porewater Well TPZ-164

KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE TPZ-164 (Page 1 of 1)

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/26/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 432.50
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 435.10
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383909, 556829

Depth in Feet	DESCRIPTION	Surf. Elev. 432.50	Samples	Blow Count	Recovery inches	Qp TSF	USCS	GRAPHIC
0	FILL - Bottom Ash, coarse, black (10YR 2/1), dry							
1								
2		430						
3	- moist <Shelby Tube Sample ST164-5 @ 3-5'> grain size analysis (Ash): 50% Sand, 42.9% Silt, 7.1% Clay	429						
4			1		17/24			
	- wet	428					AR	
5		427						
6		426						
7		425						
8		424		3				
9	CLAY (lean), stiff, medium to high plasticity, dark gray (10YR 4/1), moist - @8.9' - light yellowish brown (10YR 6/4) with <10% light gray mottling - @9.3' - gray (10YR 6/1) with 25-50% brownish-yellow mottling (10YR 6/6)	423	2	3	18/18		CL	
				5				
10	- light olive brown <Shelby Tube Sample ST164-12 @ 10-12'> grain size analysis: 7.2% Sand, 62.2% Silt, 30.6% Clay	422						
11		421	3		23/24		CL	
12	END BOREHOLE AT 10.3 FEET BLS END Split-Spoon Sampling at 12 feet BLS	420						
		419						



11-08-2013 C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Boring Logs\BEC164.BOR

40 C.F.R. § 257.95(g)(3)(ii): ALTERNATE SOURCE DEMONSTRATION
BALDWIN BOTTOM ASH POND
OCTOBER 14, 2019

October 14, 2019

Title 40 of the Code of Federal Regulations (C.F.R.) § 257.95(g)(3)(ii) allows the owner or operator of a Coal Combustion Residuals (CCR) unit 90 days from the date of determination of Statistically Significant Levels (SSLs) over Groundwater Protection Standards (GWPSs) of groundwater constituents listed in Appendix IV of 40 C.F.R. Part 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSL(s), or that the SSL(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (Alternate Source Demonstration [ASD]).

This ASD has been prepared on behalf of Dynegy Midwest Generation, LLC (DMG), by O'Brien & Gere Engineers, Inc, part of Ramboll (OBG), to provide pertinent information pursuant to 40 C.F.R. § 257.95(g)(3)(ii) for the Baldwin Bottom Ash Pond (BAP) located near Baldwin, Illinois.

The second Assessment Monitoring sampling event (A2) was completed on March 19-20, 2019 and analytical data were received on April 15, 2019. Analytical data from all sampling events, from December 2015 through A2, were evaluated in accordance with the Statistical Analysis Plan[1] to determine any Statistically Significant Increases (SSIs) of Appendix III parameters over background concentrations or SSLs of Appendix IV parameters over Groundwater Protection Standards (GWPSs). That evaluation identified SSLs at downgradient monitoring wells as follows:

- Lithium at well MW-370

Pursuant to 40 C.F.R. § 257.95(g)(3)(ii), the following demonstrates that sources other than the Baldwin BAP were the cause of the SSL listed above. This ASD was completed by October 14, 2019, within 90 days of determination of the SSLs, as required by 40 C.F.R. § 257.95(g)(3)(ii).

ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

This ASD is based on the following lines of evidence (LOE):

1. Lithium concentrations in the BAP porewater are lower than the concentrations observed in groundwater.
2. The BAP porewater has a different ionic composition than groundwater.

These lines of evidence are described and supported in greater detail below. Monitoring wells and the BAP porewater sample location are shown Figure 1 (attached).

LOE #1: LITHIUM CONCENTRATIONS IN THE BAP POREWATER ARE LOWER THAN THE CONCENTRATIONS OBSERVED IN GROUNDWATER

Lithium concentrations in BAP porewater samples collected from TPZ-164 bottom ash porewater well (see boring log in Attachment A) are lower than lithium concentrations in groundwater. A time-series plot of lithium concentrations is provided in Figure 2 below.

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

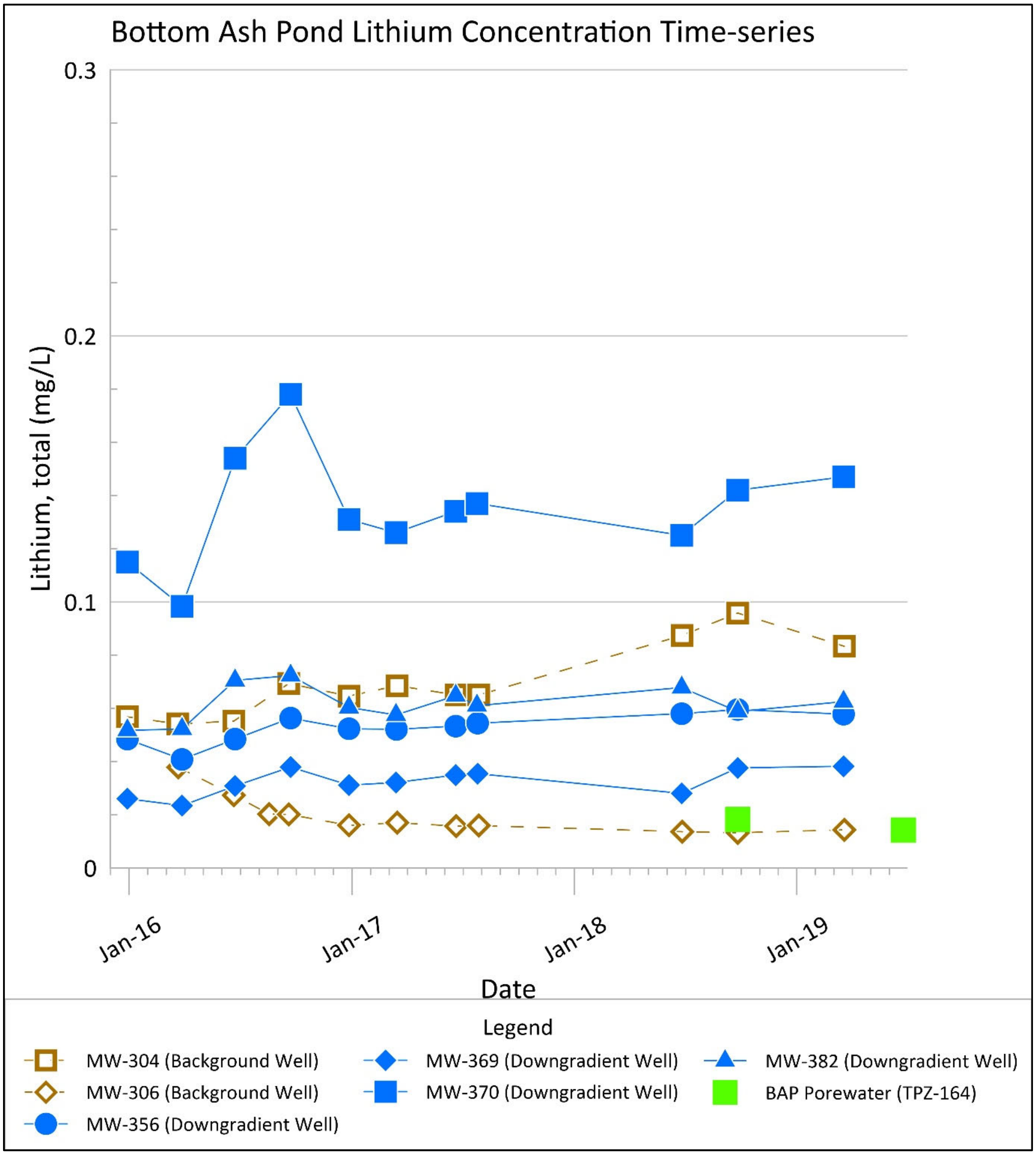


Figure 2. Lithium concentration time-series for background (brown) and downgradient (blue) groundwater samples from the BAP monitoring system, and BAP porewater (green).

The following observations can be made from Figure 2:

- Concentrations of lithium in background wells ranged from 0.0132 to 0.0958 milligrams per liter (mg/L).
- Concentrations of lithium in downgradient wells MW-356, MW-369 and MW-382 ranged from 0.0234 to 0.0723 mg/L, generally within the range of background concentrations.
- Concentrations of lithium in MW-370, where the SSL was identified, ranged from 0.0983 to 0.178 mg/L, above the upper range of lithium concentrations detected in other groundwater monitoring wells.

- Concentrations of lithium in BAP porewater range from 0.0142 to 0.0182 mg/L. These levels of lithium are at or below the lower end of the range of lithium concentrations detected in all groundwater monitoring wells. Lithium concentrations in MW-370 are five to nine times greater than the maximum lithium concentration (0.0182 mg/L) observed in BAP porewater.

If the BAP were the source of lithium in groundwater at MW-370, BAP porewater concentrations of lithium would be anticipated to be higher than concentrations at MW-370. Therefore, the BAP is not the source of the lithium observed at MW-370. Lithium concentrations at background monitoring well MW-304 are higher than BAP porewater, which also indicates lithium concentrations are from a source other than the CCR unit.

LOE #2: THE BAP POREWATER HAS A DIFFERENT IONIC COMPOSITION THAN GROUNDWATER.

Stiff diagrams graphically represent ionic composition of aqueous solutions. Figure 3 shows a series of Stiff diagrams that display the ionic compositions of groundwater from background monitoring wells (brown), downgradient monitoring wells (blue) and the BAP porewater (green). Polygons with similar shapes represent solutions with similar ionic compositions, whereas polygons with different shapes indicate solutions with dissimilar ionic compositions; the larger the area of the polygon, the greater the concentration of the various ions.

The ionic compositions of the groundwater and BAP porewater represented by Figure 3 are discussed in more detail below.

- The ionic composition of the groundwater in background and downgradient monitoring wells is similar, as represented by the similarity of the Stiff diagram sizes and shapes. The exception to this is MW-370.
  - The dominant cations in groundwater monitoring wells (background and downgradient) are sodium-potassium. However, the concentration of sodium-potassium in downgradient groundwater monitoring well MW-370 is higher compared to other groundwater monitoring wells.
  - With the exceptions of MW-370 and MW-382, the dominant anions in groundwater monitoring wells are carbonate-bicarbonate.
    - MW-370 is the only location where the dominant anion is chloride. This, coupled with the relatively high concentration of sodium-potassium cations in MW-370, results in a distinct polygon shape when compared to other groundwater sample locations.
    - The dominant anion at MW-382 is sulfate, however the concentration of carbonate-bicarbonate is consistent with the concentrations of carbonate-bicarbonate in other downgradient groundwater monitoring wells.
- The ionic composition of the BAP porewater is different than the ionic composition of the groundwater.
  - The dominant cation in the BAP porewater sample is calcium and the dominant anion is carbonate-bicarbonate. The resulting Stiff diagram is different in both shape and size from the groundwater diagrams.

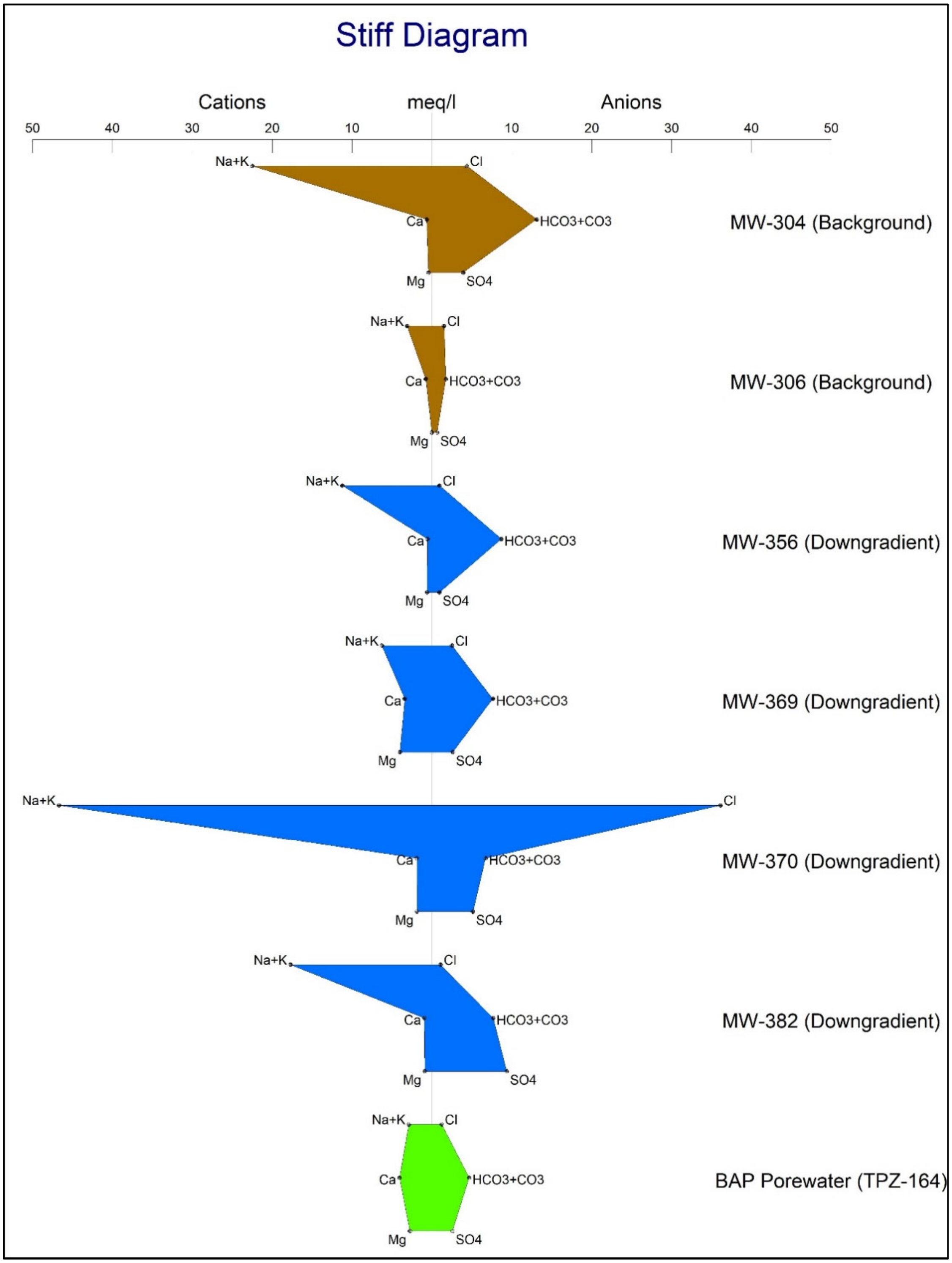


Figure 3. Stiff diagram showing ionic composition of samples of BAP background (brown) and downgradient (blue) groundwater and BAP porewater (green).

The Stiff diagrams and analysis of ionic composition in groundwater and the BAP porewater sample indicate that the ionic composition of groundwater at MW-370 is not influenced by the BAP.

Based on these two lines of evidence, it has been demonstrated that the lithium SSL at MW-370 is not due to the Baldwin BAP but is from a source other than the CCR unit being monitored.

This information serves as the written ASD prepared in accordance with 40 CFR § 257.95(g)(3)(ii) that the SSL observed during the A2 sampling event was not due to the BAP. Therefore, a corrective measures assessment is not required and the Baldwin BAP will remain in assessment monitoring.

Attachment A Boring Log for Porewater Well TPZ-164

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
OBG, part of Ramboll
Date: October 14, 2019

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

I, Jacob J. Walczak, 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.

Jacob J. Walczak
Professional Geologist
196-001473
Illinois
OBG, part of Ramboll
Date: October 14, 2019

LICENSED PROFESSIONAL GEOLOGIST
JACOB J. WALCZAK
196-001473
ILLINOIS

Figures

DRAWN BY/DATE: SDS
REVIEWED BY/DATE: JJW
APPROVED BY/DATE: JJW

MONITORING WELL AND BOTTOM ASH POND WATER SAMPLE LOCATION MAP BALDWIN BOTTOM ASH POND

ALTERNATE SOURCE DEMONSTRATION
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 70093

FIGURE NO: 1

OBG Part of Ramboll

Y:\Mapping\Projects\22\2285_Baldwin\MXD\Figure 1_Baldwin_MW MAP Porewater Samps_ASD.mxd Author: GALARNMC;

Attachment A

Boring Log for Porewater Well TPZ-164

KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE TPZ-164

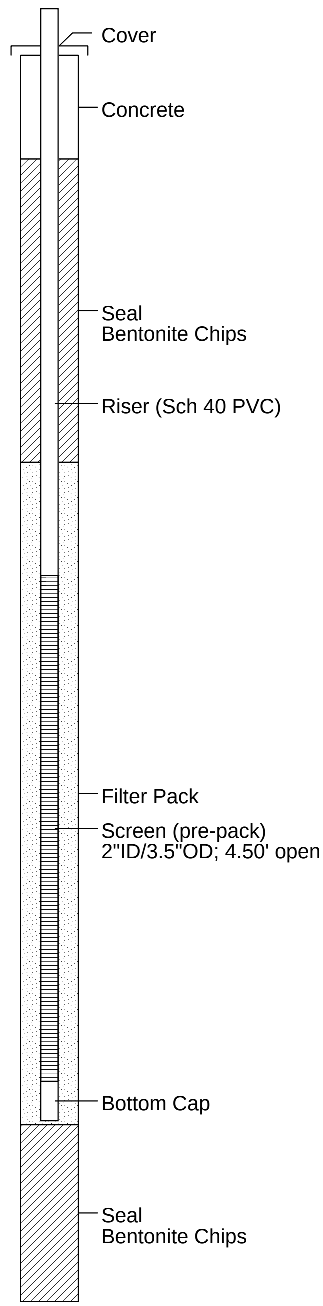
Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/26/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 432.50
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 435.10
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383909, 556829

Depth in Feet	DESCRIPTION	Samples	Blow Count	Recovery inches	Qp TSF	USCS
0	FILL - Bottom Ash, coarse, black (10YR 2/1), dry					
3	- moist <Shelby Tube Sample ST164-5 @ 3-5'> grain size analysis (Ash): 50% Sand, 42.9% Silt, 7.1% Clay	1		17/24		AR
4.5	- wet					
8.7	CLAY (lean), stiff, medium to high plasticity, dark gray (10YR 4/1), moist - @8.9' - light yellowish brown (10YR 6/4) with <10% light gray mottling - @9.3' - gray (10YR 6/1) with 25-50% brownish-yellow mottling (10YR 6/6)	2	3 3 5	18/18		CL
10.3	- light olive brown <Shelby Tube Sample ST164-12 @ 10-12'> grain size analysis: 7.2% Sand, 62.2% Silt, 30.6% Clay	3		23/24		CL
12	END BOREHOLE AT 10.3 FEET BLS END Split-Spoon Sampling at 12 feet BLS					

Surf. Elev. 432.50 (elevation scale: 430, 429, 428, 427, 426, 425, 424, 423, 422, 421, 420, 419)

Well: TPZ-164
Elev.: 435.10



ATTACHMENT 2

Intended for
Dynegy Midwest Generation, LLC

Date
October 26, 2020

Project No.
1940074914

40 C.F.R. § 257.95(g)(3)(ii): ALTERNATE SOURCE DEMONSTRATION

BALDWIN BOTTOM ASH POND

RAMBOLL Bright ideas. Sustainable change.

CERTIFICATIONS

I, Jacob J. Walczak, 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.

____

Jacob J. Walczak
Professional Geologist
196-001473
Illinois
Ramboll Americas Engineering Solutions, Inc., f/k/a O'Brien & Gere Engineers, Inc.
Date: October 26, 2020

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
Ramboll Americas Engineering Solutions, Inc., f/k/a O'Brien & Gere Engineers, Inc.
Date: October 26, 2020

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CONTENTS

TABLES (IN TEXT)

FIGURES (IN TEXT)

FIGURES (ATTACHED)

APPENDICES

ACRONYMS AND ABBREVIATIONS

40 C.F.R.	Title 40 of the Code of Federal Regulations
ASD	Alternate Source Demonstration
BAP	Bottom Ash Pond
CCR	Coal Combustion Residuals
DMG	Dynegy Midwest Generation, LLC
f/k/a	formerly known as
GWPS	Groundwater Protection Standard
LOE	line of evidence
mg/L	milligrams per liter
NRT/OBG	Natural Resource Technology, an OBG Company
Ramboll	Ramboll Americas Engineering Solutions, Inc., f/k/a O'Brien & Gere Engineers, Inc.
SSI	Statistically Significant Increase
SSL	Statistically Significant Level

1. INTRODUCTION

Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257.95(g)(3)(ii) allows the owner or operator of a Coal Combustion Residuals (CCR) unit 90 days from the date of determination of Statistically Significant Levels (SSLs) over Groundwater Protection Standards (GWPSs) of groundwater constituents listed in Appendix IV of 40 C.F.R. Part 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSL(s), or that the SSL(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (Alternate Source Demonstration [ASD]).

This ASD has been prepared on behalf of Dynegy Midwest Generation, LLC (DMG), by Ramboll Americas Engineering Solutions, Inc., f/k/a O'Brien & Gere Engineers, Inc (Ramboll), to provide pertinent information pursuant to 40 C.F.R. § 257.95(g)(3)(ii) for the Baldwin Bottom Ash Pond (BAP) located near Baldwin, Illinois.

The most recent Assessment Monitoring sampling event (A3) was completed on March 26, 2020 and analytical data were received on April 28, 2020. Analytical data from all sampling events, from December 2015 through A3, were evaluated in accordance with the Statistical Analysis Plan (Natural Resource Technology, an OBG Company [NRT/OBG], 2017) to determine any Statistically Significant Increases (SSIs) of Appendix III parameters over background concentrations or SSLs of Appendix IV parameters over GWPSs. That evaluation identified one SSL at downgradient monitoring wells as follows:

- Lithium at well MW-370

Pursuant to 40 C.F.R. § 257.95(g)(3)(ii), the following lines of evidence (LOEs) demonstrate that sources other than the Baldwin BAP were the cause of the lithium SSL listed above. This ASD was completed by October 26, 2020, within 90 days of determination of the SSLs (July 27, 2020), as required by 40 C.F.R. § 257.95(g)(3)(ii).

2. ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

This ASD is based on the following LOEs:

1. The median lithium concentration in the BAP porewater is lower than the median concentrations observed in background and downgradient groundwater.
2. The BAP porewater has a different ionic composition than groundwater.

These LOEs are described and supported in greater detail below. Monitoring wells and the BAP porewater sample locations are shown Figure 1.

2.1 LOE #1: The Median Lithium Concentration in the BAP Porewater is Lower Than Median Concentrations Observed in Background and Downgradient Groundwater.

The table below (Table A) provides summary statistics of groundwater lithium concentrations and BAP porewater lithium concentrations collected from TPZ-164 bottom ash porewater well (see boring log in Attachment A).

Table A – Summary Statistics for Lithium in Groundwater and BAP Porewater (December 2015 to March 2020).

Sample Location	Lithium (milligrams per liter [mg/L])		
	Minimum	Maximum	Median
Background Groundwater[1]	0.013	0.096	0.046
Downgradient Groundwater[2]	0.018	0.18	0.058
BAP Porewater[3]	0.013	0.018	0.014

Note:

[1]Background groundwater was collected at monitoring wells MW-304 and MW-306.

[2]Downgradient groundwater was collected at monitoring wells MW-356, MW-369, MW-370 and MW-382.

[3]BAP porewater was collected at TPZ-164.

The following observations can be made from Table A above:

- Concentrations of lithium in background wells ranged from 0.013 to 0.096 mg/L, with a median concentration of 0.046 mg/L.
- Concentrations of lithium in downgradient wells ranged from 0.018 to 0.18 mg/L, with a median concentration of 0.058 mg/L.
- Concentrations of lithium in BAP porewater ranged from 0.013 to 0.018 mg/L, with a median concentration of 0.014 mg/L. The median lithium concentration observed in porewater is below the median lithium concentrations observed in both background and downgradient groundwater monitoring wells.

If the BAP was the source of lithium in downgradient groundwater, BAP porewater concentrations of lithium would be anticipated to be higher than the groundwater concentrations. Therefore, the BAP is not the source of lithium in the downgradient groundwater, including at MW-370. Background lithium concentrations were also shown to be higher than BAP porewater, suggesting lithium concentrations are either naturally occurring due to geochemical variations within the Uppermost Aquifer or from upgradient anthropogenic sources.

2.2 LOE #2: The BAP Porewater has a Different Ionic Composition Than Groundwater.

Stiff diagrams graphically represent ionic composition of aqueous solutions. Figure A below shows a series of Stiff diagrams that display the ionic compositions of groundwater from background monitoring wells (brown), downgradient monitoring wells (blue), and the BAP porewater (green). Polygons with similar shapes represent solutions with similar ionic compositions, whereas polygons with different shapes indicate solutions with dissimilar ionic compositions; the larger the area of the polygon, the greater the concentration of the various ions.

The ionic compositions of the groundwater and BAP porewater represented by Figure A are discussed in more detail below.

- The ionic composition of the groundwater in downgradient monitoring wells is similar to that in background monitoring well MW-304, with one exception, as represented by the similarity of the Stiff diagram sizes and shapes.
  - The dominant cations in downgradient groundwater monitoring wells and background monitoring well MW-304 are sodium-potassium and the dominant anions are bicarbonate-carbonate. The exception is MW-370, which has chloride as the dominant anion.
- The BAP porewater sample has no dominant cation and the dominant anion is bicarbonate-carbonate.

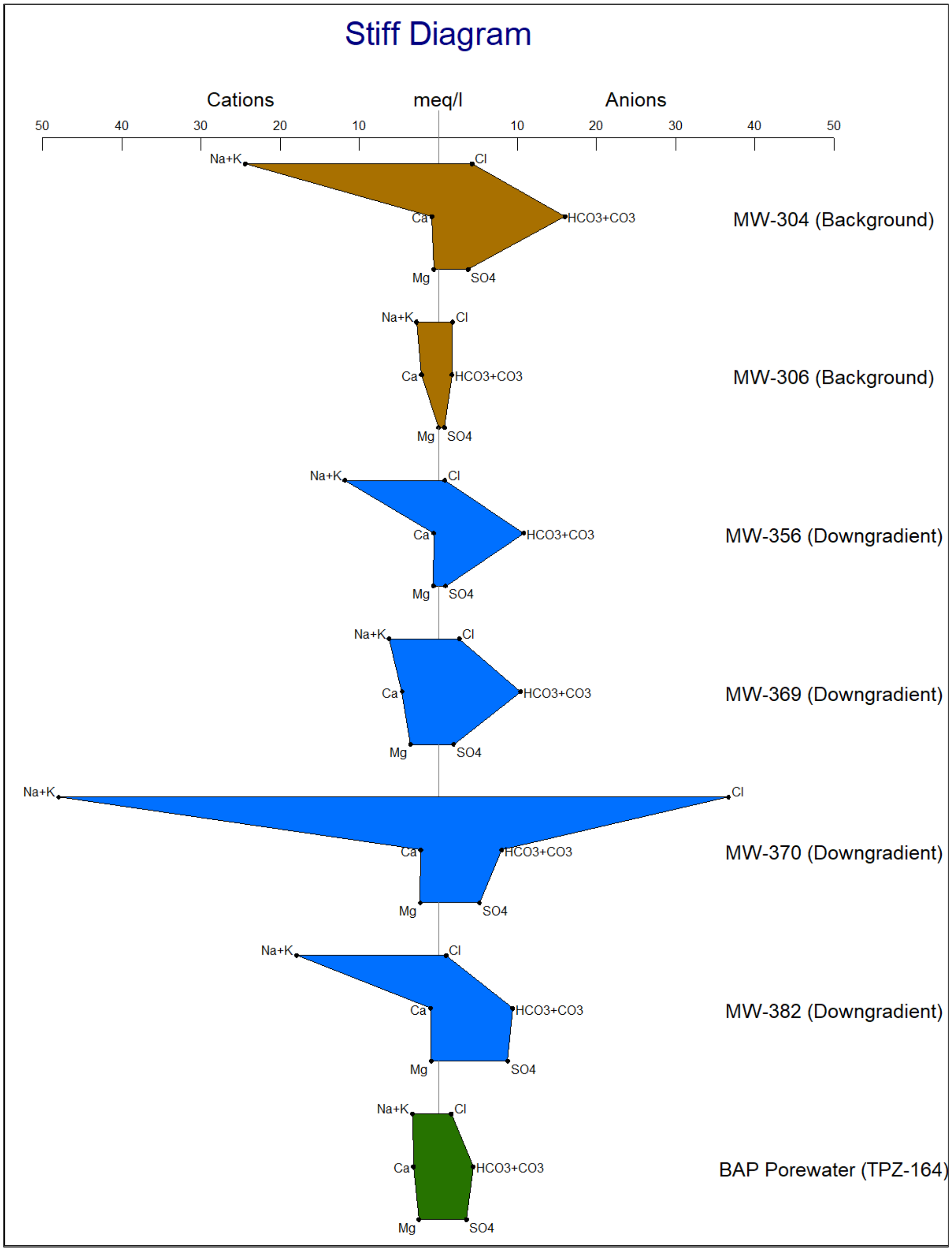


Figure A. Stiff Diagram Showing Ionic Composition of Samples of BAP Background (Brown) and Downgradient Groundwater (Blue) and BAP Porewater (Green).

The ionic composition of the BAP porewater is different than the ionic composition of the groundwater, thus the groundwater at MW-370 is not influenced by the BAP.

3. CONCLUSIONS

Based on the following two LOEs, it has been demonstrated that the lithium SSL at MW-370 is not due to the Baldwin BAP but is from a source other than the CCR unit being monitored:

1. The median lithium concentration in the BAP porewater is lower than the median concentrations observed in background and downgradient groundwater.
2. The BAP porewater has a different ionic composition than groundwater.

This information serves as the written ASD prepared in accordance with 40 C.F.R. § 257.95(g)(3)(ii) that the SSL observed during the A3 sampling event was not due to the BAP. Therefore, a corrective measures assessment is not required, and the Baldwin BAP will remain in assessment monitoring.

4. REFERENCES

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

FIGURES

Y:\Mapping\Projects\22\2285_Baldwin\MXD\ASD\Figure 1_MW and BAP Water Sam Loc_ASD.mxd

PROJECT: 169000XXXX | DATED: 4/16/2020 | DESIGNER: galarnmc

BOTTOM ASH POND DOWNGRADIENT CCR MONITORING WELL LOCATION

BOTTOM ASH POND BACKGROUND CCR MONITORING WELL LOCATION

BOTTOM ASH POND POREWATER SAMPLE LOCATION

BOTTOM ASH POND UNIT BOUNDARY

0 400 800
Feet

MONITORING WELL AND BOTTOM ASH POND WATER SAMPLE LOCATION MAP

BALDWIN BOTTOM ASH POND (UNIT ID: 601)
ALTERNATE SOURCE DEMONSTRATION
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

FIGURE 1

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

APPENDIX A
BORING LOG FOR POREWATER WELL TPZ-164

KELRON ENVIRONMENTAL
Incorporated

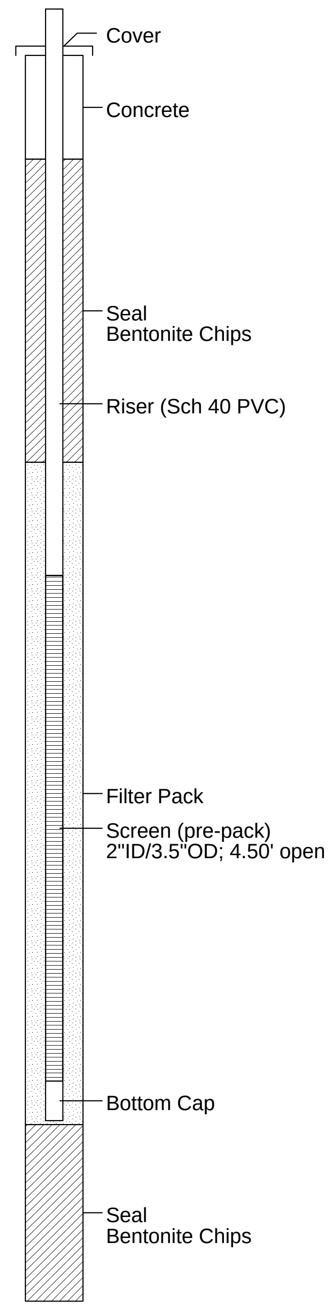
LOG OF PROBEHOLE TPZ-164

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/26/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 432.50
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 435.10
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383909, 556829

Depth in Feet	DESCRIPTION	Surf. Elev. 432.50	Samples	Blow Count	Recovery inches	Qp TSF	USCS	GRAPHIC
0	FILL - Bottom Ash, coarse, black (10YR 2/1), dry							
1								
2		430						
3	- moist <Shelby Tube Sample ST164-5 @ 3-5'> grain size analysis (Ash): 50% Sand, 42.9% Silt, 7.1% Clay	429						
4	- wet	428	1		17/24		AR	
5		427						
6		426						
7		425						
8		424		3				
9	CLAY (lean), stiff, medium to high plasticity, dark gray (10YR 4/1), moist - @8.9' - light yellowish brown (10YR 6/4) with <10% light gray mottling - @9.3' - gray (10YR 6/1) with 25-50% brownish-yellow mottling (10YR 6/6)	423	2	3 5	18/18		CL	
10	- light olive brown <Shelby Tube Sample ST164-12 @ 10-12'> grain size analysis: 7.2% Sand, 62.2% Silt, 30.6% Clay	422						
11	END BOREHOLE AT 10.3 FEET BLS END Split-Spoon Sampling at 12 feet BLS	421	3		23/24		CL	
12		420 419						

Well: TPZ-164
Elev.: 435.10



ATTACHMENT 2 – MAP OF GROUNDWATER MONITORING WELL LOCATIONS

BOTTOM ASH POND DOWNGRADIENT CCR MONITORING WELL LOCATION

BOTTOM ASH POND BACKGROUND CCR MONITORING WELL LOCATION

BOTTOM ASH POND POREWATER SAMPLE LOCATION

BOTTOM ASH POND UNIT BOUNDARY

0 400 800 Feet

MONITORING WELL AND BOTTOM ASH POND WATER SAMPLE LOCATION MAP

BALDWIN BOTTOM ASH POND (UNIT ID: 601)
ALTERNATE SOURCE DEMONSTRATION
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

Y:\Mapping\Projects\22\2285_Baldwin\MXD\ASD\Figure 1_MW and BAP Water Sam Loc_ASD.mxd

PROJECT: 169000XXXX | DATED: 4/16/2020 | DESIGNER: galarnmc

ATTACHMENT 3 – WELL CONSTRUCTION DIAGRAMS AND DRILLING LOGS

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-304

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	10/9/2015	10/20/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-304	Feet (NAVD88)	453.03 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,194.03 N, 2,386,608.77 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 17.9952"
Long -89° 51' 12.39"

Local Grid Location ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–5.8	0 - 5.8' **SILTY CLAY** CL/ML.	CL/ML									0-35.4' Blind Drilled. See log MW-104DR for soil description details.
			5.8–12	5.8 - 13.5' **FAT CLAY:** CH.	CH									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				5.8 - 13.5' **FAT CLAY:** CH. *(continued)*	CH									
			13.5	13.5 - 15' **LEAN CLAY:** CL.	CL									
			15	15 - 23.5' **SILTY CLAY** CL/ML.	CL/ML									
			23.5	23.5 - 24.5' **SANDY FAT CLAY:** s(CH).	s(CH)									
			24.5	24.5 - 27.3' **POORLY-GRADED SAND:** SP.	SP									
			27.3	27.3 - 30' **SILTY CLAY** CL/ML.	CL/ML									
			30	30 - 35.4' **SHALE:** BDX (SH).	BDX (SH)									

Depth scale: 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			33–35	30 - 35.4' **SHALE:** BDX (SH). *(continued)*	BDX (SH)									
1 CORE	60 31		36–40	35.4 - 41.3' **LEAN CLAY:** CL, gray, 2" of wood on top of unit, stiff, dry. 36.3' stiff to very hard, dry. 36.7' trace chert gravel.	CL									
2 CORE	60 59.5		40–41	40.2' dry.										
			42–45	41.3 - 46.8' **SHALEY LIMESTONE:** BDX (LS/SH), thinly to medium bedded with shale, intensely to moderately fractured (extremely narrow apertures). 41.6' - 42' vertical fracture.	BDX (LS/SH)									
3 CORE	60 63		45–46	45.4' intensely fractured.										Core 3, RQD=75%
			47–50	46.8 - 55.6' **SHALE:** BDX (SH), gray, trace chert gravel, thickly bedded, highly to moderately decomposed, intensely fractured.	BDX (SH)									
4 CORE	60 65		50–52	50.4' moderately fractured.										Core 4, RQD=95%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			53–55	46.8 - 55.6' **SHALE:** BDX (SH), gray, trace chert gravel, thickly bedded, highly to moderately decomposed, intensely fractured. *(continued)* 54.4' intensely fractured.	BDX (SH)									
5 CORE	60 57		56–59	55.6 - 60.2' **LIMESTONE:** BDX (LS), shaley, thickly bedded, fossiliferous, unfractured to slightly fractured.	BDX (LS)									Core 5, RQD=95% Bedrock corehole reamed 6" in diameter to 59' for well installation.
6 CORE	60 64		60–64	60.2 - 81.6' **SHALEY LIMESTONE:** BDX (LS/SH), medium bedded, mostly fossiliferous limestone, highly decomposed dark gray shale beds, intensely to moderately fractured.										Core 6, RQD=73%
7 CORE	60 66		65–69		BDX (LS/SH)									Core 7, RQD=64%
8 CORE	60 63		70–72	70.3' thickly bedded with dark gray shale.										Core 8, RQD=88%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			73	60.2 - 81.6' **SHALEY LIMESTONE:** BDX (LS/SH), medium bedded, mostly fossiliferous limestone, highly decomposed dark gray shale beds, intensely to moderately fractured. *(continued)*										
9 CORE	60 60		74–76	75' diagonal fracture (narrow aperture). 75.3' intensely fractured.										Core 9, RQD=50%
			77–79		BDX (LS/SH)									
10 CORE	60 72		80–81	80.3' moderately fractured.										Core 10, RQD=43%
			82–84	81.6 - 91.9' **SHALE:** BDX (SH), gray, highly decomposed, intensely fractured.										
11 CORE	60 65		85–86	85.4' moderately to highly decomposed, intensely to moderately fractured.										Core 11, RQD=57%
			87–89		BDX (SH)									
12 CORE	60 61.5		90–92	90.5' extremely narrow to very narrow apertures.										Core 12, RQD=50%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			93, 94, 95	91.9 - 115.3' **SHALEY LIMESTONE:** BDX (LS/SH), thinly to medium bedded with shale, slightly to moderately decomposed shale, intensely to moderately fractured (extremely narrow to narrow apertures). *(continued)*										
13 CORE	60 62		96, 97, 98, 99, 100	95.3' tight to very narrow apertures.										Core 13, RQD=48%
14 CORE	60 65		101, 102, 103, 104, 105	100.4' thickly bedded, moderately fractured.	BDX (LS/SH)									Core 14, RQD=65%
15 CORE	60 60		106, 107, 108, 109, 110	105.3' medium bedded, slightly fractured (very narrow apertures).										Core 15, RQD=98%
16 CORE	60 72		111, 112	110.3' moderately fractured.										Core 16, RQD=91%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			113–115	91.9 - 115.3' **SHALEY LIMESTONE:** BDX (LS/SH), thinly to medium bedded with shale, slightly to moderately decomposed shale, intensely to moderately fractured (extremely narrow to narrow apertures). *(continued)*	BDX (LS/SH)									
17 CORE	60 60.5		116–120	115.3 - 135.4' **LIMESTONE:** BDX (LS), fossiliferous, thinly to medium bedded, slightly fractured (narrow apertures).										Core 17, RQD=100%
18 CORE	60 59		121–125	120.4' trace cherty limestone, slightly to moderately fractured (extremely narrow to very narrow apertures).	BDX (LS)									Core 18, RQD=97%
19 CORE	60 60.5		126–130	125.3' slightly fractured (very narrow to narrow apertures).										Core 19, RQD=98%
20 CORE	60 60		131–132	130.4' very narrow apertures.										Core 20, RQD=98%

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			133 134 135	115.3 - 135.4' **LIMESTONE:** BDX (LS), fossiliferous, thinly to medium bedded, slightly fractured (narrow apertures). *(continued)*	BDX (LS)									
				135.4' End of Boring.										

RECORD OF SUBSURFACE EXPLORATION

MONITORING WELL BAMW-306 Renamed MW-306

PROJECT: IP BALDWIN
PHASE III, AREA 1

JOB NO.: 124081

DATE DRILLED: 09/25/91

DRILLING METHOD: H.S.A. & NX Rock Core

DRILLED BY: Crank

LOGGED BY: Brooks

BOREHOLE NUMBER: BTB-38

ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	DESCRIPTION	REMARKS	RECOVERY RATIO in/in	PENETROMETER, HAND, tsf
0 – 30	Boring Continues			Augered to 53.2'. No Samples Taken. See BAMW-124; BTB-39 for sample descriptions from 0-53.5'		

RECORD OF SUBSURFACE EXPLORATION

MONITORING WELL BAMW-306 Renamed MW-306

PROJECT: IP BALDWIN
PHASE III, AREA 1

JOB NO.: 124081

DATE DRILLED: 09/25/91

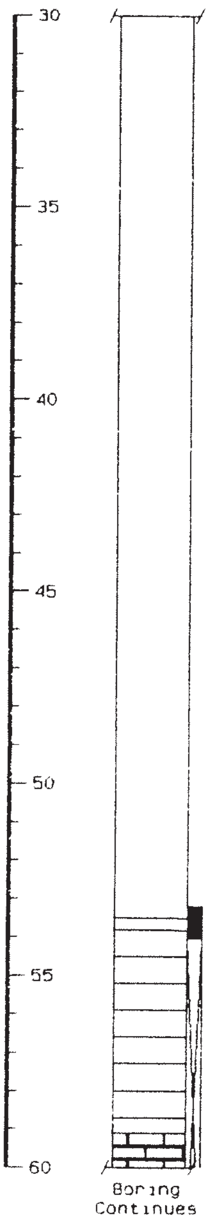
DRILLING METHOD: H.S.A. & NX Rock Core

DRILLED BY: Crank

LOGGED BY: Brooks

BOREHOLE NUMBER: BTB-38

ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	DESCRIPTION	REMARKS	RECOVERY RATIO in/in	PENETROMETER, HAND, tsf
30				Augered to 53.2'. No Samples Taken. See BAMW-124; BTB-39 sample descriptions from 0-53.5'		
			Gray Clayey SHALE		4/10 62/108	
			Light Gray LIMESTONE			



RECORD OF SUBSURFACE EXPLORATION

MONITORING WELL BAMW-306 Renamed MW-306

PROJECT: IP BALDWIN — PHASE III, AREA 1

JOB NO.: 124081

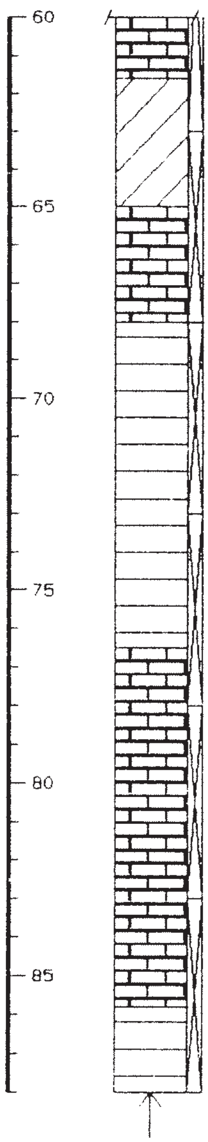
DATE DRILLED: 09/25/91

DRILLING METHOD: H.S.A. & NX Rock Core

DRILLED BY: Crank

LOGGED BY: Brooks

BOREHOLE NUMBER: BTB-38



ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	DESCRIPTION	REMARKS	RECOVERY RATIO in/in	PENETROMETER, HAND, tsf
			Light Gray LIMESTONE			
		CL	Gray Shaley CLAY			
					60/60	
			Light Gray LIMESTONE			
			Olive Clayey SHALE		37/60	
			-Dark Gray, Calcareous below 70.3'			
					60/60	
			Light Gray LIMESTONE			
					60/60	
					59/60	
			Dark Gray Clayey SHALE			

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-356

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	9/28/2015	10/1/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-356	Feet (NAVD88)	425.18 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 558,050.37 N, 2,381,958.49 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 56.2662"
Long -89° 52' 10.4808"

Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0 - 10	0 - 10' **SILTY CLAY** CL/ML.	CL/ML								0-37.3' Blind Drilled. See logs OW-156 and OW-256 for soil description.
			10 - 12	10 - 17.7' **LEAN CLAY WITH SAND:** (CL)s.	(CL)s								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			12–17.7	10 - 17.7' **LEAN CLAY WITH SAND:** (CL)s. *(continued)*	(CL)s									
			17.7–27.3	17.7 - 27.3' **SILTY CLAY** CL/ML.	CL/ML									
			27.3–28.6	27.3 - 28.6' **POORLY-GRADED SAND:** SP.	SP									
			28.6–32	28.6 - 33.9' **SILTY CLAY** CL/ML.	CL/ML									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			33	28.6 - 33.9' **SILTY CLAY** CL/ML. *(continued)*	CL/ML									
			34–35	33.9 - 35.7' **LEAN CLAY:** to **SHALE:** CL.	CL									
			36–37	35.7 - 37.3' **SHALE:** BDX (SH).	BDX (SH)									
1 CORE	28 24.5		38–39	37.3 - 53.8' **SHALE:** BDX (SH), weathered shale and clay, brown to dark gray, soft, slightly fractured.										Core 1, RQD=92%
2 CORE	60 57		40–41	39.6' light to dark gray to tan.										Core 2, RQD = 58%
			42–43	42.3' - 43.2' limestone.										
			43–44	43.2' light to dark gray/tan, very weak.										
3 CORE	60 41		45–49	45' - 50' dark gray, intensely fractured.	BDX (SH)									Low recovery, possible washout. Core 3, RQD = 18%
4 CORE	36 36		50–52	50' - 53.1' thin beds of limestone, limestone is more competent, slightly fractured, wet.										Core 4, RQD=92%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				37.3 - 53.8' **SHALE:** BDX (SH), weathered shale and clay, brown to dark gray, soft, slightly fractured. *(continued)*	BDX (SH)									
5 CORE	24 21.5		53	53.1' - 53.8' intensely fractured.										Core 5, RQD=58%
			54	53.8 - 55.4' **LIMESTONE:** BDX (LS), white, thickly bedded, moderately fractured (moderately wide to very narrow apertures).	BDX (LS)									
6 CORE	60 60.5		55											Core 6, RQD=84%
			56	55.4 - 57.2' **SHALE:** BDX (SH), dark gray, trace limestone beds, moderately fractured.	BDX (SH)									
			57	56.8' soft, highly weathered bed, decomposed. 57.1' soft, highly weathered bed.										
			58	57.2 - 60' **LIMESTONE:** BDX (LS), trace shale beds, moderately fractured (moderately wide to very wide apertures).	BDX (LS)									
			59	59.4' - 59.7' vertical fractures with pyrite mineralization.										
7 CORE	60 61		60	60 - 65.8' **SHALE:** BDX (SH), gray, moderately fractured.	BDX (SH)									Core 7 RQD=75%
			61	61' -62' dark gray.										
			62	62' - 62.4' soft, clayey.										
			63											
			64											
8 CORE	60 61.5		65	65' dark gray, narrow to moderately wide apertures. 65.3' - 65.8' fossiliferous.										Core 8, RQD=67%
			66	65.8 - 68.8' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, slightly to moderately fractured.	BDX (LS/SH)									
			67											
			68											
			69	68.8 - 70' **SHALE:** BDX (SH), gray, fossiliferous, moderately fractured (moderately wide to narrow apertures).	BDX (SH)									Bedrock corehole reamed 6" in diameter to 69' for well installation.
9 CORE	60 61		70	70 - 75' **SHALEY LIMESTONE:** BDX (LS/SH), gray to dark gray, fossiliferous, medium bedded, moderately fractured (narrow apertures).	BDX (LS/SH)									Core 9, RQD=87%
			71											
			72											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			73 74	70 - 75' **SHALEY LIMESTONE:** BDX (LS/SH), gray to dark gray, fossiliferous, medium bedded, moderately fractured (narrow apertures). *(continued)*	BDX (LS/SH)									
10 CORE	60 60		75	75 - 75.9' **SHALE:** BDX (SH), dark gray, soft, moderately fractured (narrow to moderately narrow apertures).	BDX (SH)									Core 10, RQD=95%
			76	75.9 - 76.2' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, narrow to moderately narrow apertures.	BDX (LS/SH)									
			77 78 79	76.2 - 101.8' **LIMESTONE:** BDX (LS), light gray, fossiliferous, thickly bedded, narrow to moderately narrow apertures.	BDX (LS)									
11 CORE	60 60.5		80 81 82 83 84	80' light gray to gray, unfractured.										Core 11, RQD=100%
12 CORE	60 61.5		85 86 87 88 89											Core 12, RQD=100%
13 CORE	60 59.5		90 91 92											Core 13, RQD=100%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			93–94	76.2 - 101.8' **LIMESTONE:** BDX (LS), light gray, fossiliferous, thickly bedded, narrow to moderately narrow apertures. *(continued)*	BDX (LS)									
14 CORE	61 61		95											Core 14, RQD=100%
			96–99											
15 CORE	60 59.5		100	99.7' slightly weathered, decomposed. 100' gray, no fossils.										Core 15, RQD=100%
			101											
			102–104	101.8 - 106.5' **SHALE:** BDX (SH), dark gray, thickly bedded, slightly fractured.	BDX (SH)									
16 CORE	60 58.5		105											Core 16, RQD=56%
			106	106.2' weathered, decomposed.										
			107–108	106.5 - 108.4' **LIMESTONE:** BDX (LS), light gray to green, highly decomposed, intensely fractured.	BDX (LS)									
			109	108.4 - 109.8' **SHALE:** BDX (SH), dark reddish-brown, highly decomposed.	BDX (SH)									
17 CORE	60 55		110–111	109.8 - 111.1' **LIMESTONE:** BDX (LS), gray, highly disintegrated (healed dissolution cracks with green highly decomposed infilling). 109.9' - 110.7' angular gravel-sized fragments. 110.7' moderately decomposed, very intensely fractured.	BDX (LS)									Core 17, RQD=49%
			111–112		BDX (SH)									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			113	111.1 - 114' **SHALE:** BDX (SH), dark gray, moderately to highly decomposed, moderately fractured. *(continued)*	BDX (SH)									
18 CORE	60 61		114 – 116	114 - 116.3' **LIMESTONE:** BDX (LS), gray, moderately fractured.	BDX (LS)									Core 18, RQD=61%
				116.3 - 116.7' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured.	BDX (LS/SH)									
			117 – 119	116.7 - 119.7' **SHALE:** BDX (SH), gray, slightly decomposed, intensely fractured.	BDX (SH)									
19 CORE	60 64		120	119.7 - 120.9' **SHALEY LIMESTONE:** BDX (LS/SH), gray, slightly decomposed, intensely fractured.	BDX (LS/SH)									Core 19, RQD=86%
			121 – 122	120.9 - 122.2' **SHALE:** BDX (SH), dark gray, moderately fractured.	BDX (SH)									
20 CORE	48 48		123 – 126	122.2 - 126.1' **LIMESTONE:** BDX (LS), gray, moderately fractured. 123.3' - 123.4' fossiliferous. 124.1' - 124.1' fossiliferous. 124.7' - 124.8' fossiliferous.	BDX (LS)									Core 20, RQD =88%
			127	126.1 - 127.6' **SHALE:** BDX (SH), dark gray, slightly decomposed. 126.7' - 127' limestone, gray. 127' moderately decomposed.	BDX (SH)									
			128 – 129	127.6 - 129.2' **LIMESTONE:** BDX (LS), slightly decomposed.	BDX (LS)									
21 CORE	12 12			129.2 - 130' **SHALE:** BDX (SH), gray, intensely fractured.	BDX (SH)									Core 21, RQD=0%
22 CORE	60 60		130	130 - 130.4' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, moderately fractured.	BDX (LS/SH)									Core 22, RQD=94%
			131	130.4 - 131' **LIMESTONE:** BDX (LS), gray, fossiliferous, moderately fractured.	BDX (LS)									
			132	131 - 134' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, moderately fractured.										

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			133	131 - 134' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, moderately fractured. *(continued)*	BDX (LS/SH)									The casing dropped 3" during drilling.
			134	134 - 135' **LIMESTONE:** BDX (LS), gray, thickly bedded, moderately fractured.	BDX (LS)									
			135	135' End of Boring.										

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-369

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mark Baetje Bulldog Drilling	11/17/2015	11/18/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-369	Feet (NAVD88)	420.49 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 557,329.71 N, 2,381,765.41 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 49.1496"
Long -89° 52' 12.9288"

Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0	0 - 0.2' **SILT:** ML.	ML									0-43' Blind Drilled. See log PZ-169 for soil description.
			0.2	0.2 - 2' **SILTY CLAY** CL/ML.	CL/ML									
			2	2 - 4' Shelby Tube Sample.										
			4	4 - 10' **SILTY CLAY** CL/ML.	CL/ML									
			10	10 - 12' **SILTY CLAY** to **LEAN CLAY:** CL/ML.	CL/ML									
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
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NATURAL RESOURCE TECHNOLOGY

Boring Number MW-369

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			12	12 - 14' Shelby Tube Sample.										
			14	14 - 20' **LEAN CLAY:** CL.	CL									
			20	20 - 22' **SILTY CLAY** CL/ML.	CL/ML									
			22	22 - 24' Shelby Tube Sample.										
			24	24 - 28' **LEAN CLAY WITH SAND:** (CL)s.	(CL)s									
			28	28 - 30' **SILTY CLAY** CL/ML.	CL/ML									
			30	30 - 32' **LEAN CLAY:** to **SILTY CLAY** CL.	CL									
			32											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-369

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			32 - 38	32 - 38' **LEAN CLAY:** CL.	CL						
			38 - 40	38 - 40' No Recovery.							
			40 - 42	40 - 42' **LEAN CLAY:** CL.	CL						
1 SS	24 0	10 18 30 40	42 - 45	42 - 45' No Recovery.							
2 SS	5 9	50/5"	45 - 45.3	45 - 45.3' **LEAN CLAY:** CL, dark brown (10YR 3/3), 30-50% pale brown (10YR 6/4) and brown (10YR 4/3) mottling, trace subrounded fine gravel, cohesive, low plasticity, moist.	CL						
			45.3 - 48.7	45.3 - 48.7' **SHALE:** BDX (SH), dark grayish brown, highly decomposed.	BDX (SH)						
3 SS	5 8	50/5"	47	47' trace clay layers (< 1" thick), highly decomposed, very weak.							
1 CORE	66 30		48.7 - 50.8	48.7 - 50.8' **LIMESTONE:** BDX (LS), white, fossiliferous, intensely fractured (extremely narrow to narrow apertures), microcrystalline, slightly to moderately decomposed.	BDX (LS)						Core 1, RQD=17%
			50.8 - 53.4	50.8 - 53.4' **SHALE:** BDX (SH), dark gray, intensely fractured (extremely narrow to narrow apertures), highly decomposed, very weak.	BDX (SH)						

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-369

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			53	50.8 - 53.4' **SHALE:** BDX (SH), dark gray, intensely fractured (extremely narrow to narrow apertures), highly decomposed, very weak. *(continued)*	BDX (SH)									
2 CORE	60 46		54, 55, 56, 57, 58	53.4 - 59.3' **LIMESTONE:** BDX (LS), white, moderately fractured (very narrow to narrow apertures), fossiliferous, microcrystalline, slightly decomposed, very strong, pitted, trace mineralization. 58.4' mud in fracture.	BDX (LS)									Core 2, RQD=83%
3 CORE	60 64		59, 60, 61, 62, 63, 64	59.3 - 64.9' **SHALEY LIMESTONE:** BDX (LS/SH), dark gray, medium bedded shale, intensely fractured (extremely narrow to narrow apertures), fossiliferous, microcrystalline, decomposed, very weak to weak, weathered, highly weathered shale cementing segments together.	BDX (LS/SH)									Core 3, RQD=63%
4 CORE	60 62		65, 66, 67, 68	64.9 - 68.8' **LIMESTONE:** BDX (LS), white, slightly fractured (tight to narrow apertures), fossiliferous, microcrystalline, slightly decomposed, slightly disintegrated, pitted.	BDX (LS)									Core 4, RQD=79%
			69, 70	68.8 - 70.7' Overdrilled for Well Installation.										
				70.7' End of Boring.										Bedrock corehole reamed 6" in diameter to 70.7' for well installation.

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-370

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mark Baetje Bulldog Drilling	11/20/2015	11/24/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-370	Feet (NAVD88)	418.67 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,826.50 N, 2,381,936.14 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 44.1702"
Long -89° 52' 10.8084"

Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0 - 2	0 - 2' **SILTY CLAY** CL/ML.	CL/ML									0-28' Blind Drilled. See log PZ-170 for soil description.
			2 - 4	2 - 4' Shelby Tube Sample.										
			4 - 8	4 - 8' **SILTY CLAY** CL/ML.	CL/ML									
			8 - 10	8 - 10' **SILTY CLAY** to **LEAN CLAY:** CL/ML.	CL/ML									
			10 - 12	10 - 12' **LEAN CLAY:** CL.	CL									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

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NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number MW-370

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			12–14	12 - 14' Shelby Tube Sample.									
			14–24	14 - 24' **SILTY CLAY** CL/ML.	CL/ML								
			24–26	24 - 26' Shelby Tube Sample.									
			26–28	26 - 28' **SILTY CLAY** CL/ML.	CL/ML								
1 SS	10 10	23 50/4"	28	28 - 28.4' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), trace angular limestone gravel, soft, medium plasticity, moist.	CL								
1 CORE	60 18.5		28.4	28.4 - 28.9' **SHALE:** BDX (SH), gray, highly decomposed, very weak.	BDX (SH)								Core 1, RQD=51%
			28.9	28.9 - 38.1' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (extremely narrow to moderately narrow apertures), medium to thickly bedded, microcrystalline, moderately decomposed, very strong.	BDX (LS/SH)								

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-370

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			33	28.9 - 38.1' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (extremely narrow to moderately narrow apertures), medium to thickly bedded, microcrystalline, moderately decomposed, very strong. *(continued)*									
2 CORE	51.5 12		34	33.9' - 38.1' gray, greenish gray in fractures, trace fossils, moderately to highly decomposed, slightly to moderately disintegrated, clay in shoe with a hard, reddish brown inclusion.	BDX (LS/SH)								Core 2, RQD=0%
			35–37	36' - 37.9' vertical fracture.									
3 CORE	24 25		38	38.1 - 44' **SHALE:** BDX (SH), bluish gray, intensely fractured (extremely narrow to narrow apertures), highly decomposed, weak.									Core 3, RQD=40%
4 CORE	24 11		40										Core 4, RQD=0%
5 CORE	36 32		41	40.6' - 40.8 shaley limestone layer, light gray to gray, microcrystalline, moderately decomposed, very strong. 41.1' - 43.2 gray, moderately to highly decomposed.	BDX (SH)								Core 5, RQD=78%
6 CORE	12 28		44	44 - 45.7' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (extremely narrow to narrow apertures), thin to medium bedded, microcrystalline, slightly decomposed, clay cement in apertures, very strong.	BDX (LS/SH)								Core 6, RQD=29%
7 CORE	45 27		45–46	45' shale layer, bluish gray, moderately fractured (extremely narrow to narrow apertures), highly decomposed, weak. 45.7 - 52.2' **SHALE:** BDX (SH), bluish gray, moderately fractured (tight to narrow), highly decomposed, weak.									Core 7, RQD=65%
8 CORE	24 30		49–50		BDX (SH)								Core 8, RQD=78%
9 CORE	24 24		51–52										Core 9, RQD=0%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-370

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
				52' clay cement.										
10 CORE	24 36		53, 54, 55	52.2 - 61.7' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (very narrow to narrow), thin to medium bedded, microcrystalline, slightly decomposed, cemented clay in apertures, very strong. 52.7' - 53' clayey sand in aperture. 53' - 53.1 shale bed, bluish gray, fossiliferous, moderately fractured (very narrow to narrow), highly decomposed, weak. 53.1' white to bluish gray, gray in the fractures (extremely narrow to moderately narrow apertures), thinly to medium bedded, slightly to moderately disintegrated.	BDX (LS/SH)									Core 10, RQD=0%
11 CORE	24 30		56, 57	55.7' moderately disintegrated.										Core 11, RQD=18%
12 CORE	30 27		58, 59, 60	58.1' highly decomposed.										Core 12, RQD=39%
13 CORE	36 53		61											Core 13, RQD=89%
			62, 63, 64, 65	61.7 - 65.3' **LIMESTONE:** BDX (LS).	BDX (LS)									
			66	65.3 - 66' Overdrilled for Well Installation.										
				66' End of Boring.										Bedrock corehole reamed 6" in diameter to 66' for well installation.

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-382

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	11/19/2015	11/24/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-382	Feet (NAVD88)	428.67 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,440.86 N, 2,382,404.51 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 40.344"
Long -89° 52' 4.9578"

Local Grid Location ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0-2	0 - 2' **SILTY CLAY** CL/ML.	CL/ML								0-34' Blind Drilled. See log PZ-182 log for soil description details.
			2-4	2 - 4' Shelby Tube Sample.									
			4-12	4 - 12' **SILTY CLAY** CL/ML.	CL/ML								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

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NATURAL RESOURCE TECHNOLOGY

Boring Number MW-382

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			12–14	12 - 14' Shelby Tube Sample.										
			14–22	14 - 22' **SILTY CLAY** CL/ML.	CL/ML									
			22–24	22 - 24' Shelby Tube Sample.										
			24–27	24 - 27' **SILTY CLAY** CL/ML.	CL/ML									
			27–29.1	27 - 29.1' **WELL-GRADED SAND:** SW.	SW									
			29.1–30	29.1 - 30' **SANDY LEAN CLAY WITH GRAVEL:** s(CL)g.	s(CL)g									
			30–32	30 - 34' **SILTY CLAY** CL/ML.	CL/ML									

Depth scale: 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-382

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			33	30 - 34' **SILTY CLAY** CL/ML. *(continued)*	CL/ML									
1 SS	23 20	12 20 25 50 for 5"	34–35	34 - 36' **SILTY CLAY** CL/ML, dark gray (10YR 4/1), dark yellowish brown 10YR 4/6 mottling, highly decomposed shale at bottom of spoon, hard (>4.5 tsf).	CL/ML									
1 CORE	53 48.5		36–38	36 - 38.3' **SHALE:** BDX (SH), gray, highly decomposed.	BDX (SH)									Core 1, RQD=94%
			39	38.3 - 40' **LIMESTONE:** BDX (LS), thinly laminated, intensely fractured (extremely narrow apertures).	BDX (LS)									
2 CORE	60 24.5		40–44	40 - 44.5' **SHALE:** BDX (SH), gray, highly decomposed.	BDX (SH)									Core 2, RQD=51%
			45	44.5 - 45.4' **LIMESTONE:** BDX (LS), thinly bedded.	BDX (LS)									
3 CORE	54 35		46–49	45.4 - 58.4' **SHALE:** BDX (SH), gray, highly decomposed.	BDX (SH)									Core 3, RQD=51%
4 CORE	24 23.5		50	50.1' - 51.2' reddish brown and dark gray mottling.										Core 4, RQD=19%
			51–52	51.2' - 52.1' limestone, intensely fractured.										

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-382

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
5 CORE	41 41			45.4 - 58.4' **SHALE:** BDX (SH), gray, highly decomposed. *(continued)* 52.1' gray.									Core 5, RQD=63%
			53										
			54										
			55		BDX (SH)								
6 CORE	30 25		56	55.9' gray to dark gray, intensely fractured, few medium limestone beds.									Core 6, RQD=50%
			57										
7 CORE	30 30		58										Core 7, RQD=53%
				58.4 - 62' **LIMESTONE:** BDX (LS), cherty, moderately fractured.									
			59	59.5' - 59.9' vertical fracture.									
			60	60' shale (2" layer).	BDX (LS)								
8 CORE	60 59			60.4' - 61.4' shaley, intensely fractured.									Core 8, RQD=70%
			61										
			62	62 - 67.1' **SHALE:** BDX (SH), gray, hard, slightly fractured.									
			63										
			64										
			65		BDX (SH)								
9 CORE	60 59		66										Core 9, RQD=88%
			67	67.1 - 70.6' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, slightly fractured, (very narrow apertures).									
			68										
			69		BDX (LS/SH)								Bedrock corehole reamed 6" in diameter to 69' for well installation.
			70										
				70.6' End of Boring.									

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

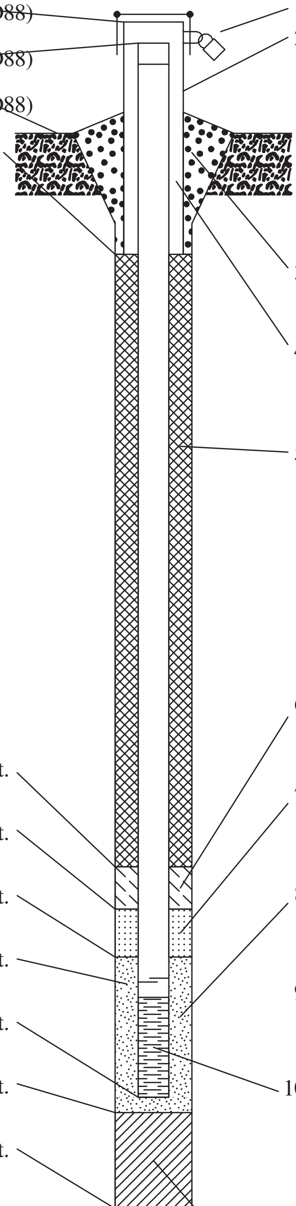
Facility/Project Name: Baldwin Energy Complex	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-304
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 17.995" Long. -89° 51' 12.390" or	
Facility ID	St. Plane 554,194.03 ft. N, 2,386,608.77 ft. E. E/Ⓦ	Date Well Installed: 10/20/2015
Type of Well: mw	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm) John Gates, Bulldog Drilling
Distance from Waste/Source: ft. / State: Illinois	Location of Well Relative to Waste/Source: u ☒ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known / Gov. Lot Number	

A. Protective pipe, top elevation ____ ft. (NAVD88)

B. Well casing, top elevation 455.49 ft. (NAVD88)

C. Land surface elevation 453.03 ft. (NAVD88)

D. Surface seal, bottom 452.0 ft. (NAVD88) or 1.0 ft.



12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☒ Hollow Stem Auger ☐ ____ Other ☐

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Village of Baldwin

E. Bentonite seal, top 413.0 ft. (NAVD88) or 40.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 410.0 ft. (NAVD88) or 43.0 ft.

H. Screen joint, top 408.0 ft. (NAVD88) or 45.0 ft.

I. Well bottom 398.0 ft. (NAVD88) or 55.0 ft.

J. Filter pack, bottom 397.0 ft. (NAVD88) or 56.0 ft.

K. Borehole, bottom 394.0 ft. (NAVD88) or 59.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.

1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒ Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Three steel bollards

3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐

4. Material between well casing and protective pipe: Bentonite ☒ Sand Other ☒

5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
d. 30 % Bentonite . . . Bentonite-cement grout ☒
e. ____ Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐

6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
a. ____
b. Volume added ____ ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. Unimin Corporation, FILTERSIL
b. Volume added ____ ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐

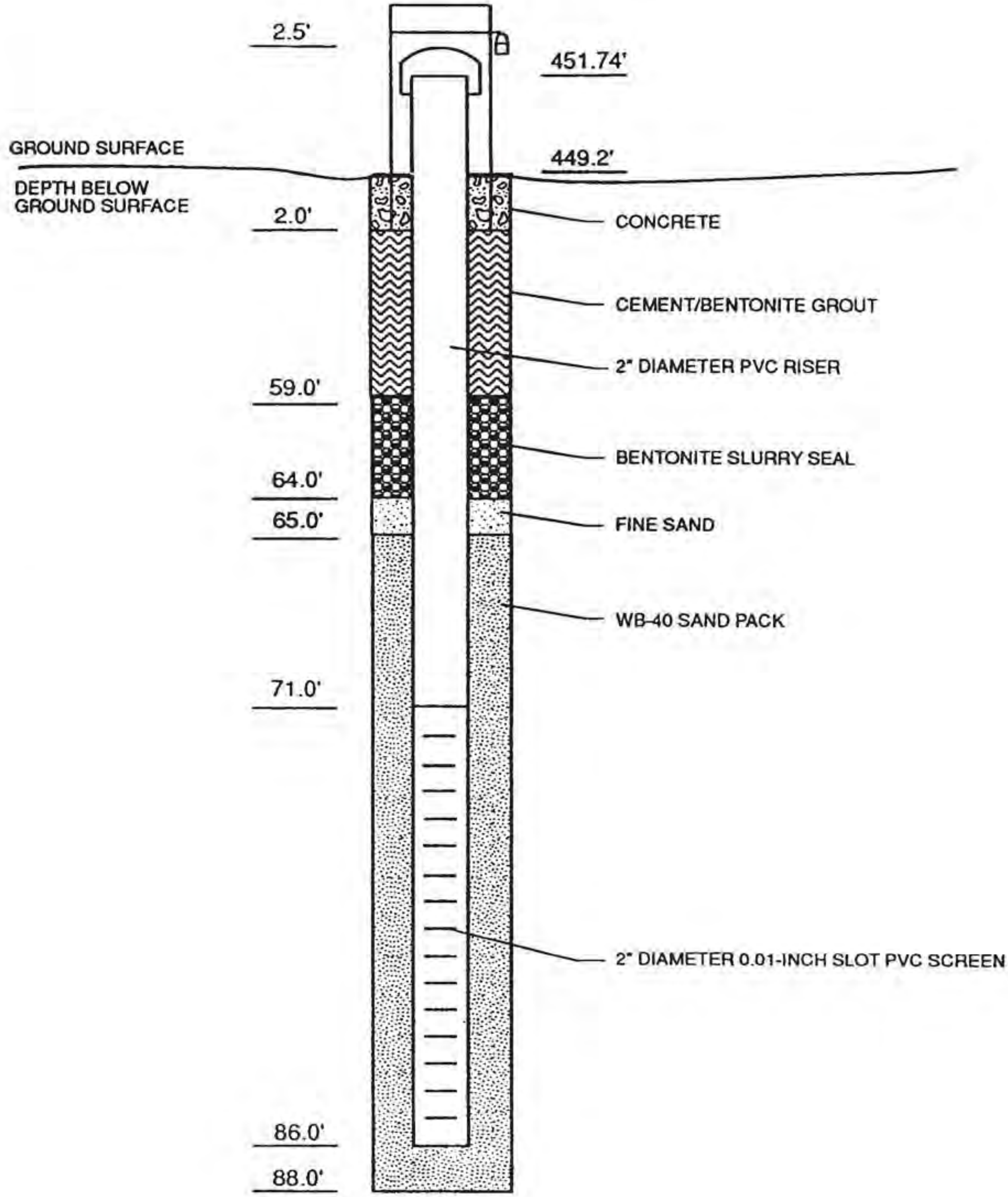
10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
b. Manufacturer ____
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☐
1' of bentonite chips, 2' of bedrock drill cuttings Other ☒

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 2/4/2016

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608



NOT TO SCALE

Burlington Environmental Inc.	
Renamed MW-306 BAMW - 306 MONITORING WELL CONSTRUCTION DIAGRAM	
BALDWIN FGD SOLID WASTE BALDWIN, ILLINOIS 124081	BAMW-306

PROJECT MANAGER | PROJECT MANAGER | CHECKED BY | DRAWN BY MH | REV. DATE 11/20/91

Natural Resource Technology

MONITORING WELL CONSTRUCTION

Facility/Project Name: Baldwin Energy Complex	Local Grid Location of Well: ____ft. ☐ N. ☐ S. ____ft. ☐ E. ☐ W.	Well Name
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 56.266" Long. -89° 52' 10.481" or	MW-356
Facility ID	St. Plane 558,050.37 ft. N, 2,381,958.49 ft. E. E /Ⓦ	Date Well Installed: 10/01/2015
Type of Well: mw	Section Location of Waste/Source: ____1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm) John Gates, Bulldog Drilling
Distance from Waste/Source ____ ft. / State: Illinois	Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☒ Downgradient; n ☐ Not Known / Gov. Lot Number	

A. Protective pipe, top elevation ____ ft. (NAVD88)

B. Well casing, top elevation 427.60 ft. (NAVD88)

C. Land surface elevation 425.18 ft. (NAVD88)

D. Surface seal, bottom 424.2 ft. (NAVD88) or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☒; Hollow Stem Auger ☐; ____ Other ☐

15. Drilling fluid used: Water ☒ 0 2; Air ☐; Drilling Mud ☐ 0 3; None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Village of Baldwin

E. Bentonite seal, top 376.1 ft. (NAVD88) or 49.1 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 371.3 ft. (NAVD88) or 53.9 ft.

H. Screen joint, top 369.2 ft. (NAVD88) or 56.0 ft.

I. Well bottom 359.2 ft. (NAVD88) or 66.0 ft.

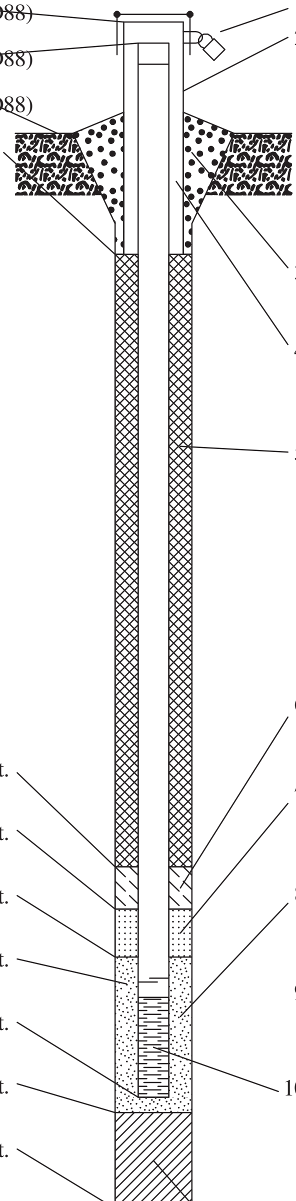
J. Filter pack, bottom 358.2 ft. (NAVD88) or 67.0 ft.

K. Borehole, bottom 356.2 ft. (NAVD88) or 69.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒; Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Two steel bollards
3. Surface seal: Bentonite ☐; Concrete ☒; Other ☐
4. Material between well casing and protective pipe: Bentonite ☒; Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____Lbs/gal mud weight . . . Bentonite slurry ☐
   d. 30 % Bentonite . . . Bentonite-cement grout ☒
   e. ____Ft^3 volume added for any of the above
   f. How installed: Tremie ☐; Tremie pumped ☒; Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Unimin Corporation, FILTERSIL
   b. Volume added ____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒; Flush threaded PVC schedule 80 ☐; Other ☐
10. Screen material: Schedule 40 PVC
   a. Screen Type: Factory cut ☒; Continuous slot ☐; Other ☐
   b. Manufacturer ____
   c. Slot size: 0.010 in.
   d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐; 2' of bedrock drill cuttings Other ☒

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 2/26/2016

Signature	Firm
Brad Rouke [signature]	Natural Resource Technology, 234 W. Florida Street, Floor 5, Milwaukee, WI 53204. Tel: (414) 837-3607 Fax: (414) 837-3608

MONITORING WELL CONSTRUCTION

Facility/Project Name: Baldwin Energy Complex	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 49.150" Long. -89° 52' 12.929" or	MW-369
Facility ID	St. Plane 557,329.71 ft. N, 2,381,765.41 ft. E. E /(W)	Date Well Installed: 11/19/2015
Type of Well: mw	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm) Mark Baetje Bulldog Drilling
Distance from Waste/ Source ____ ft. / State: Illinois	Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☒ Downgradient; n ☐ Not Known / Gov. Lot Number: ____	

A. Protective pipe, top elevation ____ ft. (NAVD88)

B. Well casing, top elevation 422.71 ft. (NAVD88)

C. Land surface elevation 420.49 ft. (NAVD88)

D. Surface seal, bottom 419.5 ft. (NAVD88) or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☒; Hollow Stem Auger ☐; ____ Other ☐

15. Drilling fluid used: Water ☒ 0 2; Air ☐; Drilling Mud ☐ 0 3; None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Village of Baldwin

E. Bentonite seal, top 373.7 ft. (NAVD88) or 46.8 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 368.7 ft. (NAVD88) or 51.8 ft.

H. Screen joint, top 364.5 ft. (NAVD88) or 56.0 ft.

I. Well bottom 354.5 ft. (NAVD88) or 66.0 ft.

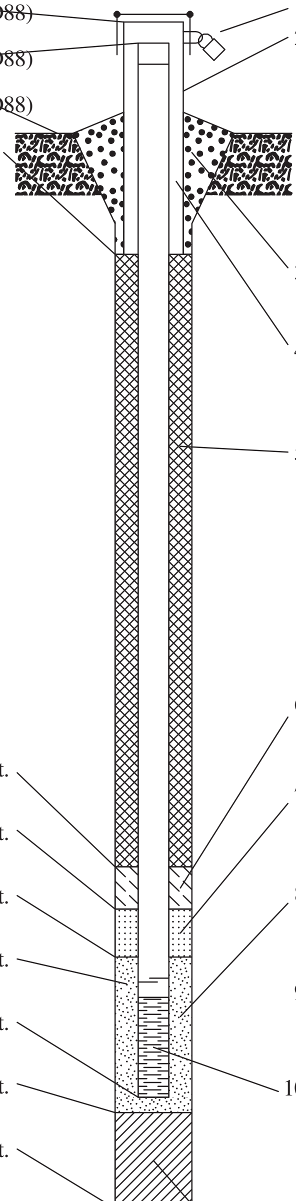
J. Filter pack, bottom 353.3 ft. (NAVD88) or 67.2 ft.

K. Borehole, bottom 349.8 ft. (NAVD88) or 70.7 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒; ____ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Two steel bollards
3. Surface seal: Bentonite ☐; Concrete ☒; ____ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒; Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. 30 % Bentonite . . . Bentonite-cement grout ☒
   e. ____ Ft^3 volume added for any of the above
   f. How installed: Tremie ☐; Tremie pumped ☒; Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Unimin Corporation, FILTERSIL
   b. Volume added ____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒; Flush threaded PVC schedule 80 ☐; ____ Other ☐
10. Screen material: Schedule 40 PVC
   a. Screen Type: Factory cut ☒; Continuous slot ☐; ____ Other ☐
   b. Manufacturer ____
   c. Slot size: 0.010 in.
   d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐
   1' of bentonite chips, 2.5' of bedrock drill cuttings Other ☒

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 2/26/2016

Signature: [signature]

Firm: Natural Resource Technology, 234 W. Florida Street, Floor 5, Milwaukee, WI 53204. Tel: (414) 837-3607 Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Baldwin Energy Complex	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-370
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 44.170" Long. -89° 52' 10.808" or	
Facility ID	St. Plane 556,826.50 ft. N, 2,381,936.14 ft. E. E/Ⓦ	Date Well Installed: 11/25/2015
Type of Well: mw	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm): Mark Baetje, Bulldog Drilling
Distance from Waste/Source: ft. / State: Illinois	Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☒ Downgradient; n ☐ Not Known / Gov. Lot Number:	

A. Protective pipe, top elevation ____ ft. (NAVD88)

B. Well casing, top elevation 420.85 ft. (NAVD88)

C. Land surface elevation 418.67 ft. (NAVD88)

D. Surface seal, bottom 417.7 ft. (NAVD88) or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☒ Hollow Stem Auger ☐ Other ☐

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Village of Baldwin

E. Bentonite seal, top 389.7 ft. (NAVD88) or 29.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 367.7 ft. (NAVD88) or 51.0 ft.

H. Screen joint, top 365.7 ft. (NAVD88) or 53.0 ft.

I. Well bottom 355.7 ft. (NAVD88) or 63.0 ft.

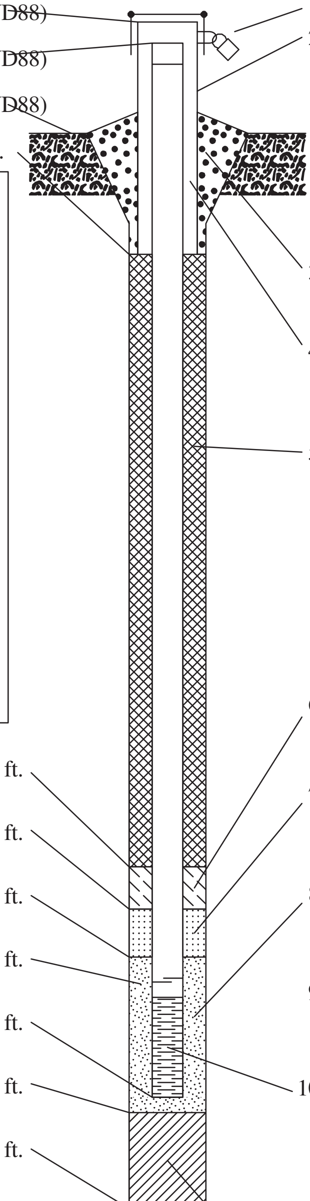
J. Filter pack, bottom 355.2 ft. (NAVD88) or 63.5 ft.

K. Borehole, bottom 352.7 ft. (NAVD88) or 66.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Three steel bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. 30 % Bentonite . . . Bentonite-cement grout ☒
   e. ____ Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Unimin Corporation, FILTERSIL
   b. Volume added ____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
   a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
   b. Manufacturer ____
   c. Slot size: 0.010 in.
   d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐ Other ☒
   2.1' of bentonite chips, 0.4' of bedrock drill cuttings

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 2/26/2016

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

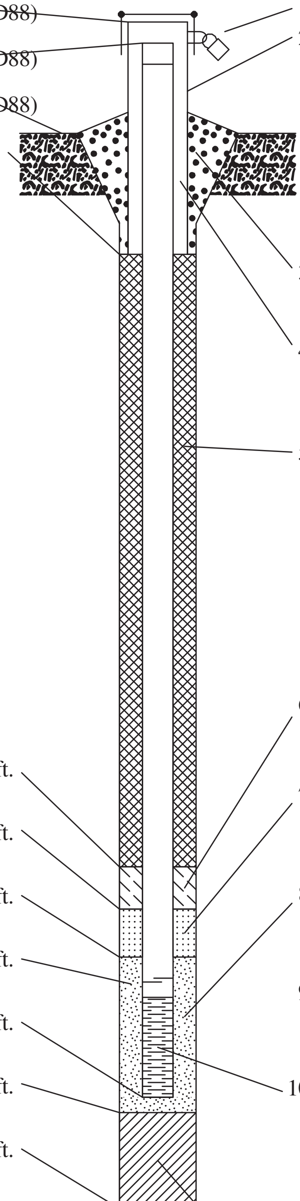
Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Energy Complex	___ ft. ☐ N. ☐ S. ___ ft. ☐ E. ☐ W.	MW-382
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 40.344" Long. -89° 52' 4.958" or St. Plane 556,440.86 ft. N, 2,382,404.51 ft. E. E/(W)	Date Well Installed 11/23/2015
Facility ID	Section Location of Waste/Source ___ 1/4 of ___ 1/4 of Sec. ___, T. ___ N, R. ___ ☐ E ☐ W	Well Installed By: (Person's Name and Firm) Jim Dittmaier, Bulldog Drilling
Type of Well: mw	Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☒ Downgradient; n ☐ Not Known	Gov. Lot Number
Distance from Waste/Source ___ ft.	State: Illinois	

A. Protective pipe, top elevation ___ ft. (NAVD88)

B. Well casing, top elevation 431.19 ft. (NAVD88)

C. Land surface elevation 428.67 ft. (NAVD88)

D. Surface seal, bottom 427.7 ft. (NAVD88) or 1.0 ft.



12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☒; Hollow Stem Auger ☐; Other ☐

15. Drilling fluid used: Water ☒ 0 2; Air ☐; Drilling Mud ☐ 0 3; None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ___

17. Source of water (attach analysis, if required):
Village of Baldwin

E. Bentonite seal, top 392.8 ft. (NAVD88) or 35.9 ft.

F. Fine sand, top ___ ft. (NAVD88) or ___ ft.

G. Filter pack, top 375.8 ft. (NAVD88) or 52.9 ft.

H. Screen joint, top 372.7 ft. (NAVD88) or 56.0 ft.

I. Well bottom 362.7 ft. (NAVD88) or 66.0 ft.

J. Filter pack, bottom 362.3 ft. (NAVD88) or 66.4 ft.

K. Borehole, bottom 359.7 ft. (NAVD88) or 69.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.

1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒; Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Three steel bollards

3. Surface seal: Bentonite ☐; Concrete ☒; Other ☐

4. Material between well casing and protective pipe: Bentonite ☒; Other ☒ Sand

5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ___ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ___ Lbs/gal mud weight . . . Bentonite slurry ☐
d. 30 % Bentonite . . . Bentonite-cement grout ☒
e. ___ Ft^3 volume added for any of the above
f. How installed: Tremie ☐; Tremie pumped ☒; Gravity ☐

6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ___ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
a. ___
b. Volume added ___ ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. Unimin Corporation, FILTERSIL
b. Volume added ___ ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒; Flush threaded PVC schedule 80 ☐; Other ☐

10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒; Continuous slot ☐; Other ☐
b. Manufacturer ___
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☐; Other ☒ 2.6' of bedrock drill cuttings

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 2/26/2016

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

Monitoring Well Boring Logs – Fly Ash Pond System

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-304

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	10/9/2015	10/20/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-304	Feet (NAVD88)	453.03 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,194.03 N, 2,386,608.77 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 17.9952"
Long -89° 51' 12.39"
Local Grid Location ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–5.8	0 - 5.8' **SILTY CLAY** CL/ML.	CL/ML								0-35.4' Blind Drilled. See log MW-104DR for soil description details.
			5.8–12	5.8 - 13.5' **FAT CLAY:** CH.	CH								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

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Tel: (414) 837-3607
Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13	5.8 - 13.5' **FAT CLAY:** CH. *(continued)*	CH									
			14	13.5 - 15' **LEAN CLAY:** CL.	CL									
			15–23	15 - 23.5' **SILTY CLAY** CL/ML.	CL/ML									
			24	23.5 - 24.5' **SANDY FAT CLAY:** s(CH).	s(CH)									
			25–27	24.5 - 27.3' **POORLY-GRADED SAND:** SP.	SP									
			28–29	27.3 - 30' **SILTY CLAY** CL/ML.	CL/ML									
			30–32	30 - 35.4' **SHALE:** BDX (SH).	BDX (SH)									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			33, 34, 35	30 - 35.4' **SHALE:** BDX (SH). *(continued)*	BDX (SH)									
1 CORE	60 31		36, 37, 38, 39, 40	35.4 - 41.3' **LEAN CLAY:** CL, gray, 2" of wood on top of unit, stiff, dry. 36.3' stiff to very hard, dry. 36.7' trace chert gravel.	CL									
2 CORE	60 59.5		41	40.2' dry.										
			42, 43, 44, 45	41.3 - 46.8' **SHALEY LIMESTONE:** BDX (LS/SH), thinly to medium bedded with shale, intensely to moderately fractured (extremely narrow apertures). 41.6' - 42' vertical fracture.	BDX (LS/SH)									
3 CORE	60 63		46	45.4' intensely fractured.										Core 3, RQD=75%
			47, 48, 49, 50	46.8 - 55.6' **SHALE:** BDX (SH), gray, trace chert gravel, thickly bedded, highly to moderately decomposed, intensely fractured.	BDX (SH)									
4 CORE	60 65		51, 52	50.4' moderately fractured.										Core 4, RQD=95%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			53–55	46.8 - 55.6' **SHALE:** BDX (SH), gray, trace chert gravel, thickly bedded, highly to moderately decomposed, intensely fractured. *(continued)* 54.4' intensely fractured.	BDX (SH)								
5 CORE	60 57		56–59	55.6 - 60.2' **LIMESTONE:** BDX (LS), shaley, thickly bedded, fossiliferous, unfractured to slightly fractured.	BDX (LS)								Core 5, RQD=95% Bedrock corehole reamed 6" in diameter to 59' for well installation.
6 CORE	60 64		60–64	60.2 - 81.6' **SHALEY LIMESTONE:** BDX (LS/SH), medium bedded, mostly fossiliferous limestone, highly decomposed dark gray shale beds, intensely to moderately fractured.									Core 6, RQD=73%
7 CORE	60 66		65–69		BDX (LS/SH)								Core 7, RQD=64%
8 CORE	60 63		70–72	70.3' thickly bedded with dark gray shale.									Core 8, RQD=88%

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			72–75	60.2 - 81.6' **SHALEY LIMESTONE:** BDX (LS/SH), medium bedded, mostly fossiliferous limestone, highly decomposed dark gray shale beds, intensely to moderately fractured. *(continued)*	BDX (LS/SH)								
9 CORE	60 / 60		75–80	75' diagonal fracture (narrow aperture). 75.3' intensely fractured.									Core 9, RQD=50%
10 CORE	60 / 72		80–81.6	80.3' moderately fractured.									Core 10, RQD=43%
			81.6–85	81.6 - 91.9' **SHALE:** BDX (SH), gray, highly decomposed, intensely fractured.	BDX (SH)								
11 CORE	60 / 65		85–90	85.4' moderately to highly decomposed, intensely to moderately fractured.									Core 11, RQD=57%
12 CORE	60 / 61.5		90–92	90.5' extremely narrow to very narrow apertures.									Core 12, RQD=50%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			93	91.9 - 115.3' **SHALEY LIMESTONE:** BDX (LS/SH), thinly to medium bedded with shale, slightly to moderately decomposed shale, intensely to moderately fractured (extremely narrow to narrow apertures). *(continued)*										
			94											
13 CORE	60 62		95	95.3' tight to very narrow apertures.										Core 13, RQD=48%
			96											
			97											
			98											
			99											
14 CORE	60 65		100	100.4' thickly bedded, moderately fractured.										Core 14, RQD=65%
			101											
			102		BDX (LS/SH)									
			103											
			104											
15 CORE	60 60		105	105.3' medium bedded, slightly fractured (very narrow apertures).										Core 15, RQD=98%
			106											
			107											
			108											
			109											
16 CORE	60 72		110	110.3' moderately fractured.										Core 16, RQD=91%
			111											
			112											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			113–115	91.9 - 115.3' **SHALEY LIMESTONE:** BDX (LS/SH), thinly to medium bedded with shale, slightly to moderately decomposed shale, intensely to moderately fractured (extremely narrow to narrow apertures). *(continued)*	BDX (LS/SH)									
17 CORE	60 60.5		115.3–120	115.3 - 135.4' **LIMESTONE:** BDX (LS), fossiliferous, thinly to medium bedded, slightly fractured (narrow apertures).	BDX (LS)									Core 17, RQD=100%
18 CORE	60 59		120–125	120.4' trace cherty limestone, slightly to moderately fractured (extremely narrow to very narrow apertures).										Core 18, RQD=97%
19 CORE	60 60.5		125–130	125.3' slightly fractured (very narrow to narrow apertures).										Core 19, RQD=98%
20 CORE	60 60		130–132	130.4' very narrow apertures.										Core 20, RQD=98%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			133 134 135	115.3 - 135.4' **LIMESTONE:** BDX (LS), fossiliferous, thinly to medium bedded, slightly fractured (narrow apertures). *(continued)*	BDX (LS)									
				135.4' End of Boring.										

RECORD OF SUBSURFACE EXPLORATION

MONITORING WELL BAMW-306 Renamed MW-306

PROJECT: IP BALDWIN
PHASE III, AREA 1

JOB NO.: 124081

DATE DRILLED: 09/25/91

DRILLING METHOD: H.S.A. & NX Rock Core

DRILLED BY: Crank

LOGGED BY: Brooks

BOREHOLE NUMBER: BTB-38

ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	DESCRIPTION	REMARKS	RECOVERY RATIO in/in	PENETROMETER, HAND, tsf
0				Augered to 53.2'. No Samples Taken. See BAMW-124; BTB-39 for sample descriptions from 0-53.5'		
5						
10						
15						
20						
25						
30	Boring Continues					

BURLINGTON ENVIRONMENTAL INC.

RECORD OF SUBSURFACE EXPLORATION

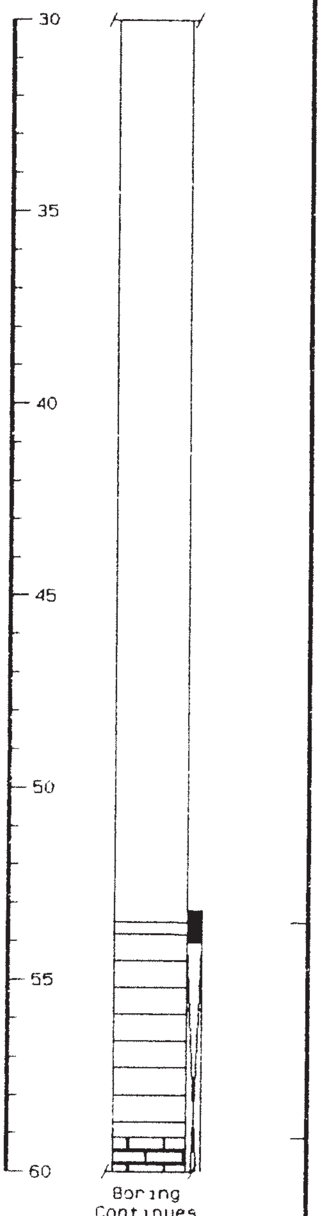
MONITORING WELL BAMW-306

PROJECT: IP BALDWIN
PHASE III, AREA 1

JOB NO.: 124081
DATE DRILLED: 09/25/91

DRILLING METHOD: H.S.A. & NX Rock Core
DRILLED BY: Crank
LOGGED BY: Brooks
BOREHOLE NUMBER: BTB-38

ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	DESCRIPTION	REMARKS	RECOVERY RATIO in/in	PENETROMETER, HAND, tsf
30				Augered to 53.2'. No Samples Taken. See BAMW-124; BTB-39 sample descriptions from 0-53.5'		
			Gray Clayey SHALE		4/10 62/108	
			Light Gray LIMESTONE			



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RECORD OF SUBSURFACE EXPLORATION

MONITORING WELL BAMW-306 Renamed MW-306

PROJECT: IP BALDWIN — JOB NO.: 124081

PHASE III, AREA 1 — DATE DRILLED: 09/25/91

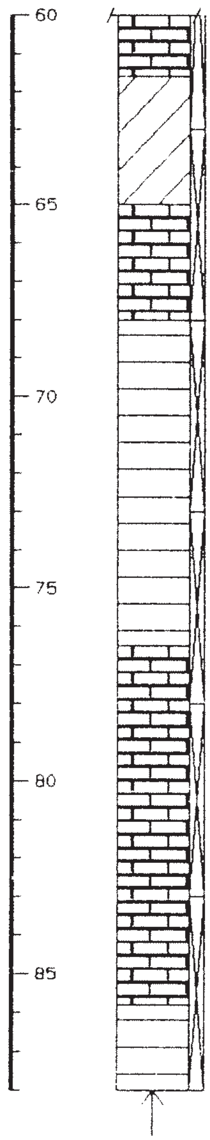
DRILLING METHOD: H.S.A. & NX Rock Core

DRILLED BY: Crank

LOGGED BY: Brooks

BOREHOLE NUMBER: BTB-38

ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	DESCRIPTION	REMARKS	RECOVERY RATIO in/in	PENETROMETER, HAND, tsf
60			Light Gray LIMESTONE			
		CL	Gray Shaley CLAY			
					60/60	
65			Light Gray LIMESTONE			
			Olive Clayey SHALE		37/60	
70			-Dark Gray, Calcareous below 70.3'			
					60/60	
75			Light Gray LIMESTONE			
					60/60	
80						
					59/60	
85			Dark Gray Clayey SHALE			



NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-366

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	12/3/2015	12/4/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-366	Feet (NAVD88)	422.54 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,581.80 N, 2,381,171.15 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 31.8876"
Long -89° 52' 20.4414"

Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–5.6	0 - 5.6' **FILL, SILTY CLAY** CL/ML.	(FILL) CL/ML								0-33' Blind Drilled. See logs TPZ-166 and B-13-4 for soil description.
			5.6–12	5.6 - 33' **SILTY CLAY** CL/ML.	CL/ML								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

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NATURAL RESOURCE TECHNOLOGY

Boring Number MW-366

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13–32	5.6 - 33' **SILTY CLAY** CL/ML. *(continued)*	CL/ML									

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number MW-366

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				5.6 - 33' **SILTY CLAY** CL/ML. *(continued)*	CL/ML									
1 SS	23 18	17 21 20 50	33	33 - 35.6' **LEAN CLAY:** to **SHALE:** CL, gray, residual soil, hard (>4.5 tsf).	CL									
			34											
			35											
1 CORE	60 54		36	35.6 - 39.3' **SHALE:** BDX (SH), gray, highly decomposed, moderately fractured.	BDX (SH)									Core 1, RQD=54%
			37											
			38	38.4' limestone layer (approximately 2.5").										
			39											
			40	39.3 - 42.3' **LIMESTONE:** BDX (LS), cherty, intensely fractured.	BDX (LS)									
2 CORE	60 47		41											Core 2, RQD=32%
			42	42.3 - 42.9' **SHALE:** BDX (SH), dark gray, intensely fractured.	BDX (SH)									
			43	42.9 - 43.7' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured.	BDX (LS/SH)									
			44	43.7 - 49.8' **SHALE:** BDX (SH), dark gray, moderately fractured.	BDX (SH)									
			45											
3 CORE	60 63		46											Core 3, RQD=73%
			47											
			48											
			49											
			50	49.8 - 54.3' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, slightly fractured.	BDX (LS/SH)									
4 CORE	60 49		51											Core 4, RQD=96%
			52											

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number MW-366

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			53 54	49.8 - 54.3' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, slightly fractured. *(continued)* 52.8' - 53.1 shale bed. 53.1' fossiliferous.	BDX (LS/SH)									
				54.3' End of Boring.										Bedrock corehole reamed 6" in diameter to 54' for well installation.

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-375

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	11/3/2015	11/6/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-375	Feet (NAVD88)	420.50 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,434.97 N, 2,380,838.70 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 20.562"
Long -89° 52' 24.6504"

Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0 - 0.9	0 - 0.9' **SILT:** ML.	ML									0- 44.8' Blind Drilled. See log PZ-175 for soil description details.
			0.9 - 5.4	0.9 - 5.4' **LEAN CLAY:** CL.	CL									
			5.4 - 13.5	5.4 - 13.5' **SILT:** ML.	ML									
			13.5 - 15	13.5 - 22.3' **LEAN CLAY:** CL.	CL									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

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Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-375

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			15.5–22.3	13.5 - 22.3' **LEAN CLAY:** CL. *(continued)*	CL									
			22.3–26	22.3 - 26' **SILT:** ML.	ML									
			26–28	26 - 28' **LEAN CLAY:** to **SILT:** CL.	CL									
			28–28.4	28 - 28.4' **SANDY SILT:** s(ML).	s(ML)									
			28.4–31.3	28.4 - 31.3' **LEAN CLAY:** CL.	CL									
			31.3–31.5	31.3 - 31.5' **WELL-GRADED SAND WITH GRAVEL:** (SW)g.	(SW)g									
			31.5–41.5	31.5 - 43.8' **LEAN CLAY:** CL.	CL									

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-375

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	RQD/ Comments
			42	31.5 - 43.8' **LEAN CLAY:** CL. *(continued)*	CL	
			44	43.8 - 44.8' **SANDY LEAN CLAY WITH GRAVEL:** s(CL)g.	s(CL)g	
1 CORE 1 SS	60 42 5 5	50 for 5"	45	44.8 - 45.3' **WELL-GRADED GRAVEL:** GW, gray, mostly limestone cobbles.	GW	Core 1, RQD=86% Broken limestone in split spoon at 45'.
			46	45.3 - 49.3' **SILTY CLAY** CL/ML, dark yellowish brown (10YR 4/6).	CL/ML	
			49	49.3 - 50.1' **LEAN CLAY:** CL, dark gray (10YR 4/1).	CL	
2 CORE	24 18		50	50.1 - 51.3' **SHALE:** BDX (SH), highly decomposed.	BDX (SH)	Core 2, RQD=33%
			51	51.3 - 62.8' **SHALEY LIMESTONE:** BDX (LS/SH), gray, thickly bedded, fossiliferous, moderately fractured.	BDX (LS/SH)	
3 CORE	36 30.5		52			Core 3, RQD=85%
4 CORE	60 55		55			Core 4, RQD=95%
5 CORE	60 62		60	59.9' very narrow to narrow apertures.		Core 5, RQD=94%
			63	62.8 - 84.7' **LIMESTONE:** BDX (LS), fossiliferous, thickly bedded, slightly fractured (extremely narrow to moderately narrow apertures).	BDX (LS)	
6 CORE	60 55		65	64.9' very narrow apertures.		Core 6, RQD=100%

Soil Properties: Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-375

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			68	62.8 - 84.7' **LIMESTONE:** BDX (LS), fossiliferous, thickly bedded, slightly fractured (extremely narrow to moderately narrow apertures). *(continued)*	BDX (LS)									
7 CORE	60 63		70	69.5' slightly to moderately fractured (very narrow to moderately narrow apertures).										Core 7, RQD=95% Bedrock corehole reamed 6" in diameter to 70' for well installation.
8 CORE	60 62		75	74.9' extremely narrow apertures.										Core 8, RQD=100%
9 CORE	60 56		80	80.2' unfractured, cherty.										Core 9, RQD=100%
			84.7	84.7' End of Boring.										

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Baldwin Energy Complex		MW-377	

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	10/29/2015	11/2/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-377	Feet (NAVD88)	418.75 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,198.46 N, 2,381,923.68 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 18.1896"
Long -89° 52' 11.0712"

Local Grid Location: ☐ N ☐ S Feet; ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0 - 4	0 - 4' **TOPSOIL:** ML.	ML									0-28.5' Blind Drilled. See log PZ-177 for soil description.
			4 - 13	4 - 19.3' **LEAN CLAY:** CL.	CL									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13–19.3	4 - 19.3' **LEAN CLAY:** CL. *(continued)*	CL								
			19.3–22	19.3 - 22' **SILT:** ML.	ML								
			22–28.5	22 - 28.5' **LEAN CLAY:** CL.	CL								
1 SS	24	3 6 9 17	28.5–30.8	28.5 - 30.8' **LEAN CLAY:** CL, brownish yellow (10YR 6/6), gray (10YR 5/4) mottling, hard (4.5 tsf).	CL								
2 SS	24 12	12 20 27 30	30.8–34.9	30.8 - 34.9' **SHALE:** BDX (SH), gray, moderately to highly decomposed.	BDX (SH)								
1 CORE	41 51		31.7	31.7' grayish brown mottling, thickly bedded.									Core 1, RQD=92%

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-377

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
2 CORE	55.8 16		35	34.9 - 35.3' **LIMESTONE:** BDX (LS), cherty, moderately decomposed, reddish gray mottling, moderately fractured.	BDX (LS)								Core 2, RQD=25%
			36	35.3 - 46.4' **SHALE:** BDX (SH), gray, moderately to highly decomposed.									
			37										
			38										
			39										
3 CORE	60 64.2		40	39.7' - 40.4' gray and brown mottling, highly decomposed, blocky structure.									Core 3, RQD=75%
			41	40.4' - 43.1' highly decomposed, moderately fractured.	BDX (SH)								
			42										
			43										
			44										
			45										
4 CORE	60 58		46										Core 4, RQD=12%
			47	46.4 - 51.1' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured (narrow apertures).									
			48										
			49		BDX (LS/SH)								
5 CORE	60 50		50	49.5 - 49.9' vertical fracture.									Core 5, RQD=58%
			51										
			52	51.1 - 55.5' **SHALE:** BDX (SH), gray, thickly bedded.									
			53										
			54		BDX (SH)								
			55										
6 CORE	60 41		56	55.5 - 58.2' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, moderately fractured.	BDX (LS/SH)								Core 6, RQD=61%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-377

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			57 58	55.5 - 58.2' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, moderately fractured. *(continued)*	BDX (LS/SH)									
				58.2' End of Boring.										Bedrock corehole reamed 6" in diameter to 58' for well installation.

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-383

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	12/7/2015	12/21/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-383	Feet (NAVD88)	457.18 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,586.04 N, 2,385,208.26 E E/W
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 41.6862"
Long -89° 51' 29.8296"

Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24	4 2 2 4	0–1	0 - 16' **FILL, ASH (Coal):** black (10YR 2/1) and dark yellowish brown (10YR 4/4), mostly sand-sized ash, 30-50% cinders, >15% silt-sized ash, very soft (0 tsf).									
2 SS	24	1 3 2 3	2–3										
3 SS	24 18	1 2 3 7	4–5										
4 SS	24 18	2 11 11 7	6–7		(FILL)								
5 SS	24 17	7 4 3 2	8–9	8' mostly black (10YR 2/1).									
6 SS	24 18	2 4 4 4	10–12										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

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SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-383

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24	2 3 4 1	13	0 - 16' **FILL, ASH (Coal):** black (10YR 2/1) and dark yellowish brown (10YR 4/4), mostly sand-sized ash, 30-50% cinders, >15% silt-sized ash, very soft (0 tsf). *(continued)*	(FILL)									
8 SS	24	1 2 1 2	14, 15	14' clay (2" thick layer).										
9 SS	24 10	WOH WOH 2 2	16, 17	16 - 18' **LEAN CLAY:** CL, gray (5Y 5/1), stiff (1.75 tsf).	CL									WOH=weight of hammer
10 SS	24 14	WOH 2 2 2	18, 19	18 - 40' **SILTY CLAY** CL/ML, gray (10YR 6/1), yellowish brown (10YR 5/6) mottling, stiff to very stiff (1.0-3.0 tsf), low plasticity.										
11 SS	24	WOH 2 2 2	20, 21											
			22, 23											Blind drill 22-24' bgs during casing install. Permanent 6" PVC casing was installed to 22.5' bgs.
13 SS	24 13	1 1 3 3	24, 25	24' gray (10YR 5/1), dark yellowish brown (10YR 4/6) mottling.	CL/ML									
14 SS	24 12	1 1 2 3	26, 27	26' dark gray (10YR 5/6) mottling.										
15 SS	24 23	2 4 4 6	28, 29											
16 SS	24 27	4 4 2 7	30, 31, 32	31' trace oxidation staining.										

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-383

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
17 SS	24 27	4 4 5 5	33	18 - 40' **SILTY CLAY** CL/ML, gray (10YR 6/1), yellowish brown (10YR 5/6) mottling, stiff to very stiff (1.0-3.0 tsf), low plasticity. *(continued)* 32' light brownish gray (10YR 6/2), yellowish brown (10YR 5/6) mottling, very stiff (3.0 tsf).										
18 SS	24 26	2 3 5 6	34, 35	34' gray (10YR 5/1), dark yellowish brown (10YR 4/6) mottling, very stiff (2.0 tsf).										
19 SS	24 14	WOH WOH 3 4	36, 37	36' very soft to stiff (0-1.75 tsf).	CL/ML									
20 SS	24 12	3 4 3 5	38, 39	38' strong brown (7.5YR 4/6), gray (10Y R5/1) mottling, trace sand, very stiff (3.5 tsf).										
21 SS	24 22	1 2 2 2	40	40 - 41' **LEAN CLAY WITH SAND:** (CL)s, gray (10YR 5/1), dark yellowish brown (10YR 4/6) mottling, moderately stiff (0.75 tsf).	(CL)s									
			41	41 - 42' **SILTY SAND:** SM, yellowish brown (10YR 5/6), mostly medium sand, trace coarse sand, soft.	SM									
22 SS	24 24	5 8 9 10	42, 43	42 - 44' **SILTY CLAY** CL/ML, brown (10YR 5/3), >15% sand, moderately stiff (0.75 tsf), nonplastic.	CL/ML									
23 SS	24 20	4 6 8 7	44, 45	44 - 50' **LEAN CLAY:** CL, yellowish brown (10YR 5/6), trace black oxidation staining, very stiff to hard (3.25-4.5+ tsf), plastic.										
24 SS	24 16	4 6 10 11	46, 47		CL									
25 SS	24 19	6 18 21 21	48, 49	48' brown (10YR 5/3), hard (4.25-4.5+), low plasticity.										
26 SS 1 CORE	24 60	8 16 22 32	50, 51, 52	50 - 53.1' **SHALE:** BDX (SH), light olive gray (5Y 6/2), hard, highly decomposed, dry.	BDX (SH)									Core 1, RQD=60%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-383

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
27 SS	24	8 10 15 50/4"		50 - 53.1' **SHALE:** BDX (SH), light olive gray (5Y 6/2), hard, highly decomposed, dry. *(continued)*	BDX (SH)									
			53	53.1 - 55.1' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured.	BDX (LS/SH)									
			54											
2 CORE	60		55	55.1 - 58.6' **LIMESTONE:** BDX (LS), slightly fractured.	BDX (LS)									Core 2, RQD=82%
			56											
			57											
			58	58.6 - 59.5' **SHALE:** BDX (SH), thinly bedded with limestone, moderately fractured.	BDX (SH)									
			59	59.5 - 70.1' **SHALE:** BDX (SH), gray, moderately decomposed. 60' intensely to moderately fractured.	BDX (SH)									
3 CORE	60		60											Core 3, RQD=31%
			61											
			62											
			63	63' moderately fractured.										
			64											
4 CORE	60		65											Core 4, RQD=49%
			66											
			67											
			68											
			69											
5 CORE	34		70	70.1 - 73' **LIMESTONE:** BDX (LS), unfractured.	BDX (LS)									Core 5, RQD=100%
			71											
			72											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-383

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			73	70.1 - 73' **LIMESTONE:** BDX (LS), unfractured. *(continued)*	BDX (LS)									
				73' End of Boring.										Bedrock corehole reamed 6" in diameter to 73' for well installation.

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-384

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	12/7/2015	12/16/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-384	Feet (NAVD88)	456.70 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,446.11 N, 2,384,518.72 E E/W(circled)
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 30.4398"
Long -89° 51' 38.5158"

Local Grid Location ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 / 8	2 3 4 6	0–2	0 - 2.5' **FILL, ASH (Coal):** very soft to moderately stiff (0-0.75 tsf).	(FILL)								
2 SS	24 / 19	2 4 3 6	2–4	2.5 - 4' **FILL, SILTY CLAY** CL/ML, strong brown (7.5YR 4/6), trace gravel, very soft to very stiff (0-3.5 tsf).	(FILL) CL/ML								
3 SS	24 / 10	1 2 3 4	4–6	4 - 18' **FILL, ASH (Coal):** yellowish red (5YR 4/6) to reddish black (10R 2.5/1), sand-sized ash and cinders, very soft to stiff (0-1.5 tsf).	(FILL)								
4 SS	24	2 2 2 2	6–8										
5 SS	24	1 2 1 1	8–10										
6 SS	24	1 2 1 1	10–12										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

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NATURAL RESOURCE TECHNOLOGY

Boring Number MW-384

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24	1 5 10 10	13	4 - 18' **FILL, ASH (Coal):** yellowish red (5YR 4/6) to reddish black (10R 2.5/1), sand-sized ash and cinders, very soft to stiff (0-1.5 tsf). *(continued)*									
8 SS	24 14	5 10 11 11	14	14' wet.									
			15		(FILL)								
9 SS	24 14	5 8 14 15	16, 17										
10 SS	24 16	2 2 3 4	18, 19	18 - 22' **SILTY CLAY** CL/ML, gray (5Y 6/1), organic odor, stiff to very stiff (1.25-3.75 tsf), wet.									
11 SS	24 18	2 2 6 4	20, 21		CL/ML								
12 SS	24 16	4 4 5 4	22, 23	22 - 24' **SILT:** ML, very dark gray (10YR 3/1), dark yellowish brown (10YR 3/6) mottling, hard (4.25-4.5 tsf).	ML								
13 SS	24 22	1 2 5 7	24, 25	24 - 42.4' **SILTY CLAY** CL/ML, gray (10YR 5/1) with yellowish brown (10YR 5/8), oxidation staining, very soft to hard (<0.25-4.5+ tsf).									Permanent 6" PVC casing set at 25' bgs.
14 SS	24 21	3 4 5 7	26, 27	26' yellowish brown (10YR 5/4), trace yellowish brown (10YR 5/8) and very dark gray (10YR 3/1) mottling, 15-30% silt, 5-15% fine sand, trace fine gravel, stiff to very stiff (1.25-2.5 tsf), low to medium plasticity, moist.									
15 SS	24 21	3 4 5 6	28, 29	28' color grades to gray (10YR 5/1), 30-50% silt, soft to stiff (0.5-1.25 tsf).	CL/ML								
16 SS	24 17.5	1 5 5 7	30, 31, 32	30' yellowish brown (10YR 5/8) mottling (15-30%), trace very dark gray (10YR 3/1) mottling, no gravel, very soft to very stiff (<0.25-2.5 tsf), medium plasticity.									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-384

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
17 SS	24 20.5	4 4 4 6	33	24 - 42.4' **SILTY CLAY** CL/ML, gray (10YR 5/1) with yellowish brown (10YR 5/8), oxidation staining, very soft to hard (<0.25-4.5+ tsf). *(continued)* 32' trace yellowish brown (10YR 5/8) and very dark gray (10YR 3/1) mottling, 15-30% silt, stiff to very stiff (1.75-3.5 tsf).									
18 SS	24 22	3 4 5 7	34, 35	34' yellowish brown (10YR 5/8) mottling (15-30%), trace very dark gray (10YR 3/1) mottling, stiff to very stiff (1.5-2.5), dry to moist. 35.3' yellowish brown (10YR 5/8), trace gray (10YR 5/1) and very dark gray (10YR 3/1) mottling.									
19 SS	24 21	4 3 3 4	36, 37	36' gray (10YR 5/1) mottling (15-30%), silt content increasing with depth, moderately stiff to stiff (0.75-1.25 tsf), low plasticity, moist.	CL/ML								
20 SS	24 24	2 4 7 14	38, 39	38' grayish brown (10YR 5/2), trace gray (10YR 5/1), trace strong brown (7.5YR 4/6) mottling, 30-50% silt, soft to very stiff (0.5-3.75 tsf). 38.7' - 40' very dark gray (10YR 3/1) mottling (5-15%), 5-15% fine gravel.									
21 SS	24 25	3 11 21 44	40, 41	40' sand (5-15%), trace gravel, very stiff to hard (3.5-4.5+ tsf). 40.3' wet. 40.8' very stiff to hard (3.5-4.5+ tsf), moist.									
22 SS	24 20	13 11 15 17	42, 43	41.8' fine sand seam (1/4" thick). 42' - 42.4' fine gravel, 30-50% clay, trace sand, wet. 42.4 - 44.3' **CLAYEY SILT** ML/CL, gray (10YR 5/1) to grayish brown (10YR 5/2), 30-50% clay, 5-15% fine sand, trace subrounded gravel, very stiff to hard (3.5-4.5+), nonplastic to low plasticity, moist.	ML/CL								
23 SS	24 17	6 8 10 14	44, 45	43.5' - 44.3' very dark grayish brown (10YR 3/2), brownish yellow trace (10YR 6/6) mottling, trace coal. 44.3 - 56' **LEAN CLAY:** CL, brownish yellow trace (10YR 6/6), trace light brownish gray (10YR 6/2) mottling, 15-30% silt, 5-15% gravel, trace gravel-sized oxidation-stained nodules, very stiff (2.5-3.0 tsf), low to medium plasticity, moist to dry.									
24 SS	24 16	5 10 11 15	46, 47	46' decreasing silt content, trace gravel, clay becoming laminated with depth, very stiff (2.25-3.0 tsf).									
25 SS	24 13.5	6 8 12 22	48, 49	48' silt (5-15%), trace shale gravel, very stiff (3.0 tsf), medium plasticity, dry. 49.2' gravel (2" diameter).	CL								
26 SS	24 16	8 9 15 19	50, 51, 52	50' very dark grayish brown (10YR 3/2) to dark grayish brown (10YR 4/2), trace silt, very stiff (3.5 tsf), medium to high plasticity, highly weathered shale (residual soil).									

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
27 SS	24 22	13 14 9 14	53	44.3 - 56' **LEAN CLAY:** CL, brownish yellow trace (10YR 6/6), trace light brownish gray (10YR 6/2) mottling, 15-30% silt, 5-15% gravel, trace gravel-sized oxidation-stained nodules, very stiff (2.5-3.0 tsf), low to medium plasticity, moist to dry. *(continued)*	CL								
28 SS	24 24	12 12 14 22	54, 55	52' - 54' clay is fractured, light brownish gray (10YR 6/2) to light yellowish brown (10YR 6/4) in fractures. 54' trace very dark brown (10YR 2/2) laminations, hard (>4.5 tsf).									
29 SS	23 20	11 14 20 50/5"	56	56 - 58.2' **SHALE:** BDX (SH), very dark gray (10YR 3/1), highly weathered, fissile, totally healed fractures, very weak, highly decomposed [light brownish gray (10YR 6/2) in fractures], very intensely fractured (closed to narrow apertures).	BDX (SH)								3" steel casing set at 57.7 ft bgs.
1 CORE	24 40		57, 58	57' light yellowish brown (10YR 6/4) to very dark gray (10YR 3/1) layers, thinly bedded, highly decomposed to residual soil.									Core 1, RQD=36%
2 CORE	60 64		59, 60	58.2 - 60.8' **LIMESTONE:** BDX (LS), light greenish gray (GLEY 1 7/10Y), microcrystalline, trace fossils, moderately strong to strong, medium bedded, slightly to moderately decomposed, moderately fractured.	BDX (LS)								Core 2, RQD=73%
			61, 62, 63	60.8 - 64' **SHALEY LIMESTONE:** BDX (LS/SH), weak, thin to medium bedded, moderately decomposed, slightly to moderately disintegrated.	BDX (LS/SH)								
3 CORE	60 73		64, 65, 66, 67, 68	64 - 82.6' **SHALE:** BDX (SH), greenish gray (GLEY 1 5/10Y), very weak, thinly bedded, highly to moderately decomposed, slightly to moderately disintegrated, intensely fractured (very narrow to moderately narrow apertures). 67.9' - 68.8' shale clasts within decomposed shale matrix.	BDX (SH)								Core 3, RQD= 58%
4 CORE	60 63		69, 70, 71, 72	68.8' - 69.2' light yellowish brown (10YR 6/4), trace dark yellowish brown (10YR 3/6) layers. 69.2' - 74' intensely fractured (extremely narrow to narrow aperture).									Core 4, RQD=46%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-384

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			73	64 - 82.6' **SHALE:** BDX (SH), greenish gray (GLEY 1 5/10Y), very weak, thinly bedded, highly to moderately decomposed, slightly to moderately disintegrated, intensely fractured (very narrow to moderately narrow apertures). *(continued)*	BDX (SH)									
5 CORE	60 20		74	74' - 79' intensely to very intensely fractured.										Core 5, RQD=0%
			77											Bedrock corehole reamed 6" in diameter to 77' for well installation.
6 CORE	60 64		79	79' - 82.6' intensely fractured.										Core 6, RQD=64%
			83	82.6 - 83.9' **SHALEY LIMESTONE:** BDX (LS/SH), light greenish gray (GLEY 1 7/10Y), fossiliferous, intensely fractured (extremely narrow to narrow apertures), slightly decomposed.	BDX (LS/SH)									
7 CORE	60 37		84	83.9 - 85.6' **SHALE:** BDX (SH), greenish gray (GLEY 1 5/10Y), very weak, medium bedded, highly to moderately decomposed, slightly to moderately disintegrated, intensely fractured (extremely narrow to narrow apertures).	BDX (SH)									Core 7, RQD=15%
			86	85.6 - 88.7' **SHALEY LIMESTONE:** BDX (LS/SH), light greenish gray (GLEY 1 7/10Y), shaley, fossiliferous, intensely fractured (extremely narrow to narrow apertures), slightly decomposed. 86.4' - 87' SHALE layer, greenish gray (GLEY 1 5/10Y), very weak, medium bedded.	BDX (LS/SH)									
8 CORE	60 50		89	88.7 - 94.1' **SHALE:** BDX (SH), greenish gray (GLEY 1 5/10Y), very weak, medium bedded, highly to moderately decomposed, slightly to moderately disintegrated, intensely fractured (extremely narrow to narrow apertures).	BDX (SH)									Core 8, RQD=49%
			92											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-384

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			93 94	88.7 - 94.1' **SHALE:** BDX (SH), greenish gray (GLEY 1 5/10Y), very weak, medium bedded, highly to moderately decomposed, slightly to moderately disintegrated, intensely fractured (extremely narrow to narrow apertures). *(continued)* 92.5' - 93.2' light greenish gray (GLEY 1 7/10Y), shaley, fossiliferous, intensely fractured, slightly decomposed.	BDX (SH)									
				94.1' End of Boring.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-390

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	2/29/2016	3/4/2016	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-390	Feet (NAVD88)	425.98 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,865.00 N, 2,381,902.09 E E/W (W circled)
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 34.6302"
Long -89° 52' 11.2533"

Local Grid Location: Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 / 14	2 2 3 4	0–1	0 - 26.5' **FILL, LEAN CLAY:** CL, dark grayish brown (10YR 4/2) with black (10YR 2/1) and dark gray (10YR 4/1) mottling, 5-10% silt, trace roots, stiff to very stiff (1.5-3.5 tsf), nonplastic to medium plasticity, cohesive, moist to dry.	(FILL) CL								
2 SS	24 / 10	2 2 3 3	2–3	2' trace sand, no roots, moist. 2.4' dark gray (10YR 4/1) with dark grayish brown (10YR 3/2) mottling.									
3 SS	24 / 8.5	1 2 1 2	4–5	4' dark grayish brown (10YR 3/2), trace sand, silt, and roots, high plasticity, cohesive, trace black (10YR 2/1) oxidation.									
4 SS	24 / 15	1 2 3 4	6–7	6' gray (10YR 5/1) mottling, 15-20% silt, trace roots, low to medium plasticity, cohesive, black (10YR 2/1) and dark yellowish brown (10YR 4/5) oxidation.									
5 SS	24 / 19	1 1 3 5	8–9										
6 SS	24 / 17	1 2 3 4	10–12	10' moist to dry.									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-390

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
7 SS	24 21	1 2 3 4	13	0 - 26.5' **FILL, LEAN CLAY:** CL, dark grayish brown (10YR 4/2) with black (10YR 2/1) and dark gray (10YR 4/1) mottling, 5-10% silt, trace roots, stiff to very stiff (1.5-3.5 tsf), nonplastic to medium plasticity, cohesive, moist to dry. *(continued)* 12' moist.									
8 SS	24 19	1 3 5 7	14 15	14' dry.									
9 SS	24 24	2 3 2 5	16 17										
10 SS	24 20	2 2 4 5	18 19		(FILL) CL								
11 SS	24 24	1 2 3 4	20 21										
12 SS	24 24	1 3 4 4	22 23	22' trace fine gravel (subrounded), dry.									
13 SS	24 24	1 2 4 6	24 25	24' no fine gravel, dry. 24.7' dark gray (10YR 4/1) with dark yellowish brown (10YR 4/5).									
14 SS	24 24	2 2 2 3	26	26' brown (10YR 4/3) with dark gray (10YR 4/1), black (10YR 2/1), and dark yellowish brown (10YR 4/5) mottling, dry to moist.									
			27	26.5 - 28.5' **FILL, SILT:** ML, trace gravel, nonplastic, cohesive, wet.	(FILL) ML								
15 SS	24 21	1 3 4 6	28	28' soft to stiff (0.5-1.5).									
			29	28.5 - 30.6' **FILL, LEAN CLAY:** CL, brown (10YR 4/3), trace dark gray (10YR 4/1) mottling, 15-25% silt, very stiff (3.0 tsf), dry to moist, trace dark yellowish brown (10YR 4/6) oxidation.	(FILL) CL								
16 SS	24 24	2 5 7 8	30										
			31 32	30.6 - 36.5' **LEAN CLAY:** CL, dark gray (10YR 4/1) with blueish mottling, 15-25% silt, trace sand and fine gravel, stiff to very stiff (2.0-3.0 tsf), moist to dry, native clay.	CL								

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-390

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
17 SS	24 20	1 2 5 7	33	30.6 - 36.5' **LEAN CLAY:** CL, dark gray (10YR 4/1) with blueish mottling, 15-25% silt, trace sand and fine gravel, stiff to very stiff (2.0-3.0 tsf), moist to dry, native clay. *(continued)*	CL						
18 SS	24 20	1 1 8 28	34, 35	34' very dark gray (10YR 3/1), very stiff to hard (2.5- 4.5 tsf), consistency increasing with depth, slightly laminated, dry.							
19 SS	24 16	3 12 19 23	36	36' very dark gray (10YR 3/1), hard (4.5 tsf).							
			37, 38	36.5 - 39.5' **SHALE:** BDX (SH), dark gray (10YR 4/1), highly decomposed, intensely fractured (tight mud-filled apertures).	BDX (SH)						
20 SS	21 16	1 6 22 50 for 3"									
1 CS	16 15		39	38.7' gray to greenish gray.							Core 1, RQD = 63%
				39.5 - 39.9' **LIMESTONE:** BDX (LS), intensely fractured, mostly angular gravel sized pieces of limestone.	BDX (LS)						
2 CS	54 52		40, 41, 42, 43, 44	39.9 - 47.3' **SHALE:** BDX (SH), dark gray, highly decomposed to fresh, intensely fractured (tight mud-filled apertures).	BDX (SH)						Core 2, RQD = 27%
3 CS	66 60.5		45, 46, 47	44.5' dark gray, slightly to highly decomposed, intensely fractured (extremely narrow to narrow apertures).							Core 3, RQD = 54%
			48, 49, 50	47.3 - 50.2' **LIMESTONE:** BDX (LS), gray, intensely fractured (tight to narrow apertures).	BDX (LS)						
4 CS	60 57		51, 52	50.2 - 52' **SHALEY LIMESTONE:** BDX (LS/SH), gray to dark gray, moderately to highly decomposed, intensely fractured (extremely tight to narrow apertures).	BDX (LS/SH)						Core 4, RQD = 57%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-390

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			53	52 - 56.6' **SHALE:** BDX (SH), dark gray, massive, slightly fractured (extremely narrow to narrow apertures).										
			54		BDX (SH)									
5 CS	60 55		55	54.8' dark gray, fossiliferous, moderately to intensely fractured (extremely narrow to narrow apertures).										Core 5, RQD = 57%
			56											
			57	56.6 - 64.9' **SHALEY LIMESTONE:** BDX (LS/SH), light gray, fossiliferous, moderately fractured (extremely narrow to narrow apertures).										
			58											
			59											
6 CS	60 58.5		60	59.9' moderately to intensely fractured (tight to narrow apertures).										Core 6, RQD = 74%
			61		BDX (LS/SH)									
			62											
			63											
			64											
				64.9 - 68' Overdrilled for Well Installation.										Bedrock corehole reamed 6" in diameter to 68' bgs for well installation.
				68' End of Boring.										

SOIL BORING LOG INFORMATION

Facility/Project Name: Baldwin Energy Complex		License/Permit/Monitoring Number:		Boring Number: MW-391	
Boring Drilled By: Name of crew chief (first, last) and Firm: Jim Dittmaier, Bulldog Drilling		Date Drilling Started: 3/7/2016	Date Drilling Completed: 3/10/2016		Drilling Method: 4 1/4 HSA and rotary
Common Well Name: MW-391		Final Static Water Level: Feet (NAVD88)	Surface Elevation: 424.24 Feet (NAVD88)		Borehole Diameter: 8.3 inches
Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒ State Plane 555,100.63 N, 2,380,477.06 E E/W(W) 1/4 of 1/4 of Section , T N, R		Lat 38° 11' 27.1285" Long -89° 52' 29.1339"	Local Grid Location Feet ☐N ☐S Feet ☐E ☐W		
Facility ID	County: Randolph	State: Illinois	Civil Town/City/ or Village: Baldwin		

Sample: Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–4	0 - 4' **SILTY CLAY** CL/ML.	CL/ML								0-35' Blind Drilled. See log MW-387 for soil description.
			4–10.8	4 - 10.8' **SILTY CLAY** CL/ML.	CL/ML								
			10.8–12	10.8 - 12' **CLAYEY SILT** ML/CL.	ML/CL								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
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Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

Natural Resource Technology

Boring Number MW-391

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			12 - 24	12 - 24' **SILTY CLAY** CL/ML.	CL/ML									
			24 - 27.4	24 - 27.4' **LEAN CLAY:** CL.	CL									
			27.4 - 28.5	27.4 - 28.5' **SILTY SAND:** SM.	SM									
			28.5 - 32	28.5 - 32.5' **SILTY CLAY** CL/ML.	CL/ML									

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-391

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
				28.5 - 32.5' **SILTY CLAY** CL/ML. *(continued)*										
			33	32.5 - 34' **POORLY-GRADED SAND:** SP.	SP									
			34	34 - 34.5' **SILTY SAND:** SM.	SM									
				34.5 - 35' **SILTY CLAY** CL/ML.	CL/ML									
1 CS	60 52.5		35	35 - 35.8' **LEAN CLAY:** CL, brown, wet, possible wash out of clay.	CL									Core 1, RQD = 25%
			36 37 38 39	35.8 - 40.7' **LIMESTONE:** BDX (LS), brown and tan, moderately fractured (extremely narrow to narrow apertures), oxidation discoloration. 37.4' white, intensely fractured (extremely narrow to narrow apertures).	BDX (LS)									
2 CS	60 25.5		40											Core 2, RQD = 0%
			41 42 43 44	40.7 - 45.8' **SHALE:** BDX (SH), dark gray, highly decomposed, intensely fractured (tight to very narrow mud-filled fractures).	BDX (SH)									
3 CS	60 49.5		45											Core 3, RQD = 80%
			46 47	45.8 - 47.5' **SHALEY LIMESTONE:** BDX (LS/SH), light gray, moderately fractured (very narrow apertures).	BDX (LS/SH)									
			48 49	47.5 - 49.7' **LIMESTONE:** BDX (LS), white, massive, slightly fractured.	BDX (LS)									
4 CS	60 64		50 51 52	49.7 - 60' **SHALEY LIMESTONE:** BDX (LS/SH), light gray, medium to thinly bedded, moderately to highly decomposed, moderately fractured (tight to narrow apertures).	BDX (LS/SH)									Core 4, RQD = 55%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-391

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			53	49.7 - 60' **SHALEY LIMESTONE:** BDX (LS/SH), light gray, medium to thinly bedded, moderately to highly decomposed, moderately fractured (tight to narrow apertures). *(continued)*									
5 CS	60 58.5		55	54.7' light gray, moderately decomposed, moderately fractured, decomposition and fracture density decrease with depth.	BDX (LS/SH)								Core 5, RQD = 96%
6 CS	60 52.5		60	60 - 74.4' **LIMESTONE:** BDX (LS), white, massive, slightly fractured (extremely narrow to very narrow apertures).									Core 6, RQD =99%
7 CS	60 63.25		64.4	64.4' slightly fractured (very narrow aperture).	BDX (LS)								Core 7, RQD = 100%
8 CS	60 55		70	69.8' unfractured.									Core 8, RQD = 100%

SOIL BORING LOG INFORMATION SUPPLEMENT

Natural Resource Technology

Boring Number MW-391

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			73 74	60 - 74.4' **LIMESTONE:** BDX (LS), white, massive, slightly fractured (extremely narrow to very narrow apertures). *(continued)*	BDX (LS)									
				74.4' End of Boring.										Bedrock corehole reamed to 6" in diameter to 72' bgs for well installation.

Monitoring Well Construction Forms – Fly Ash Pond System

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Energy Complex	______ft. ☐ N. ☐ S. ______ft. ☐ E. ☐ W.	MW-304
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 17.995" Long. -89° 51' 12.390" or	
Facility ID	St. Plane 554,194.03 ft. N, 2,386,608.77 ft. E. E /Ⓦ	Date Well Installed 10/20/2015
Type of Well: mw	Section Location of Waste/Source ____1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm) John Gates, Bulldog Drilling
Distance from Waste/Source ft. — State: Illinois	Location of Well Relative to Waste/Source: u ☒ Upgradient; s ☐ Sidegradient; d ☐ Downgradient; n ☐ Not Known — Gov. Lot Number	

A. Protective pipe, top elevation ______ ft. (NAVD88)

B. Well casing, top elevation 455.49 ft. (NAVD88)

C. Land surface elevation 453.03 ft. (NAVD88)

D. Surface seal, bottom 452.0 ft. (NAVD88) or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☒ Hollow Stem Auger ☐ Other ☐

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ______

17. Source of water (attach analysis, if required): Village of Baldwin

E. Bentonite seal, top 413.0 ft. (NAVD88) or 40.0 ft.

F. Fine sand, top ______ ft. (NAVD88) or ______ ft.

G. Filter pack, top 410.0 ft. (NAVD88) or 43.0 ft.

H. Screen joint, top 408.0 ft. (NAVD88) or 45.0 ft.

I. Well bottom 398.0 ft. (NAVD88) or 55.0 ft.

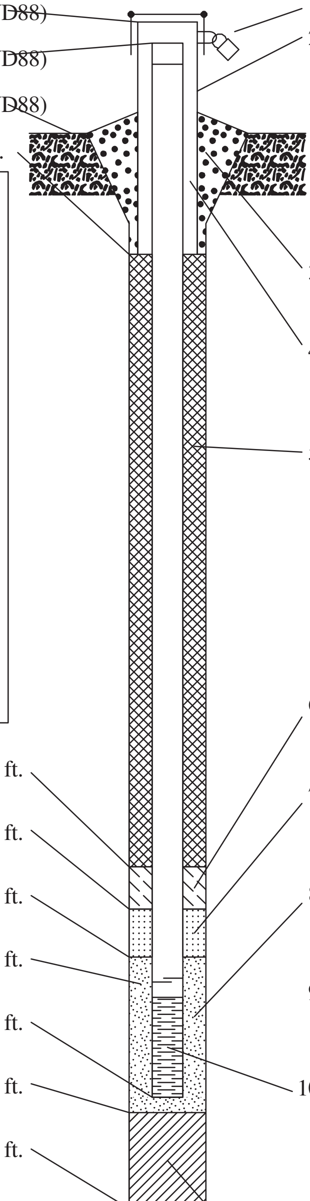
J. Filter pack, bottom 397.0 ft. (NAVD88) or 56.0 ft.

K. Borehole, bottom 394.0 ft. (NAVD88) or 59.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



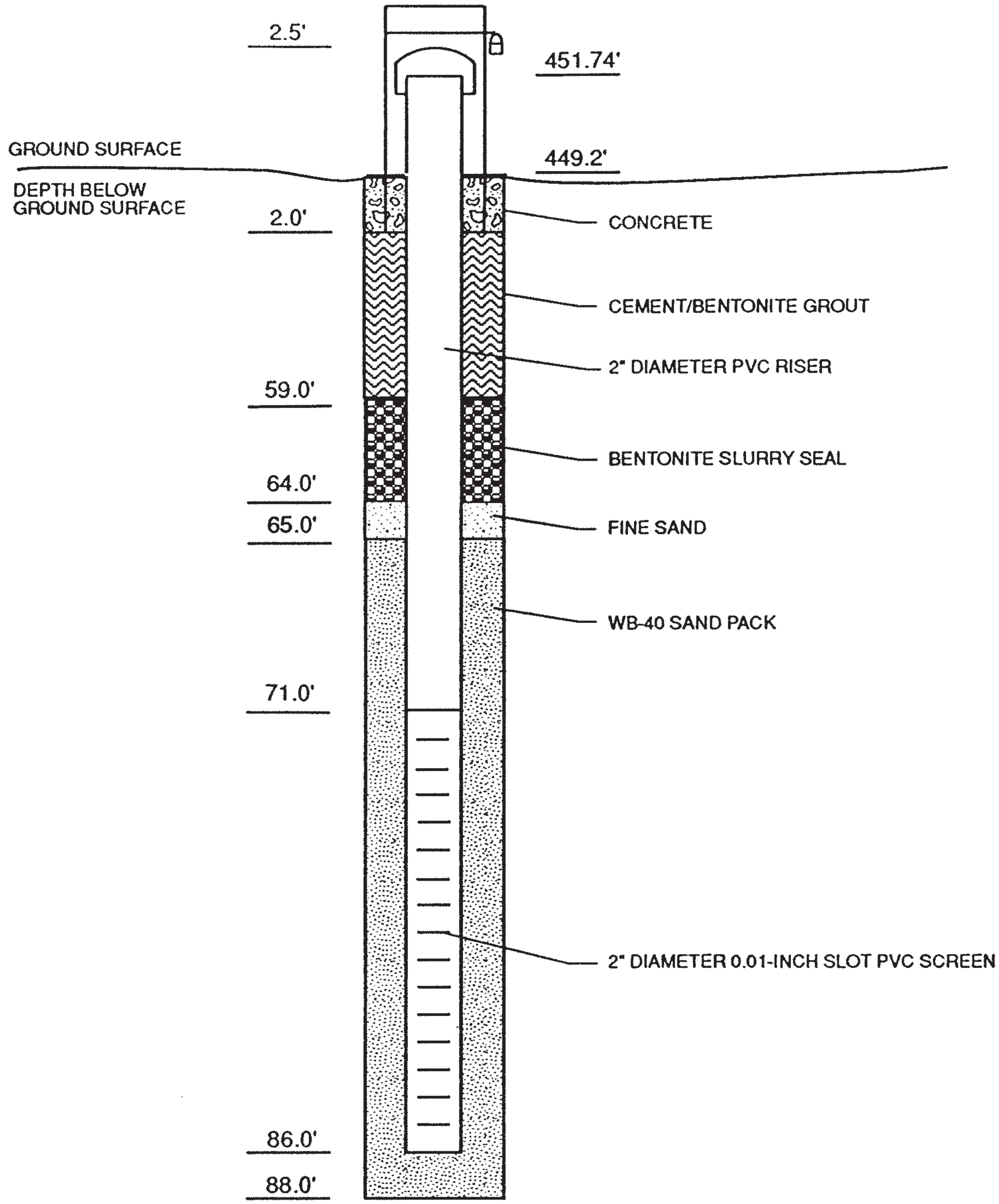
1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Three steel bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____Lbs/gal mud weight . . . Bentonite slurry ☐
   d. 30 % Bentonite . . . Bentonite-cement grout ☒
   e. ____ Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ______ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ______
   b. Volume added ______ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Unimin Corporation, FILTERSIL
   b. Volume added ______ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
   a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
   b. Manufacturer ______
   c. Slot size: 0.010 in.
   d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐ Other ☒
   1' of bentonite chips, 2' of bedrock drill cuttings

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 2/4/2016

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608



NOT TO SCALE

PROJECT MANAGER

PROJECT MANAGER

CHECKED BY

DRAWN BY

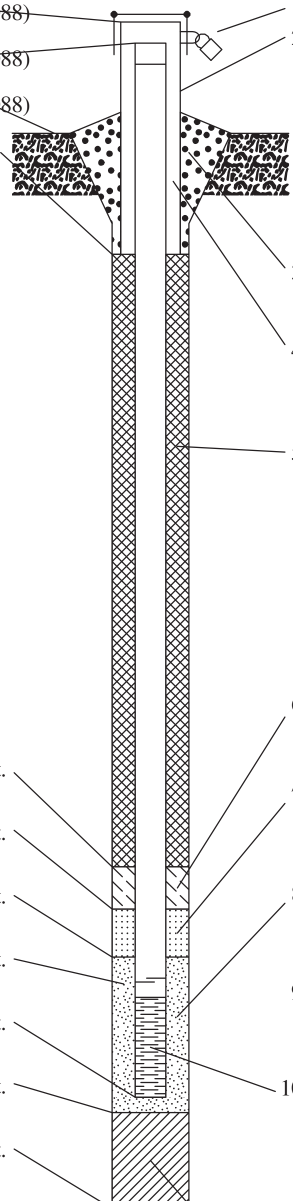
MH REV. DATE 11/20/91

Burlington Environmental Inc.	
Renamed MW-306 BAMW - 306 MONITORING WELL CONSTRUCTION DIAGRAM	
BALDWIN FGD SOLID WASTE BALDWIN, ILLINOIS 124081	BAMW-306

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Baldwin Energy Complex	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 31.888" Long. -89° 52' 20.441" or	MW-366
Facility ID	St. Plane 555,581.80 ft. N, 2,381,171.15 ft. E. E/(W)	Date Well Installed: 12/04/2015
Type of Well: mw	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm) Jim Dittmaier, Bulldog Drilling
Distance from Waste/Source: ft. / State: Illinois	Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☒ Downgradient; n ☐ Not Known / Gov. Lot Number	



A. Protective pipe, top elevation ____ ft. (NAVD88)

B. Well casing, top elevation 425.08 ft. (NAVD88)

C. Land surface elevation 422.54 ft. (NAVD88)

D. Surface seal, bottom 421.5 ft. (NAVD88) or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☒; Hollow Stem Auger ☐; Other ☐

15. Drilling fluid used: Water ☒ 0 2; Air ☐; Drilling Mud ☐ 0 3; None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Village of Baldwin

E. Bentonite seal, top 387.5 ft. (NAVD88) or 35.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 382.5 ft. (NAVD88) or 40.0 ft.

H. Screen joint, top 380.5 ft. (NAVD88) or 42.0 ft.

I. Well bottom 370.5 ft. (NAVD88) or 52.0 ft.

J. Filter pack, bottom 370.0 ft. (NAVD88) or 52.5 ft.

K. Borehole, bottom 368.5 ft. (NAVD88) or 54.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.

1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒; Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Three steel bollards
3. Surface seal: Bentonite ☐; Concrete ☒; Other ☐
4. Material between well casing and protective pipe: Bentonite ☒; Other ☒ Sand
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. 30 % Bentonite . . . Bentonite-cement grout ☒
   e. ____ Ft^3 volume added for any of the above
   f. How installed: Tremie ☐; Tremie pumped ☒; Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Unimin Corporation, FILTERSIL
   b. Volume added ____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒; Flush threaded PVC schedule 80 ☐; Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒; Continuous slot ☐; Other ☐
    b. Manufacturer ____
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐; Other ☒ 1.5' bedrock drill cuttings

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 2/4/2016

Signature: [signature]

Firm: Natural Resource Technology
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Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Energy Complex	____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	MW-375
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 20.562" Long. -89° 52' 24.650" or	
Facility ID	St. Plane 554,434.97 ft. N, 2,380,838.70 ft. E. E /Ⓦ	Date Well Installed 11/06/2015
Type of Well: mw	Section Location of Waste/Source ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm) Jim Dittmaier, Bulldog Drilling
Distance from Waste/Source ft. / State: Illinois	Location of Well Relative to Waste/Source: u ☐ Upgradient, s ☐ Sidegradient, d ☒ Downgradient, n ☐ Not Known / Gov. Lot Number	

A. Protective pipe, top elevation ____ ft. (NAVD88)

B. Well casing, top elevation 423.05 ft. (NAVD88)

C. Land surface elevation 420.50 ft. (NAVD88)

D. Surface seal, bottom 419.5 ft. (NAVD88) or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☒ Hollow Stem Auger ☐ Other ☐

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Village of Baldwin

E. Bentonite seal, top 380.5 ft. (NAVD88) or 40.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 366.5 ft. (NAVD88) or 54.0 ft.

H. Screen joint, top 363.5 ft. (NAVD88) or 57.0 ft.

I. Well bottom 353.5 ft. (NAVD88) or 67.0 ft.

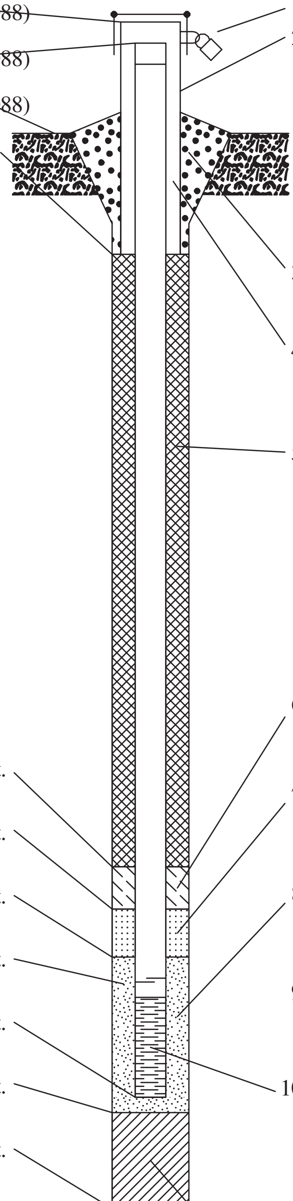
J. Filter pack, bottom 352.5 ft. (NAVD88) or 68.0 ft.

K. Borehole, bottom 350.5 ft. (NAVD88) or 70.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Two steel bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ Other ☒ Sand
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. 30 % Bentonite . . . Bentonite-cement grout ☒
   e. ____ Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Unimin Corporation, FILTERSIL
   b. Volume added ____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer ____
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐ Other ☒ 2' of bentonite chips

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 2/4/2016

Signature [signature]

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Energy Complex	____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	MW-377
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 18.190" Long. -89° 52' 11.071" or	
Facility ID	St. Plane 554,198.46 ft. N, 2,381,923.68 ft. E. E /(W)	Date Well Installed 11/02/2015
Type of Well mw	Section Location of Waste/Source ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm) Jim Dittmaier, Bulldog Drilling
Distance from Waste/Source ft. / State Illinois	Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☒ Downgradient; n ☐ Not Known / Gov. Lot Number	

A. Protective pipe, top elevation ____ ft. (NAVD88)

B. Well casing, top elevation 421.36 ft. (NAVD88)

C. Land surface elevation 418.75 ft. (NAVD88)

D. Surface seal, bottom 417.8 ft. (NAVD88) or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☒; Hollow Stem Auger ☐; ____ Other ☐

15. Drilling fluid used: Water ☒ 0 2; Air ☐; Drilling Mud ☐ 0 3; None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Village of Baldwin

E. Bentonite seal, top 378.0 ft. (NAVD88) or 40.8 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 374.8 ft. (NAVD88) or 44.0 ft.

H. Screen joint, top 372.8 ft. (NAVD88) or 46.0 ft.

I. Well bottom 362.8 ft. (NAVD88) or 56.0 ft.

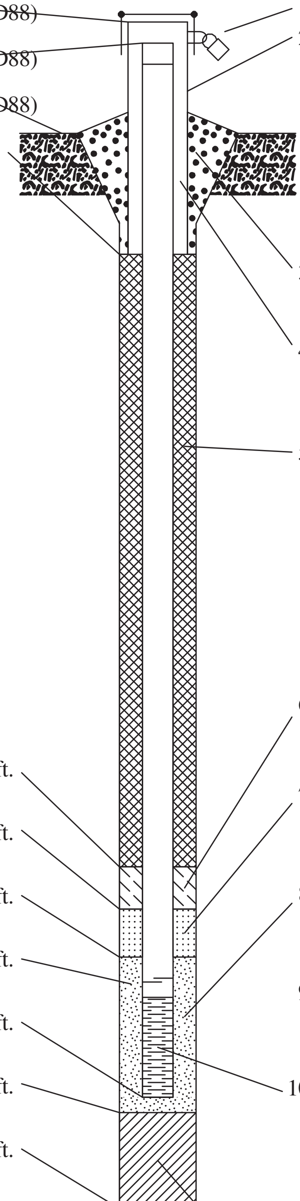
J. Filter pack, bottom 362.1 ft. (NAVD88) or 56.7 ft.

K. Borehole, bottom 360.8 ft. (NAVD88) or 58.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒; Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Three steel bollards
3. Surface seal: Bentonite ☐; Concrete ☒; Other ☐
4. Material between well casing and protective pipe: Bentonite ☒; Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. 30 % Bentonite . . . Bentonite-cement grout ☒
   e. ____ Ft^3 volume added for any of the above
   f. How installed: Tremie ☐; Tremie pumped ☒; Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Unimin Corporation, FILTERSIL
   b. Volume added ____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒; Flush threaded PVC schedule 80 ☐; Other ☐
10. Screen material: Schedule 40 PVC
   a. Screen Type: Factory cut ☒; Continuous slot ☐; Other ☐
   b. Manufacturer ____
   c. Slot size: 0.010 in.
   d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐; 1.3' bedrock drill cuttings Other ☒

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 2/4/2016

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Energy Complex	______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.	
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 41.686" Long. -89° 51' 29.830" or	MW-383
Facility ID	St. Plane 556,586.04 ft. N, 2,385,208.26 ft. E. E/W (W circled)	Date Well Installed 12/21/2015
Type of Well: mw	Section Location of Waste/Source ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm) Jim Dittmaier, Bulldog Drilling
Distance from Waste/Source ft. ; State: Illinois	Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☒ Downgradient; n ☐ Not Known ; Gov. Lot Number	

A. Protective pipe, top elevation ______ ft. (NAVD88)

B. Well casing, top elevation 459.49 ft. (NAVD88)

C. Land surface elevation 457.18 ft. (NAVD88)

D. Surface seal, bottom 456.2 ft. (NAVD88) or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☒; Hollow Stem Auger ☐; Other ☐

15. Drilling fluid used: Water ☒ 0 2; Air ☐; Drilling Mud ☐ 0 3; None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ______

17. Source of water (attach analysis, if required):
Village of Baldwin

E. Bentonite seal, top 406.7 ft. (NAVD88) or 50.5 ft.

F. Fine sand, top ______ ft. (NAVD88) or ______ ft.

G. Filter pack, top 401.5 ft. (NAVD88) or 55.7 ft.

H. Screen joint, top 399.2 ft. (NAVD88) or 58.0 ft.

I. Well bottom 389.2 ft. (NAVD88) or 68.0 ft.

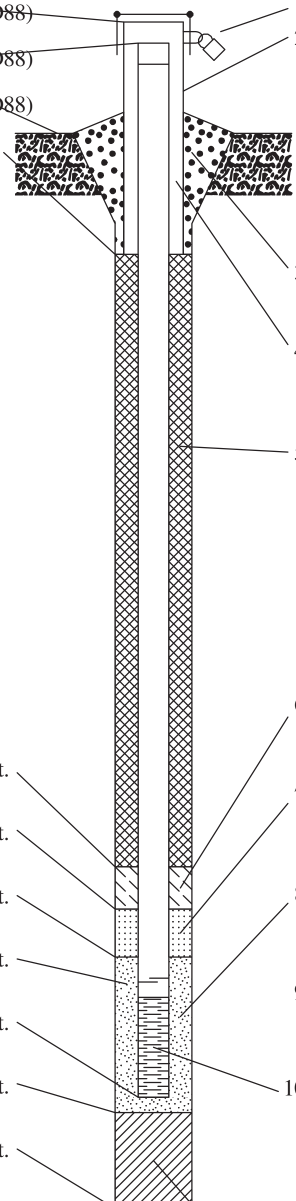
J. Filter pack, bottom 388.1 ft. (NAVD88) or 69.1 ft.

K. Borehole, bottom 384.2 ft. (NAVD88) or 73.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒; Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Steel bollards (3), 6" PVC casing to 22.5' bgs
3. Surface seal: Bentonite ☐; Concrete ☒; Other ☐
4. Material between well casing and protective pipe: Bentonite ☒; Other ☒ Sand
5. Annular space seal:
   a. Granular/Chipped Bentonite ☐
   b. ______ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ______ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. 30 % Bentonite . . . Bentonite-cement grout ☒
   e. ______ Ft^3 volume added for any of the above
   f. How installed: Tremie ☐; Tremie pumped ☒; Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ______ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ______
   b. Volume added ______ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Unimin Corporation, FILTERSIL
   b. Volume added ______ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒; Flush threaded PVC schedule 80 ☐; Other ☐
10. Screen material: Schedule 40 PVC
   a. Screen Type: Factory cut ☒; Continuous slot ☐; Other ☐
   b. Manufacturer ______
   c. Slot size: 0.010 in.
   d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐; Other ☒
   3.2' of bentonite chips, 0.7' of bedrock drill cuttings

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 2/4/2016

Signature [signature]

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Energy Complex	____ft. ☐ N. ☐ S. ____ft. ☐ E. ☐ W.	
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 30.440" Long. -89° 51' 38.516" or	MW-384
Facility ID	St. Plane 555,446.11 ft. N, 2,384,518.72 ft. E. E/Ⓦ	Date Well Installed 12/18/2015
Type of Well mw	Section Location of Waste/Source ____1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm) Chad Dutton, Bulldog Drilling
Distance from Waste/Source ft. — State Illinois	Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☒ Downgradient; n ☐ Not Known — Gov. Lot Number	

A. Protective pipe, top elevation ____ ft. (NAVD88)

B. Well casing, top elevation 458.95 ft. (NAVD88)

C. Land surface elevation 456.70 ft. (NAVD88)

D. Surface seal, bottom 455.7 ft. (NAVD88) or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☒ Hollow Stem Auger ☐ ____ Other ☐

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Village of Baldwin

E. Bentonite seal, top 402.7 ft. (NAVD88) or 54.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 398.2 ft. (NAVD88) or 58.5 ft.

H. Screen joint, top 396.2 ft. (NAVD88) or 60.5 ft.

I. Well bottom 386.2 ft. (NAVD88) or 70.5 ft.

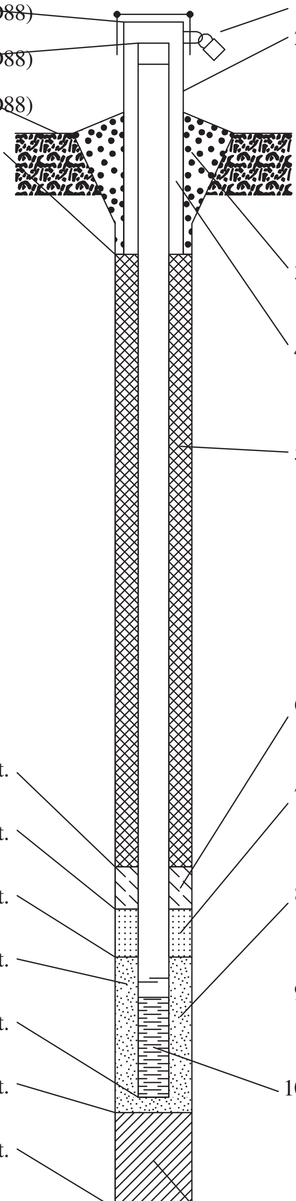
J. Filter pack, bottom 385.2 ft. (NAVD88) or 71.5 ft.

K. Borehole, bottom 379.7 ft. (NAVD88) or 77.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Steel bollards (3), 6" PVC casing to 25' bgs
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____Lbs/gal mud weight . . . Bentonite slurry ☐
   d. 30 % Bentonite . . . Bentonite-cement grout ☒
   e. ____Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Unimin Corporation, FILTERSIL
   b. Volume added ____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer ____
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐ Other ☒ 0.5' of bentonite chips, 5' of bedrock drill cuttings

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 2/4/2016

Signature [signature]

Firm Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Energy Complex	______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.	
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒	MW-390
	Lat. 38° 11' 34.630" Long. -89° 52' 11.253" or	
Facility ID	St. Plane 555,865.00 ft. N, 2,381,902.09 ft. E. E/Ⓦ	Date Well Installed 03/04/2016
Type of Well: mw	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm) Jim Dittmaier, Bulldog Drilling
Distance from Waste/Source ____ ft. / State: Illinois	Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☒ Downgradient; n ☐ Not Known	Gov. Lot Number ______

A. Protective pipe, top elevation ______ ft. (NAVD88)

B. Well casing, top elevation 428.06 ft. (NAVD88)

C. Land surface elevation 425.98 ft. (NAVD88)

D. Surface seal, bottom 425.0 ft. (NAVD88) or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☒ Hollow Stem Auger ☐ ______ Other ☐

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ______

17. Source of water (attach analysis, if required): Village of Baldwin

E. Bentonite seal, top 386.1 ft. (NAVD88) or 39.9 ft.

F. Fine sand, top ______ ft. (NAVD88) or ______ ft.

G. Filter pack, top 378.0 ft. (NAVD88) or 48.0 ft.

H. Screen joint, top 376.0 ft. (NAVD88) or 50.0 ft.

I. Well bottom 361.0 ft. (NAVD88) or 65.0 ft.

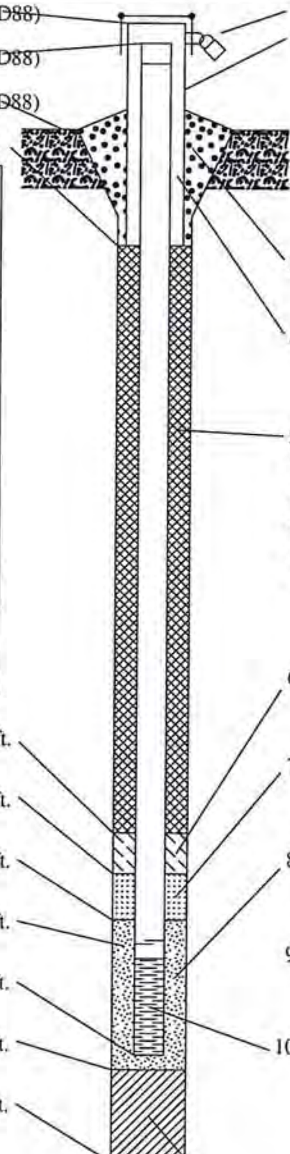
J. Filter pack, bottom 360.3 ft. (NAVD88) or 65.7 ft.

K. Borehole, bottom 358.0 ft. (NAVD88) or 68.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No. If yes, describe: Three steel bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. 30 % Bentonite . . . Bentonite-cement grout ☒
   e. ____ Ft³ volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ______ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ______
   b. Volume added ______ ft³
8. Filter pack material: Manufacturer, product name & mesh size
   a. Unimin Corporation, FILTERSIL
   b. Volume added ______ ft³
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
   a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
   b. Manufacturer ______
   c. Slot size: 0.010 in.
   d. Slotted length: 15.0 ft.
11. Backfill material (below filter pack): None ☐ 2.3' of bedrock drill cuttings Other ☒

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 3/28/2016

Signature [signature]

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Baldwin Energy Complex	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-391
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 27.129" Long. -89° 52' 29.134" or	
Facility ID	St. Plane 555,100.63 ft. N, 2,380,477.06 ft. E. E/W (W circled)	Date Well Installed: 03/10/2016
Type of Well: mw	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm) Jim Dittmaier, Bulldog Drilling
Distance from Waste/ Source ____ ft. / State: Illinois	Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☒ Downgradient; n ☐ Not Known / Gov. Lot Number	

A. Protective pipe, top elevation ____ ft. (NAVD88)

B. Well casing, top elevation 426.63 ft. (NAVD88)

C. Land surface elevation 424.24 ft. (NAVD88)

D. Surface seal, bottom 423.2 ft. (NAVD88) or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☒; Hollow Stem Auger ☐; ____ Other ☐

15. Drilling fluid used: Water ☒ 0 2; Air ☐; Drilling Mud ☐ 0 3; None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Village of Baldwin

E. Bentonite seal, top 377.2 ft. (NAVD88) or 47.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 371.2 ft. (NAVD88) or 53.0 ft.

H. Screen joint, top 369.2 ft. (NAVD88) or 55.0 ft.

I. Well bottom 354.2 ft. (NAVD88) or 70.0 ft.

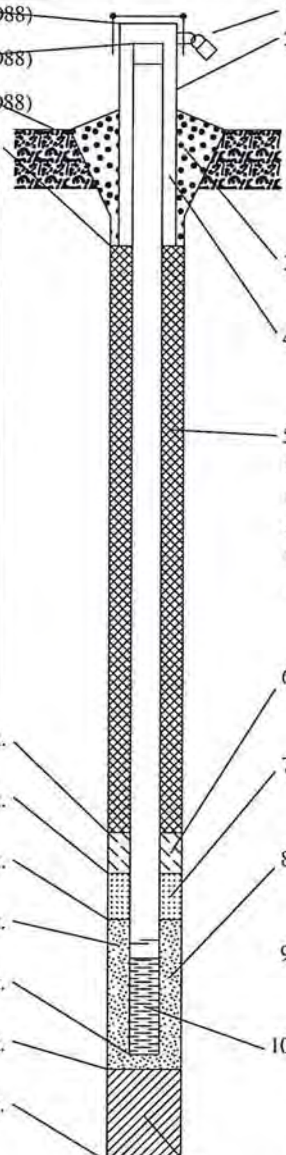
J. Filter pack, bottom 352.4 ft. (NAVD88) or 71.8 ft.

K. Borehole, bottom 352.2 ft. (NAVD88) or 72.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒; ____ Other ☐
   d. Additional protection? ☒ Yes ☐ No. If yes, describe: Three steel bollards
3. Surface seal: Bentonite ☐; Concrete ☒; ____ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒; Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. 30 % Bentonite . . . Bentonite-cement grout ☒
   e. ____ Ft^3 volume added for any of the above
   f. How installed: Tremie ☐; Tremie pumped ☒; Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Unimin Corporation, FILTERSIL
   b. Volume added ____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒; Flush threaded PVC schedule 80 ☐; ____ Other ☐
10. Screen material: Schedule 40 PVC
   a. Screen Type: Factory cut ☒; Continuous slot ☐; ____ Other ☐
   b. Manufacturer ____
   c. Slot size: 0.010 in.
   d. Slotted length: 15.0 ft.
11. Backfill material (below filter pack): None ☐; 0.2' of bedrock drill cuttings Other ☒

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 3/28/2016

Signature	Firm	
(signature)	Natural Resource Technology 234 W. Florida Street, Floor 5, Milwaukee, WI 53204	Tel: (414) 837-3607 Fax: (414) 837-3608

ILLINOIS DEPARTMENT OF PUBLIC HEALTH
WATER WELL CONSTRUCTION REPORTS

State of Illinois
Department of Public Health

WATER WELL CONSTRUCTION REPORT

Complete within 30 days of well completion and send to the appropriate Health Department

Print Form

1. Type of Well

a. Driven Well: Casing Diameter (in.) ____ Depth (ft.) ____

b. Bored Well: Casing Diameter (in.) ____ Buried Slab? ____

c. Drilled Well: PVC Casing Formation Packer Set at Depth of (ft.) ____

d. Drilled Well: Steel Casing Mechanically Driven ____

e. Hole Diameter (in.) 8.3 to (ft.) 35.4 ; (in.) 6 to (ft.) 59 ; (in.) 3 to (ft.) 135.4

f.

Type of Grout	# of bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)
See attached page					

g. Well Finished within Bedrock

h.

Kind of Gravel/Sand Pack	Grain Size/Supplier #	From (ft.)	To (ft.)
Filtersil Sand		43	56

2. Well Use: Monitoring Well Disinfected? ____

3. Date Well Completed: Oct 20, 2015 Driller's Estimated Well Yield (gpm): ____

4. Date Permanent Pump Installed: ____ Set at Depth (ft.): ____

5. Pump Capacity (gpm): ____

6. Pitless Adapter Model and Manufacturer: ____ Attachment to Casing: ____

7. Well Cap Type & Manufacturer: ____

8. Pressure Tank Working Cycle (gals.): ____ Captive Air? ____ 9. Pump System Disinfected: ____

10. Name of Pump Company ____

11. Pump Installer: ____ License # ____

12. ____ Date ____
Licensed Pump Installation Contractor Signature

Illinois Department of Public Health
Division of Environmental Health
525 West Jefferson Street
Springfield, IL 62761

IMPORTANCE NOTICE: This state agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Public Act-0863. Disclosure of this information is Mandatory. This form has been approved by the Forms Management Center.

IL 482-0126
Revised 6/09

13. Property Owner: Dynegy Midwest Generation Well # MW-304

14. Driller: John Gates License # ____

15. Name of Drilling Company : Bulldog Drilling 16. Permit Number: ____

Date Issued: ____ 17. Date Drilling Started Oct 9, 2015

18. Well Site Address: 10901 Baldwin Rd., Baldwin, IL 62217

19. Township Name: Baldwin Land I.D. # ____

20. Subdivision Name: ____ Lot # ____

21. Location: a. County Randolph b. Site Elevation ____ ft. (above msl)

c. Township: ____ Range: ____ Section: ____

d. ____ Quarter of the ____ Quarter of the ____ Quarter

e. GPS: Lat: Degrees 38 Minutes 11 Seconds 18.00 N

Lon: Degrees -89 Minutes 51 Seconds 12.39 W

Survey use only

22. Casing and Liner Information

Diameter (in.)	Material, Joint Type	From (ft.)	To (ft.)
2	Schedule 40 PVC	-2.5	45

23. Is the well screened? Yes If yes

Diameter (in.)	Length (ft.)	Slot Size (in.)	From (ft.)	To (ft.)
2	10	0.01	45	55

24. Water from ____ at a depth of (ft.) ____ To (ft.) ____

a. Static water level (ft.) below top of casing ____ which is (in.) above ground 30

b. pumping level is (ft.) ____ pumping (gpm) ____ for (hours) ____

25.

Earth Materials Passed Through	From (ft.)	To (ft.)
Clay	0	24.5
Sand	24.5	27.3
Clay/Weathered Shale	27.3	41.3
Bedrock (Shale and Limestone)	41.3	135.4

(Attach 2nd page, if necessary) (If DRY HOLE, fill out log & indicate how hole was sealed)

[signature] License # 092-006857
Licensed Water Well Contractor Signature

WATER WELL CONSTRUCTION REPORT
MW-304 Well Construction Report Continued

1. Type of Well
   f. Type of Grout

Type of Grout	# of bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)
High Solids Grout	4		1	40	
Bentonite Chips	2		40	43	
Bentonite Chips	1		56	57	
Bedrock Drill Cuttings			57	59	
High Solids Grout	6		59	135.4	

State of Illinois
Department of Public Health

WATER WELL CONSTRUCTION REPORT

Complete within 30 days of well completion and send to the appropriate Health Department

Print Form

1. Type of Well

a. **Driven Well**: Casing Diameter (in.) ______ Depth (ft.) ______

b. **Bored Well**: Casing Diameter (in.) ______ Buried Slab? ______

c. **Drilled Well**: PVC Casing Formation Packer Set at Depth of (ft.) ______

d. **Drilled Well**: Steel Casing Mechanically Driven ______

e. Hole Diameter (in.) 8.3 to (ft.) 35.6 ; (in.) 6 to (ft.) 54 ; (in.) 3 to (ft.) 54.3

f. Type of Grout

Type of Grout	# of bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)
See attached page					

g. Well Finished within Bedrock

h.

Kind of Gravel/Sand Pack	Grain Size/Supplier #	From (ft.)	To (ft.)
Filtersil Sand		40	52.5

2. Well Use: Monitoring Well Disinfected? ______

3. Date Well Completed: Dec 4, 2015 Driller's Estimated Well Yield (gpm): ______

4. Date Permanent Pump Installed: ______ Set at Depth (ft.): ______

5. Pump Capacity (gpm): ______

6. Pitless Adapter Model and Manufacturer: ______ Attachment to Casing: ______

7. Well Cap Type & Manufacturer: ______

8. Pressure Tank Working Cycle (gals.): ______ Captive Air? ______ 9. Pump System Disinfected: ______

10. Name of Pump Company ______

11. Pump Installer: ______ License # ______

12. ______ Date ______
Licensed Pump Installation Contractor Signature

13. Property Owner: Dynegy Midwest Generation Well # MW-366

14. Driller: Jim Dittmaier License # ______

15. Name of Drilling Company : Bulldog Drilling 16. Permit Number: ______

Date Issued: ______ 17. Date Drilling Started Dec 3, 2015

18. Well Site Address: 10901 Baldwin Rd., Baldwin, IL 62217

19. Township Name: Baldwin Land I.D. # ______

20. Subdivision Name: ______ Lot # ______

21. Location: a. County Randolph b. Site Elevation ______ ft. (above msl)

c. Township: ______ Range: ______ Section: ______

d. ______ Quarter of the ______ Quarter of the ______ Quarter

e. GPS: Lat: Degrees 38 Minutes 11 Seconds 31.89 N

Lon: Degrees -89 Minutes 52 Seconds 20.44 W

Survey use only

22. Casing and Liner Information

Diameter (in.)	Material, Joint Type	From (ft.)	To (ft.)
2	Schedule 40 PVC	-2.5	42

23. Is the well screened? Yes If yes

Diameter (in.)	Length (ft.)	Slot Size (in.)	From (ft.)	To (ft.)
2	10	0.01	42	52

24. Water from ______ at a depth of (ft.) ______ To (ft.) ______

a. Static water level (ft.) below top of casing ______ which is (in.) above ground 30

b. pumping level is (ft.) ______ pumping (gpm) ______ for (hours) ______

25.

Earth Materials Passed Through	From (ft.)	To (ft.)
Clay	0	35.6
Bedrock (Shale and Limestone)	35.6	54.3

(Attach 2nd page, if necessary) (If DRY HOLE, fill out log & indicate how hole was sealed)

______ License # 092-006857
Licensed Water Well Contractor Signature

Illinois Department of Public Health
Division of Environmental Health
525 West Jefferson Street
Springfield, IL 62761

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IL 482-0126
Revised 6/09

WATER WELL CONSTRUCTION REPORT
MW-366 Well Construction Report Continued

1. Type of Well

f. Type of Grout

Type of Grout	# of bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)
High Solids Grout	3		1	35	
Bentonite Chips	2		35	40	
Bedrock Drill Cuttings			52.5	54	

State of Illinois
Department of Public Health

WATER WELL CONSTRUCTION REPORT

Complete within 30 days of well completion and send to the appropriate Health Department

Print Form

1. Type of Well

a. **Driven Well:** Casing Diameter (in.) ______ Depth (ft.) ______

b. **Bored Well:** Casing Diameter (in.) ______ Buried Slab? ______

c. **Drilled Well:** PVC Casing Formation Packer Set at Depth of (ft.) ______

d. **Drilled Well:** Steel Casing Mechanically Driven ______

e. Hole Diameter (in.) 8.3 to (ft.) 44.8 ; (in.) 6 to (ft.) 70 ; (in.) 3 to (ft.) 84.7

f. Type of Grout

Type of Grout	# of bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)
See attached page					

g. Well Finished within Bedrock

h.

Kind of Gravel/Sand Pack	Grain Size/Supplier #	From (ft.)	To (ft.)
Filtersil Sand		54	68

2. Well Use: Monitoring Well Disinfected? ______

3. Date Well Completed: Nov 6, 2015 Driller's Estimated Well Yield (gpm): ______

4. Date Permanent Pump Installed: ______ Set at Depth (ft.): ______

5. Pump Capacity (gpm): ______

6. Pitless Adapter Model and Manufacturer: ______ Attachment to Casing: ______

7. Well Cap Type & Manufacturer: ______

8. Pressure Tank Working Cycle (gals.): ______ Captive Air? ______ **9.** Pump System Disinfected: ______

10. Name of Pump Company ______

11. Pump Installer: ______ License # ______

12. ______ Date ______
Licensed Pump Installation Contractor Signature

Illinois Department of Public Health
Division of Environmental Health
525 West Jefferson Street
Springfield, IL 62761

IL 482-0126
Revised 6/09

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13. Property Owner: Dynegy Midwest Generation Well # MW-375

14. Driller: Jim Dittmaier License # ______

15. Name of Drilling Company : Bulldog Drilling **16.** Permit Number: ______

Date Issued: ______ **17.** Date Drilling Started Nov 3, 2015

18. Well Site Address: 10901 Baldwin Rd., Baldwin, IL 62217

19. Township Name: Baldwin Land I.D. # ______

20. Subdivision Name: ______ Lot # ______

21. Location: a. County Randolph b. Site Elevation ______ ft. (above msl)

c. Township: ______ Range: ______ Section: ______

d. ______ Quarter of the ______ Quarter of the ______ Quarter

e. GPS: Lat: Degrees 38 Minutes 11 Seconds 20.56 N

Lon: Degrees -89 Minutes 52 Seconds 24.65 W

Survey use only

22. Casing and Liner Information

Diameter (in.)	Material, Joint Type	From (ft.)	To (ft.)
2	Schedule 40 PVC	-2.5	57

23. Is the well screened? Yes

If yes	Diameter (in.)	Length (ft.)	Slot Size (in.)	From (ft.)	To (ft.)
	2	10	0.01	57	67

24. Water from ______ at a depth of (ft.) ______ To (ft.) ______

a. Static water level (ft.) below top of casing ______ which is (in.) above ground 30

b. pumping level is (ft.) ______ pumping (gpm) ______ for (hours) ______

25.

Earth Materials Passed Through	From (ft.)	To (ft.)
Clay/Silt	0	44.8
Gravel	44.8	45.3
Clay	45.3	50.1
Bedrock (Shale and Limestone)	50.1	84.7

(Attach 2nd page, if necessary) (If DRY HOLE, fill out log & indicate how hole was sealed)

[signature] License # 092-006857
Licensed Water Well Contractor Signature

WATER WELL CONSTRUCTION REPORT
MW-375 Well Construction Report Continued

1. Type of Well
   f. Type of Grout

Type of Grout	# of bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)
High Solids Grout	4		1	40	
Bentonite Chips	2		40	54	
Bentonite Chips	1		68	70	
High Solids Grout	2		70	84.7	

State of Illinois
Department of Public Health

WATER WELL CONSTRUCTION REPORT

Complete within 30 days of well completion and send to the appropriate Health Department

Print Form

1. Type of Well

a. **Driven Well**: Casing Diameter (in.) ______ Depth (ft.) ______

b. **Bored Well**: Casing Diameter (in.) ______ Buried Slab? ______

c. **Drilled Well**: PVC Casing Formation Packer Set at Depth of (ft.) ______

d. **Drilled Well**: Steel Casing Mechanically Driven ______

e. Hole Diameter (in.) 8.3 to (ft.) 31.7 ; (in.) 6 to (ft.) 58 ; (in.) 3 to (ft.) 58.2

f.

Type of Grout	# of bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)
See attached page					

g. Well Finished within Bedrock

h.

Kind of Gravel/Sand Pack	Grain Size/Supplier #	From (ft.)	To (ft.)
Filtersil Sand		44	56.7

2. Well Use: Monitoring Well Disinfected? ______

3. Date Well Completed: Nov 2, 2015 Driller's Estimated Well Yield (gpm): ______

4. Date Permanent Pump Installed: ______ Set at Depth (ft.): ______

5. Pump Capacity (gpm): ______

6. Pitless Adapter Model and Manufacturer: ______ Attachment to Casing: ______

7. Well Cap Type & Manufacturer: ______

8. Pressure Tank Working Cycle (gals.): ______ Captive Air? ______ 9. Pump System Disinfected: ______

10. Name of Pump Company ______

11. Pump Installer: ______ License # ______

12. ______ Date ______
Licensed Pump Installation Contractor Signature

13. Property Owner: Dynegy Midwest Generation Well # MW-377

14. Driller: Jim Dittmaier License # ______

15. Name of Drilling Company : Bulldog Drilling 16. Permit Number: ______

Date Issued: ______ 17. Date Drilling Started Oct 29, 2015

18. Well Site Address: 10901 Baldwin Rd., Baldwin, IL 62217

19. Township Name: Baldwin Land I.D. # ______

20. Subdivision Name: ______ Lot # ______

21. Location: a. County Randolph b. Site Elevation ______ ft. (above msl)

c. Township: ______ Range: ______ Section: ______

d. ______ Quarter of the ______ Quarter of the ______ Quarter

e. GPS: Lat: Degrees 38 Minutes 11 Seconds 18.19 N

Lon: Degrees -89 Minutes 52 Seconds 11.07 W

Survey use only

22. Casing and Liner Information

Diameter (in.)	Material, Joint Type	From (ft.)	To (ft.)
2	Schedule 40 PVC	-2.6	46

23. Is the well screened? Yes If yes

Diameter (in.)	Length (ft.)	Slot Size (in.)	From (ft.)	To (ft.)
2	10	0.01	46	56

24. Water from ______ at a depth of (ft.) ______ To (ft.) ______

a. Static water level (ft.) below top of casing ______ which is (in.) above ground 31.2

b. pumping level is (ft.) ______ pumping (gpm) ______ for (hours) ______

25.

Earth Materials Passed Through	From (ft.)	To (ft.)
Topsoil	0	4
Clay/Silt	4	30.8
Bedrock (Shale and Limestone)	30.8	58.2

(Attach 2nd page, if necessary) (If DRY HOLE, fill out log & indicate how hole was sealed)

______ License # 092-006857
Licensed Water Well Contractor Signature

Illinois Department of Public Health
Division of Environmental Health
525 West Jefferson Street
Springfield, IL 62761

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IL 482-0126
Revised 6/09

WATER WELL CONSTRUCTION REPORT
MW-377 Well Construction Report Continued

1. Type of Well
   f. Type of Grout

Type of Grout	# of bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)
High Solids Grout	4		1	40.8	
Bentonite Chips	1		40.8	44	
Bedrock Drill Cuttings			56.7	58.2	

State of Illinois
Department of Public Health

WATER WELL CONSTRUCTION REPORT

Complete within 30 days of well completion and send to the appropriate Health Department

Print Form

1. Type of Well
   a. Driven Well: Casing Diameter (in.) ______ Depth (ft.) ______
   b. Bored Well: Casing Diameter (in.) ______ Buried Slab? ______
   c. Drilled Well: PVC Casing Formation Packer Set at Depth of (ft.) ______
   d. Drilled Well: Steel Casing Mechanically Driven ______
   e. Hole Diameter (in.) 8.3 to (ft.) 50 ; (in.) 6 to (ft.) 73 ; (in.) ___ to (ft.) ___
   f.

Type of Grout	# of bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)
See attached page					

   g. Well Finished within Bedrock
   h.

Kind of Gravel/Sand Pack	Grain Size/Supplier #	From (ft.)	To (ft.)
Filtersil Sand		55.7	69.1

2. Well Use: Monitoring Well Disinfected? ______
3. Date Well Completed: Dec 21, 2015 Driller's Estimated Well Yield (gpm): ______
4. Date Permanent Pump Installed: ______ Set at Depth (ft.): ______
5. Pump Capacity (gpm): ______
6. Pitless Adapter Model and Manufacturer: ______ Attachment to Casing: ______
7. Well Cap Type & Manufacturer: ______
8. Pressure Tank Working Cycle (gals.): ______ Captive Air? ______ 9. Pump System Disinfected: ______
10. Name of Pump Company ______
11. Pump Installer: ______ License # ______
12. ______ Date ______
Licensed Pump Installation Contractor Signature

Illinois Department of Public Health
Division of Environmental Health
525 West Jefferson Street
Springfield, IL 62761

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IL 482-0126
Revised 6/09

13. Property Owner: Dynegy Midwest Generation Well # MW-383
14. Driller: Jim Dittmaier License # ______
15. Name of Drilling Company: Bulldog Drilling 16. Permit Number: ______
Date Issued: ______ 17. Date Drilling Started Dec 7, 2015
18. Well Site Address: 10901 Baldwin Rd., Baldwin, IL 62217
19. Township Name: Baldwin Land I.D. # ______
20. Subdivision Name: ______ Lot # ______
21. Location: a. County Randolph b. Site Elevation ______ ft. (above msl)
   c. Township: ______ Range: ______ Section: ______
   d. ______ Quarter of the ______ Quarter of the ______ Quarter
   e. GPS: Lat: Degrees 38 Minutes 11 Seconds 41.69 N
   Lon: Degrees -89 Minutes 51 Seconds 29.83 W

Survey use only

22. Casing and Liner Information

Diameter (in.)	Material, Joint Type	From (ft.)	To (ft.)
2	Schedule 40 PVC	-2.3	58
6	PVC	0	22.5

23. Is the well screened? Yes If yes

Diameter (in.)	Length (ft.)	Slot Size (in.)	From (ft.)	To (ft.)
2	10	0.01	58	68

24. Water from ______ at a depth of (ft.) ______ To (ft.) ______
   a. Static water level (ft.) below top of casing ______ which is (in.) above ground 27.6
   b. pumping level is (ft.) ______ pumping (gpm) ______ for (hours) ______

25.

Earth Materials Passed Through	From (ft.)	To (ft.)
Ash (Fill)	0	16
Clay	16	41
Sand	41	42
Clay	42	50
Bedrock (Shale and Limestone)	50	73

(Attach 2nd page, if necessary) (If DRY HOLE, fill out log & indicate how hole was sealed)

Licensed Water Well Contractor Signature License # 092-006857

WATER WELL CONSTRUCTION REPORT

MW-383 Well Construction Report Continued

1. Type of Well

   f. Type of Grout

Type of Grout	# of bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)
High Solids Grout	4		1	50.5	
Bentonite Chips	3		50.5	55.7	
Bentonite Chips	1		69.1	72.3	
Bedrock Drill Cuttings			72.3	73	

State of Illinois
Department of Public Health

WATER WELL CONSTRUCTION REPORT

Complete within 30 days of well completion and send to the appropriate Health Department

Print Form

1. Type of Well

a. **Driven Well:** Casing Diameter (in.) ______ Depth (ft.) ______

b. **Bored Well:** Casing Diameter (in.) ______ Buried Slab? ______

c. **Drilled Well:** PVC Casing Formation Packer Set at Depth of (ft.) ______

d. **Drilled Well:** Steel Casing Mechanically Driven ______

e. Hole Diameter (in.) 8.3 to (ft.) 57 ; (in.) 6 to (ft.) 77 ; (in.) 3 to (ft.) 94.1

f. Type of Grout

Type of Grout	# of bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)
See attached page					

g. Well Finished within Bedrock

h.

Kind of Gravel/Sand Pack	Grain Size/Supplier #	From (ft.)	To (ft.)
Filtersil Sand		58.5	71.5

2. Well Use: Monitoring Well Disinfected? ______

3. Date Well Completed: Dec 18, 2015 Driller's Estimated Well Yield (gpm): ______

4. Date Permanent Pump Installed: ______ Set at Depth (ft.): ______

5. Pump Capacity (gpm): ______

6. Pitless Adapter Model and Manufacturer: ______ Attachment to Casing: ______

7. Well Cap Type & Manufacturer: ______

8. Pressure Tank Working Cycle (gals.): ______ Captive Air? ______ 9. Pump System Disinfected: ______

10. Name of Pump Company ______

11. Pump Installer: ______ License # ______

12. ______ Date ______
Licensed Pump Installation Contractor Signature

Illinois Department of Public Health
Division of Environmental Health
525 West Jefferson Street
Springfield, IL 62761

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IL 482-0126
Revised 6/09

13. Property Owner: Dynegy Midwest Generation Well # MW-384

14. Driller: Chad Dutton License # ______

15. Name of Drilling Company: Bulldog Drilling 16. Permit Number: ______

Date Issued: ______ 17. Date Drilling Started Dec 7, 2015

18. Well Site Address: 10901 Baldwin Rd., Baldwin, IL 62217

19. Township Name: Baldwin Land I.D. # ______

20. Subdivision Name: ______ Lot # ______

21. Location: a. County Randolph b. Site Elevation ______ ft. (above msl)

c. Township: ______ Range: ______ Section: ______

d. ______ Quarter of the ______ Quarter of the ______ Quarter

e. GPS: Lat: Degrees 38 Minutes 11 Seconds 30.44 N
Lon: Degrees -89 Minutes 51 Seconds 38.52 W

Survey use only

22. Casing and Liner Information

Diameter (in.)	Material, Joint Type	From (ft.)	To (ft.)
2	Schedule 40 PVC	-2.2	60.5
6	PVC	0	25

23. Is the well screened? Yes If yes

Diameter (in.)	Length (ft.)	Slot Size (in.)	From (ft.)	To (ft.)
2	10	0.01	60.5	70.5

24. Water from ______ at a depth of (ft.) ______ To (ft.) ______

a. Static water level (ft.) below top of casing ______ which is (in.) above ground 26.4

b. pumping level is (ft.) ______ pumping (gpm) ______ for (hours) ______

25. Earth Materials Passed Through

Earth Materials Passed Through	From (ft.)	To (ft.)
Ash (Fill)	0	2.5
Clay (Fill)	2.5	4
Ash (Fill)	4	18
Clay/Silt	18	56
Bedrock (Shale/Limestone)	56	94.1

(Attach 2nd page, if necessary) (If DRY HOLE, fill out log & indicate how hole was sealed)

______ License # 092-006857
Licensed Water Well Contractor Signature

WATER WELL CONSTRUCTION REPORT
MW-384 Well Construction Report Continued

1. Type of Well
   f. Type of Grout

Type of Grout	# of bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)
High Solids Grout	3		1	54	
Bentonite Chips	1		54	58.5	
Bentonite Chips	1		71.5	72	
Bedrock Drill Cuttings			72	77	
High Solids Grout	2		77	94.1	

State of Illinois
Department of Public Health

WATER WELL CONSTRUCTION REPORT

Complete within 30 days of well completion and send to the appropriate Health Department

Print Form

1. Type of Well

a. Driven Well: Casing Diameter (in.) ____ Depth (ft.) ____

b. Bored Well: Casing Diameter (in.) ____ Buried Slab? ____

c. Drilled Well: PVC Casing Formation Packer Set at Depth of (ft.) ____

d. Drilled Well: Steel Casing Mechanically Driven ____

e. Hole Diameter (in.) 8.3 to (ft.) 38.7 ; (in.) 6 to (ft.) 68 ; (in.) ____ to (ft.) ____

f.

Type of Grout	# of bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)
See attached page					

g. Well Finished within Bedrock

h.

Kind of Gravel/Sand Pack	Grain Size/Supplier #	From (ft.)	To (ft.)
Filtersil Sand		48	65.7

2. Well Use: Monitoring Well Disinfected? ____

3. Date Well Completed: 3/4/2016 Driller's Estimated Well Yield (gpm): ____

4. Date Permanent Pump Installed: ____ Set at Depth (ft.): ____

5. Pump Capacity (gpm): ____

6. Pitless Adapter Model and Manufacturer: ____ Attachment to Casing: ____

7. Well Cap Type & Manufacturer: ____

8. Pressure Tank Working Cycle (gals.): ____ Captive Air? ____ 9. Pump System Disinfected: ____

10. Name of Pump Company ____

11. Pump Installer: ____ License # ____

12. ____ Date ____
Licensed Pump Installation Contractor Signature

13. Property Owner: Dynegy Midwest Generation Well # MW-390

14. Driller: Jim Dittmaier License # ____

15. Name of Drilling Company: Bulldog Drilling 16. Permit Number: ____

Date Issued: ____ 17. Date Drilling Started 2/29/2016

18. Well Site Address: 10901 Baldwin Rd., Baldwin, IL 62217

19. Township Name: Baldwin Land I.D. # ____

20. Subdivision Name: ____ Lot # ____

21. Location: a. County Randolph b. Site Elevation ____ ft. (above msl)

c. Township: ____ Range: ____ Section: ____

d. ____ Quarter of the ____ Quarter of the ____ Quarter

e. GPS: Lat: Degrees 38 Minutes 11 Seconds 34.63 N

Lon: Degrees -89 Minutes 52 Seconds 11.25 W

Survey use only

22. Casing and Liner Information

Diameter (in.)	Material, Joint Type	From (ft.)	To (ft.)
2	Schedule 40 PVC	-2.1	50

23. Is the well screened? Yes If yes

Diameter (in.)	Length (ft.)	Slot Size (in.)	From (ft.)	To (ft.)
2	10	0.01	50	65

24. Water from ____ at a depth of (ft.) ____ To (ft.) ____

a. Static water level (ft.) below top of casing ____ which is (in.) above ground 25

b. pumping level is (ft.) ____ pumping (gpm) ____ for (hours) ____

25.

Earth Materials Passed Through	From (ft.)	To (ft.)
Clay (Fill), Silt (Fill)	0	30.6
Clay	30.6	36.5
Bedrock (Shale and Limestone)	36.5	64.9

(Attach 2nd page, if necessary) (If DRY HOLE, fill out log & indicate how hole was sealed)

Licensed Water Well Contractor Signature License # 092-006857

Illinois Department of Public Health
Division of Environmental Health
525 West Jefferson Street
Springfield, IL 62761

IL 482-0126
Revised 6/09

WATER WELL CONSTRUCTION REPORT
MW-390 Well Construction Report Continued

1. Type of Well
   f. Type of Grout

Type of Grout	# of bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)
High Solids Grout	4		1	39.9	
Bentonite Chips	3		39.9	48	
Bedrock Drill Cuttings			65.7	68	

State of Illinois
Department of Public Health

WATER WELL CONSTRUCTION REPORT

Complete within 30 days of well completion and send to the appropriate Health Department

Print Form

1. Type of Well

a. **Driven Well**: Casing Diameter (in.) ______ Depth (ft.) ______

b. **Bored Well**: Casing Diameter (in.) ______ Buried Slab? ______

c. **Drilled Well**: PVC Casing Formation Packer Set at Depth of (ft.) ______

d. **Drilled Well**: Steel Casing Mechanically Driven ______

e. Hole Diameter (in.) 8.3 to (ft.) 35 ; (in.) 6 to (ft.) 72 ; (in.) 3 to (ft.) 74.4

f. Type of Grout

Type of Grout	# of bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)
See attached page					

g. Well Finished within Bedrock

h.

Kind of Gravel/Sand Pack	Grain Size/Supplier #	From (ft.)	To (ft.)
Filtersil Sand		53	71.8

2. Well Use: Monitoring Well Disinfected? ______

3. Date Well Completed: Mar 10, 2016 Driller's Estimated Well Yield (gpm): ______

4. Date Permanent Pump Installed: ______ Set at Depth (ft.): ______

5. Pump Capacity (gpm): ______

6. Pitless Adapter Model and Manufacturer: ______ Attachment to Casing: ______

7. Well Cap Type & Manufacturer: ______

8. Pressure Tank Working Cycle (gals.): ______ Captive Air? ______ 9. Pump System Disinfected: ______

10. Name of Pump Company ______

11. Pump Installer: ______ License # ______

12. ______ Date ______
Licensed Pump Installation Contractor Signature

Illinois Department of Public Health
Division of Environmental Health
525 West Jefferson Street
Springfield, IL 62761

IMPORTANCE NOTICE: This state agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Public Act-0863. Disclosure of this information is Mandatory. This form has been approved by the Forms Management Center.

IL 482-0126
Revised 6/09

13. Property Owner: Dynegy Midwest Generation Well # MW-391

14. Driller: Jim Dittmaier License # ______

15. Name of Drilling Company : Bulldog Drilling 16. Permit Number: ______

Date Issued: ______ 17. Date Drilling Started Mar 7, 2016

18. Well Site Address: 10901 Baldwin Rd., Baldwin, IL 62217

19. Township Name: Baldwin Land I.D. # ______

20. Subdivision Name: ______ Lot # ______

21. Location: a. County Randolph b. Site Elevation ______ ft. (above msl)

c. Township: ______ Range: ______ Section: ______

d. ______ Quarter of the ______ Quarter of the ______ Quarter

e. GPS: Lat: Degrees 38 Minutes 11 Seconds 27.13 N
Lon: Degrees -89 Minutes 52 Seconds 29.13 W

Survey use only

22. Casing and Liner Information

Diameter (in.)	Material, Joint Type	From (ft.)	To (ft.)
2	Schedule 40 PVC	-2.4	55

23. Is the well screened? Yes If yes

Diameter (in.)	Length (ft.)	Slot Size (in.)	From (ft.)	To (ft.)
2	10	0.01	55	70

24. Water from ______ at a depth of (ft.) ______ To (ft.) ______

a. Static water level (ft.) below top of casing ______ which is (in.) above ground 29

b. pumping level is (ft.) ______ pumping (gpm) ______ for (hours) ______

25.

Earth Materials Passed Through	From (ft.)	To (ft.)
Clay, Silt	0	27.4
Sand	27.4	28.5
Clay	28.5	32.5
Sand	32.5	34.5
Clay	34.5	35.8
Bedrock (Limestone and Shale)	35.8	74.4

(Attach 2nd page, if necessary) (If DRY HOLE, fill out log & indicate how hole was sealed)

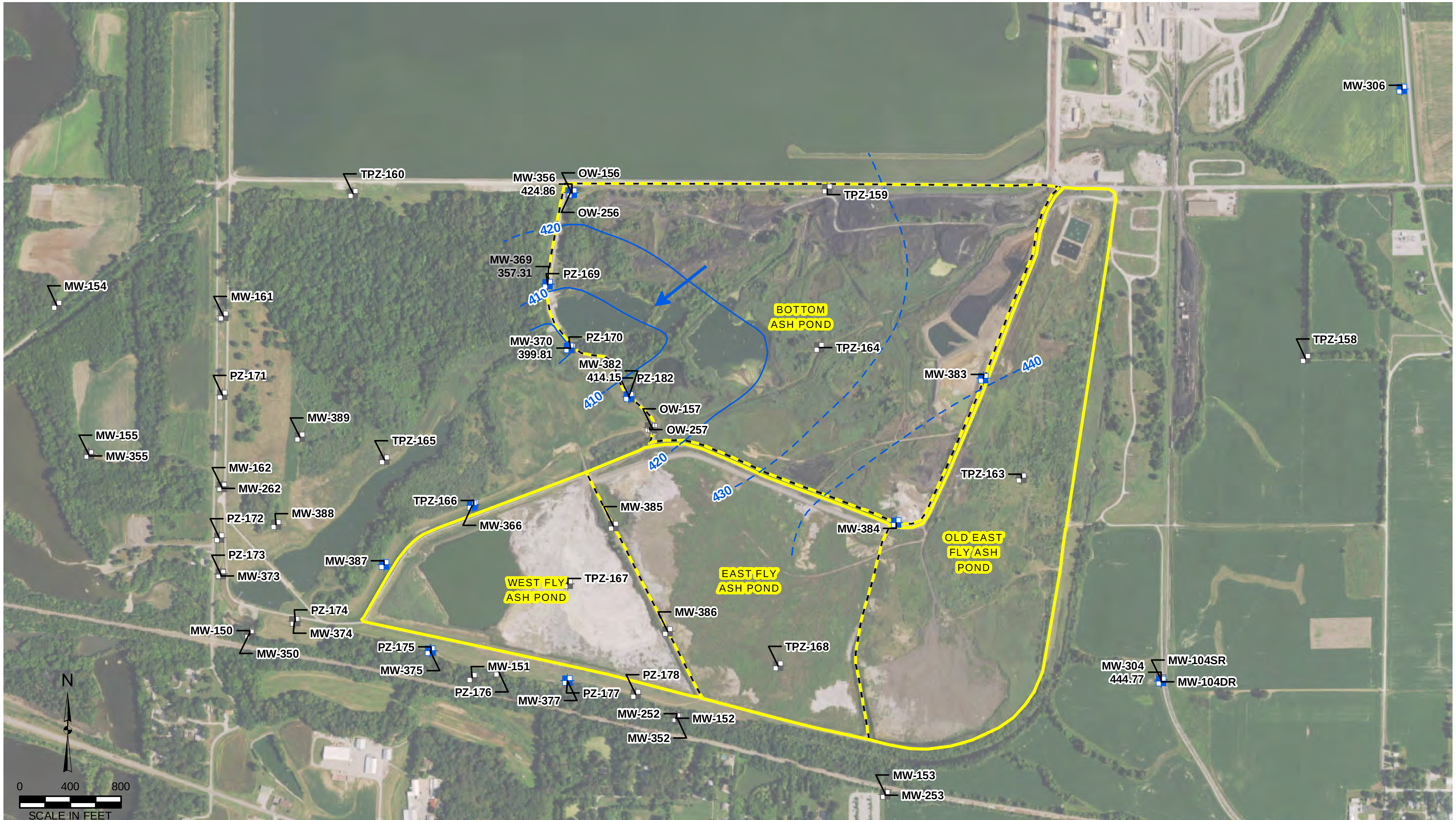
______ License # 092-006857
Licensed Water Well Contractor Signature

WATER WELL CONSTRUCTION REPORT
MW-391 Well Construction Report Continued

1. Type of Well
   f. Type of Grout

Type of Grout	# of bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)
High Solids Grout	4		1	47	
Bentonite Chips	2		47	53	
Bedrock Drill Cuttings			71.8	72	
High Solids Grout	2		72	74.4	

ATTACHMENT 4 – MAPS OF THE DIRECTION OF GROUNDWATER FLOW



CCR RULE MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD 88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR MONITORED MULTI-UNIT

CCR UNIT

NOTES:
-GROUNDWATER ELEVATIONS WITH GRAY OUTLINE WERE NOT USED FOR CONTOURING BECAUSE WATER LEVELS DID NOT RECOVER TO STATIC LEVELS AT TIME OF MEASUREMENT FOLLOWING INSTALLATION AND DEVELOPMENT.

-MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.

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DRAWN BY/DATE: SDS 1/24/17
REVIEWED BY/DATE: TBN 1/25/17
APPROVED BY/DATE: JJW 2/8/17

BALDWIN BOTTOM ASH POND (UNIT ID: 601) UPPERMOST AQUIFER UNIT GROUNDWATER ELEVATION CONTOUR MAP ROUND 1: DECEMBER 29, 2015

DYNEGY CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

UPPERMOST AQUIFER MONITORING WELL LOCATION
NON-CCR RULE MONITORING WELL LOCATION
ABANDONED MONITORING WELL LOCATION
GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD 88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
CCR UNIT
CCR MONITORED MULTI-UNIT

NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.
* = MONITORING WELL GROUNDWATER ELEVATION NOT USED FOR CONTOURING

DRAWN BY/DATE: SDS 1/24/17
REVIEWED BY/DATE: TBN 1/25/17
APPROVED BY/DATE: JJW 2/8/17

BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND BALDWIN FLY ASH POND SYSTEM (UNIT IT: 605) UPPERMOST AQUIFER UNIT GROUNDWATER ELEVATION CONTOUR MAP ROUND 2: MARCH 21, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285
FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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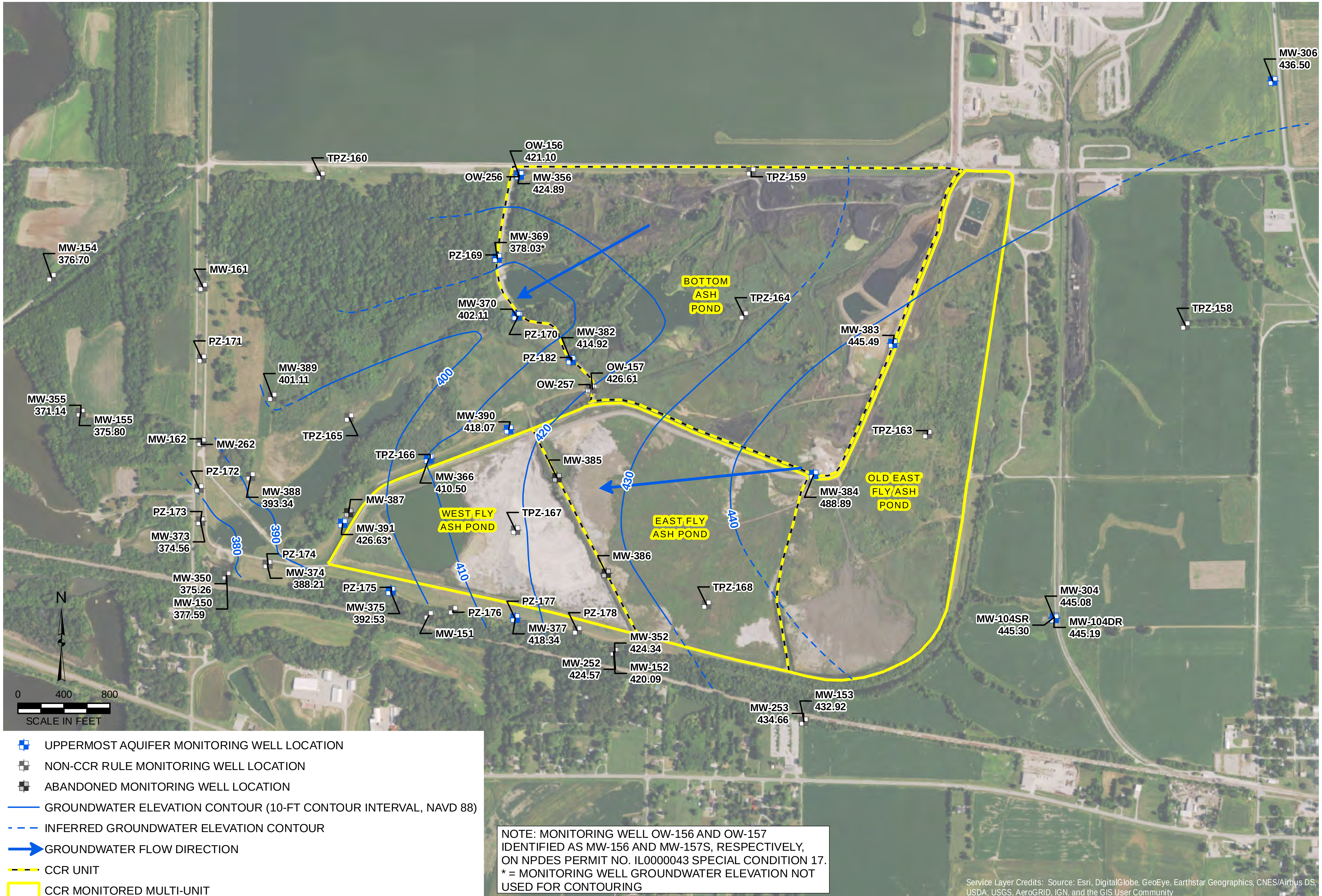


UPPERMOST AQUIFER MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

ABANDONED MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD 88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR UNIT

CCR MONITORED MULTI-UNIT

NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.
* = MONITORING WELL GROUNDWATER ELEVATION NOT USED FOR CONTOURING

DRAWN BY/DATE:
SDS 1/24/17
REVIEWED BY/DATE:
TBN 1/25/17
APPROVED BY/DATE:
JJW 2/8/17

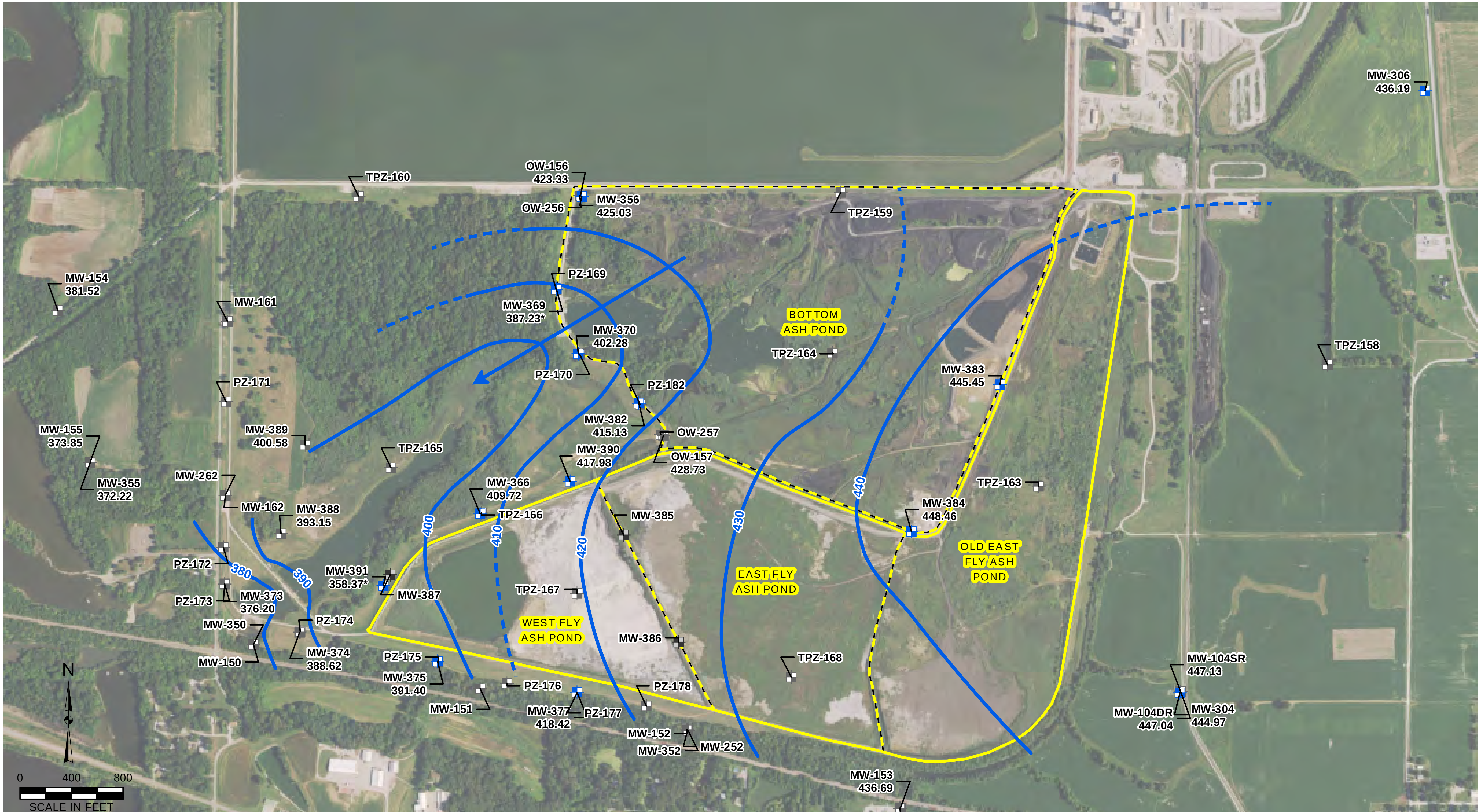
BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND BALDWIN FLY ASH POND SYSTEM (UNIT IT: 605) UPPERMOST AQUIFER UNIT GROUNDWATER ELEVATION CONTOUR MAP ROUND 3: JUNE 21, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



UPPERMOST AQUIFER MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

ABANDONED MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD 88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR UNIT

CCR MONITORED MULTI-UNIT

NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.
* = MONITORING WELL GROUNDWATER ELEVATION NOT USED FOR CONTOURING

DRAWN BY/DATE:
SDS 1/25/17
REVIEWED BY/DATE:
TBN 1/26/17
APPROVED BY/DATE:
JJW 2/8/17

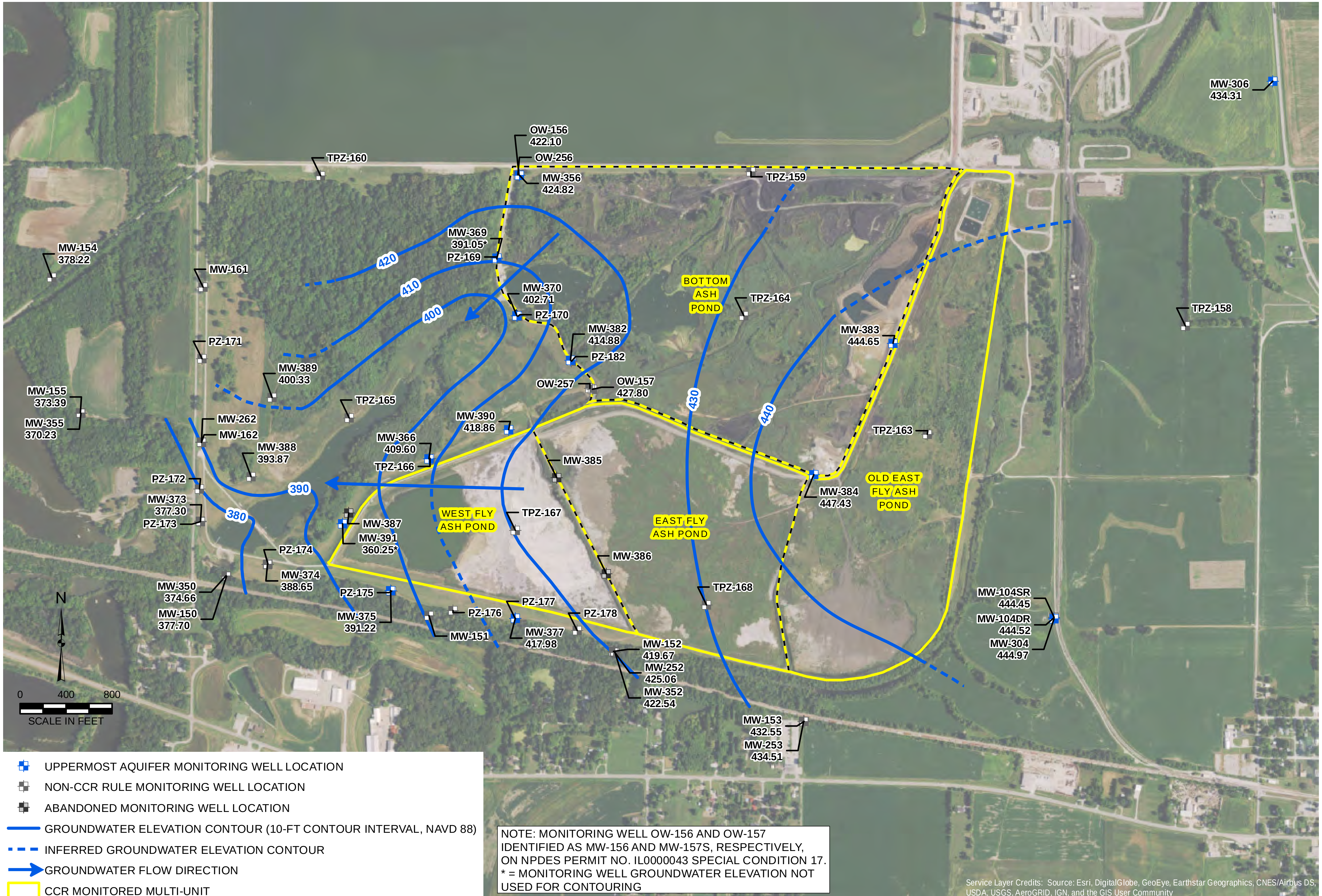
BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND BALDWIN FLY ASH POND SYSTEM (UNIT IT: 605) UPPERMOST AQUIFER GROUNDWATER ELEVATION CONTOUR MAP ROUND 4: SEPTEMBER 19, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



UPPERMOST AQUIFER MONITORING WELL LOCATION
NON-CCR RULE MONITORING WELL LOCATION
ABANDONED MONITORING WELL LOCATION
GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD 88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
CCR MONITORED MULTI-UNIT

NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.
* = MONITORING WELL GROUNDWATER ELEVATION NOT USED FOR CONTOURING

DRAWN BY/DATE: SDS 3/6/17
REVIEWED BY/DATE: TBN 3/6/17
APPROVED BY/DATE: JJW 8/30/17

BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605) UPPERMOST AQUIFER UNIT GROUNDWATER ELEVATION CONTOUR MAP ROUND 5: DECEMBER 21, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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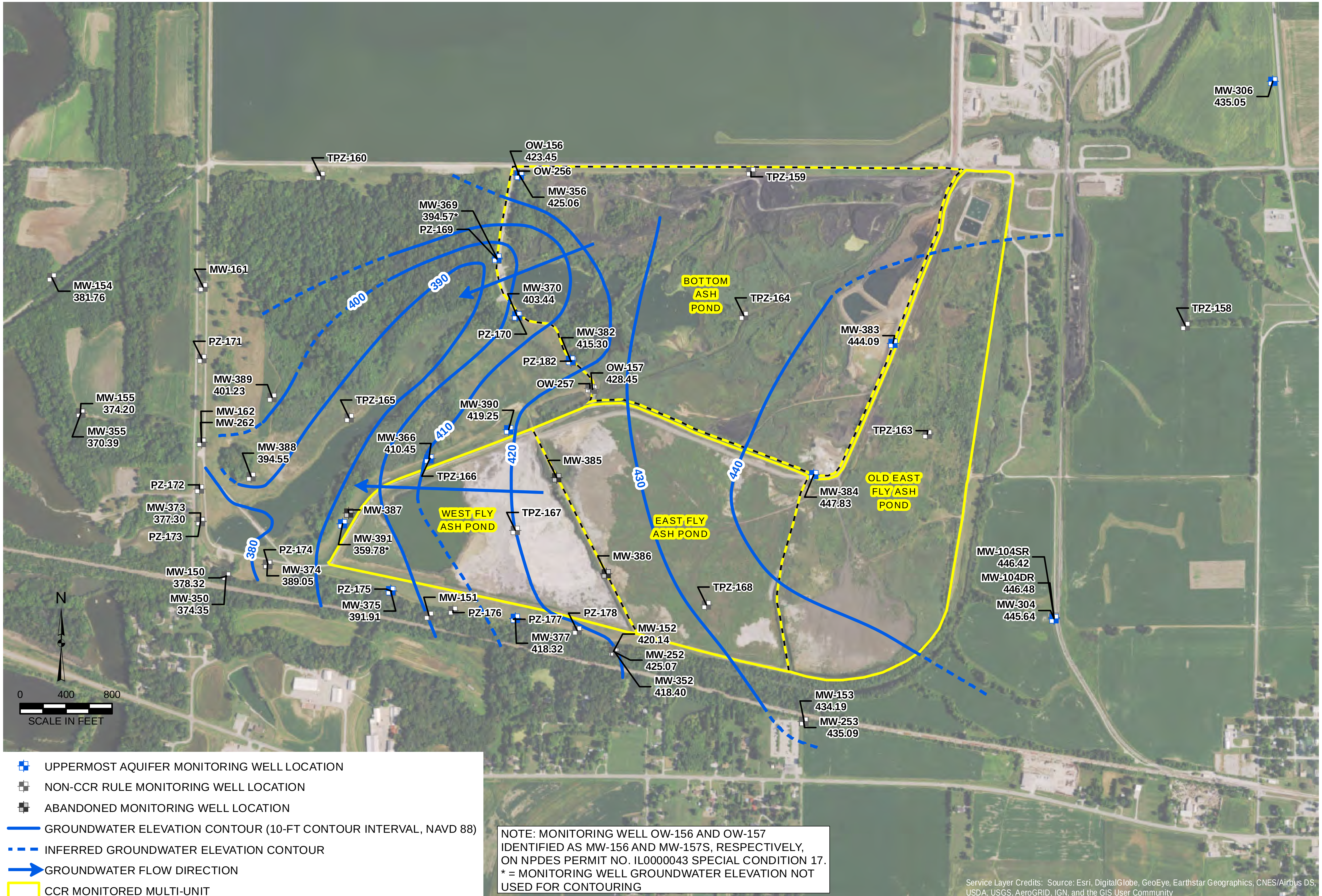


NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.
* = MONITORING WELL GROUNDWATER ELEVATION NOT USED FOR CONTOURING

DRAWN BY/DATE: SDS 4/14/17
REVIEWED BY/DATE: TBN 4/14/17
APPROVED BY/DATE: JJW 8/30/17

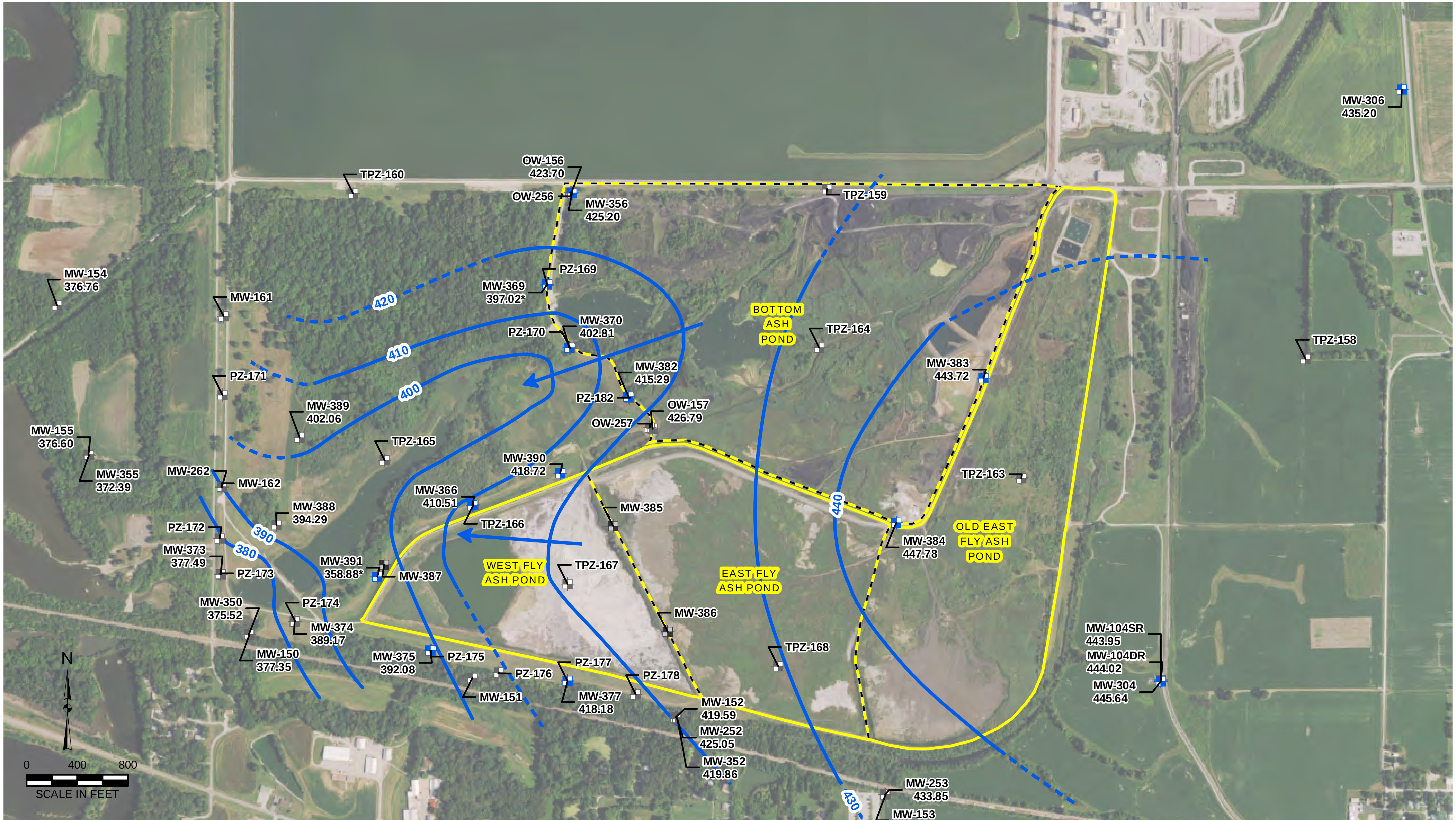
BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND BALDWIN FLY ASH POND SYSTEM (UNIT IT: 605) UPPERMOST AQUIFER UNIT GROUNDWATER ELEVATION CONTOUR MAP ROUND 6: MARCH 14, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



- UPPERMOST AQUIFER MONITORING WELL LOCATION
- NON-CCR RULE MONITORING WELL LOCATION
- ABANDONED MONITORING WELL LOCATION
- GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD 88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- CCR MONITORED MULTI-UNIT

NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.
* = MONITORING WELL GROUNDWATER ELEVATION NOT USED FOR CONTOURING

DRAWN BY/DATE: SDS 7/12/17
REVIEWED BY/DATE: TBN 7/12/17
APPROVED BY/DATE: JJW 8/30/17

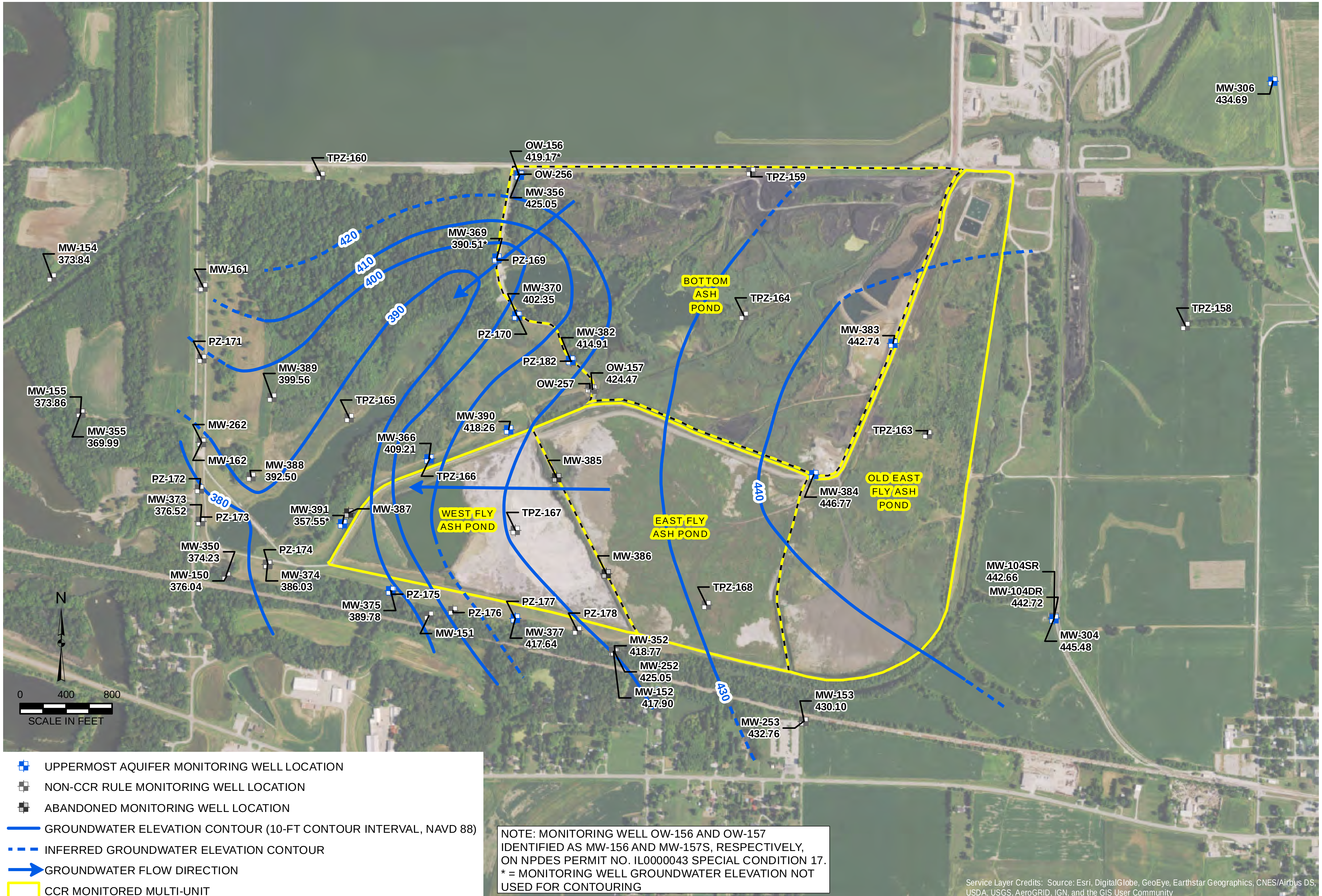
BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605) UPPERMOST AQUIFER UNIT GROUNDWATER ELEVATION CONTOUR MAP ROUND 7: JUNE 19, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



DRAWN BY/DATE: SDS 8/10/17
REVIEWED BY/DATE: TBN 8/10/17
APPROVED BY/DATE: JJW 8/30/17

BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND BALDWIN FLY ASH POND SYSTEM (UNIT IT: 605) UPPERMOST AQUIFER UNIT GROUNDWATER ELEVATION CONTOUR MAP ROUND 8: JULY 25, 2017

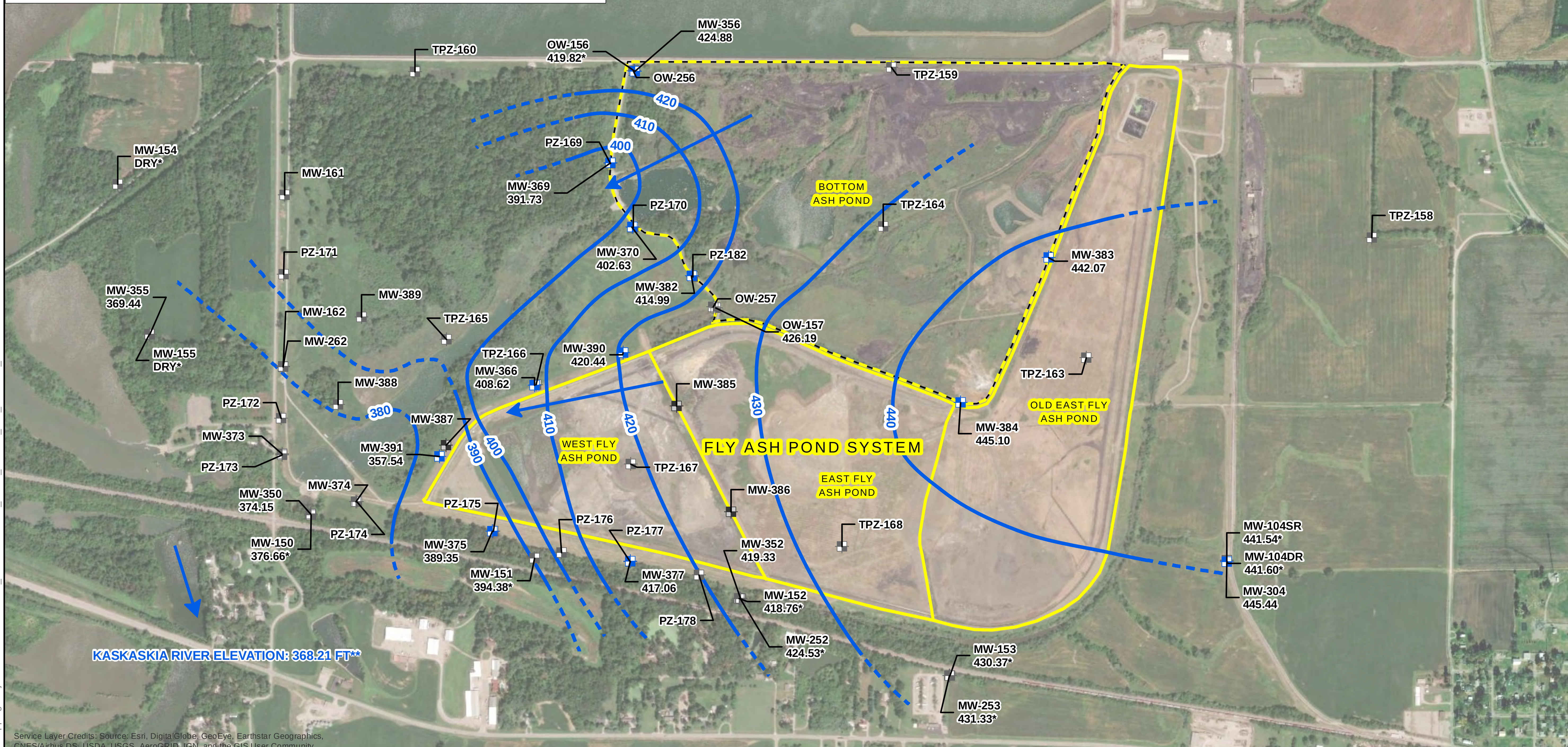
DYNEGY CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.
* = MONITORING WELL GROUNDWATER ELEVATION NOT USED FOR CONTOURING
**RIVER ELEVATION OBTAINED FROM UNITED STATES GEOLOGICAL SURVEY KASKASKIA RIVER NEAR RED BUD, IL GAUGING STATION (05595240).
ELEVATION WAS REPORTED IN NGVD29 THEN CONVERTED TO NAVD88. AT THE TIME OF THIS DRAWING, THE DATA WAS PRELIMINARY AND SUBJECT TO CHANGE
NON-CCR RULE WELLS WERE NOT MONITORED FOR ELEVATION. AVAILABLE ELEVATION DATA IS PROVIDED.



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- CCR RULE MONITORING WELL LOCATION
- NON-CCR RULE MONITORING WELL LOCATION
- ABANDONED MONITORING WELL LOCATION
- GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- CCR MONITORED MULTI-UNIT
- CCR MONITORED UNIT

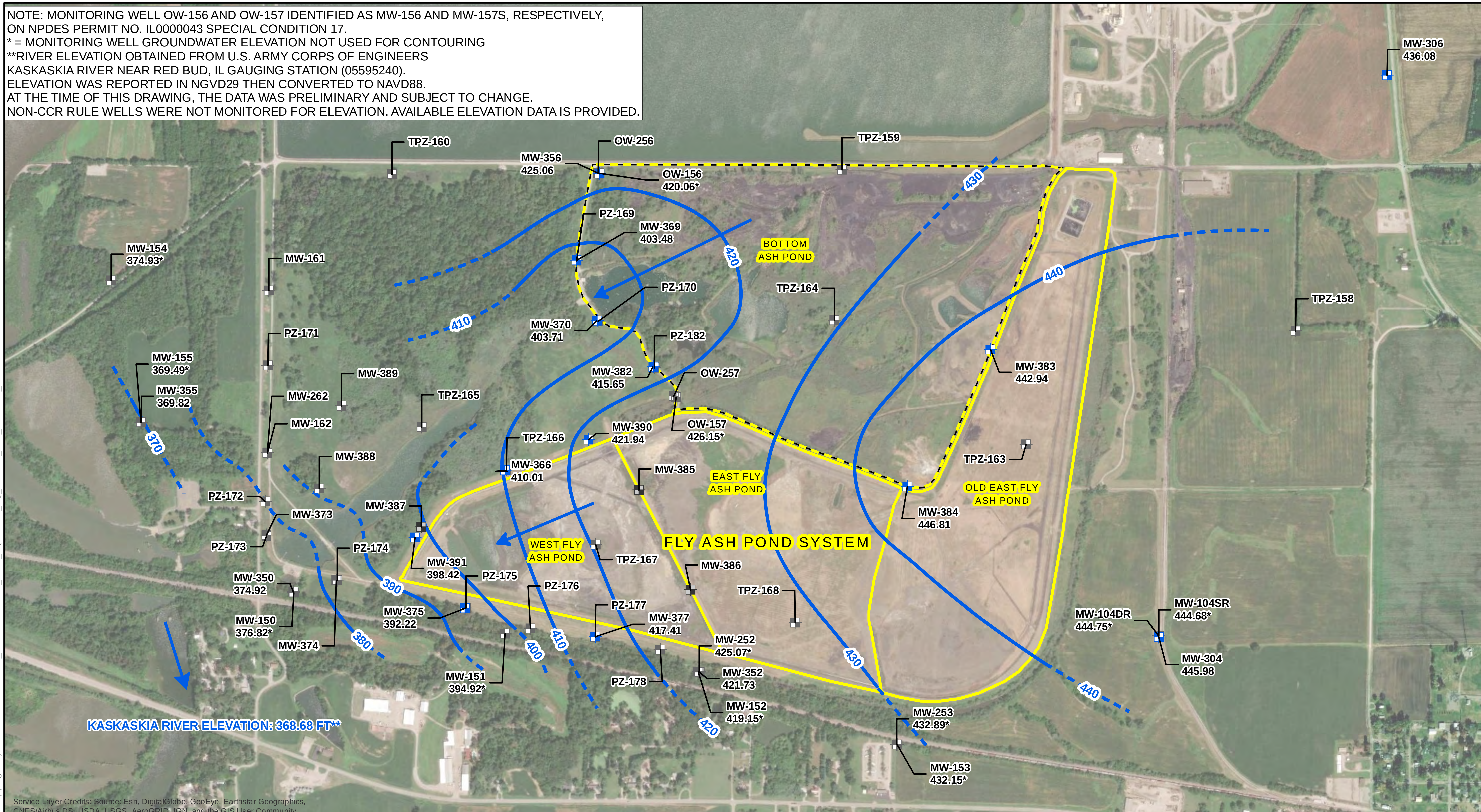
CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

N

0 200 400 800
Feet

BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND
BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)
GROUNDWATER ELEVATION CONTOUR MAP
NOVEMBER 27, 2017

O'BRIEN & GERE ENGINEERS, INC.



CCR RULE MONITORING WELL LOCATION
NON-CCR RULE MONITORING WELL LOCATION
ABANDONED MONITORING WELL LOCATION
GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
CCR MONITORED MULTI-UNIT
CCR MONITORED UNIT

CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

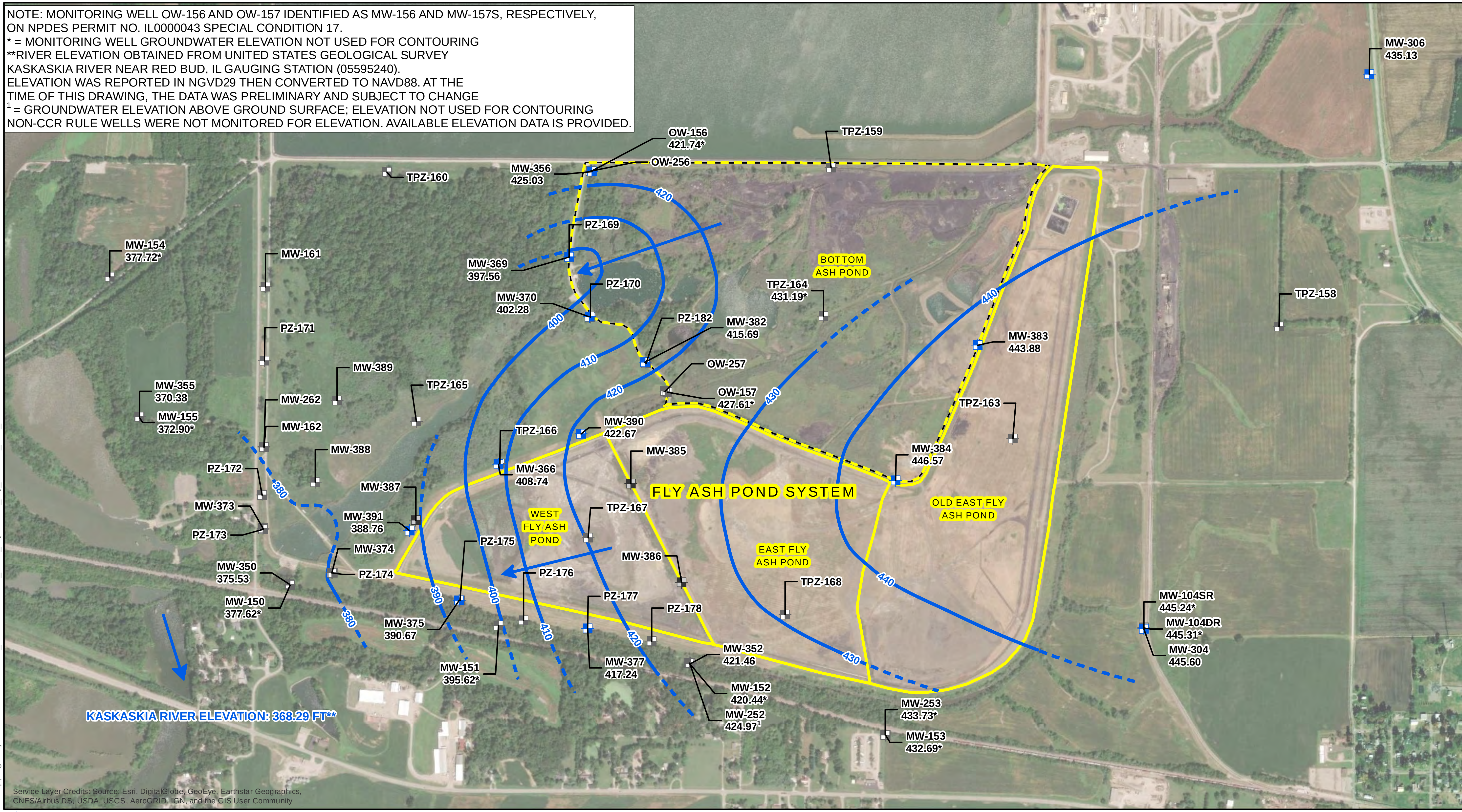
N

0 200 400 800
Feet

BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND
BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)
GROUNDWATER ELEVATION CONTOUR MAP
JUNE 25, 2018

O'BRIEN & GERE ENGINEERS, INC.

NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.
* = MONITORING WELL GROUNDWATER ELEVATION NOT USED FOR CONTOURING
**RIVER ELEVATION OBTAINED FROM UNITED STATES GEOLOGICAL SURVEY KASKASKIA RIVER NEAR RED BUD, IL GAUGING STATION (05595240). ELEVATION WAS REPORTED IN NGVD29 THEN CONVERTED TO NAVD88. AT THE TIME OF THIS DRAWING, THE DATA WAS PRELIMINARY AND SUBJECT TO CHANGE
[1] = GROUNDWATER ELEVATION ABOVE GROUND SURFACE; ELEVATION NOT USED FOR CONTOURING
NON-CCR RULE WELLS WERE NOT MONITORED FOR ELEVATION. AVAILABLE ELEVATION DATA IS PROVIDED.



CCR RULE MONITORING WELL LOCATION
NON-CCR RULE MONITORING WELL LOCATION
ABANDONED MONITORING WELL LOCATION
GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
CCR MONITORED MULTI-UNIT
CCR MONITORED UNIT

CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

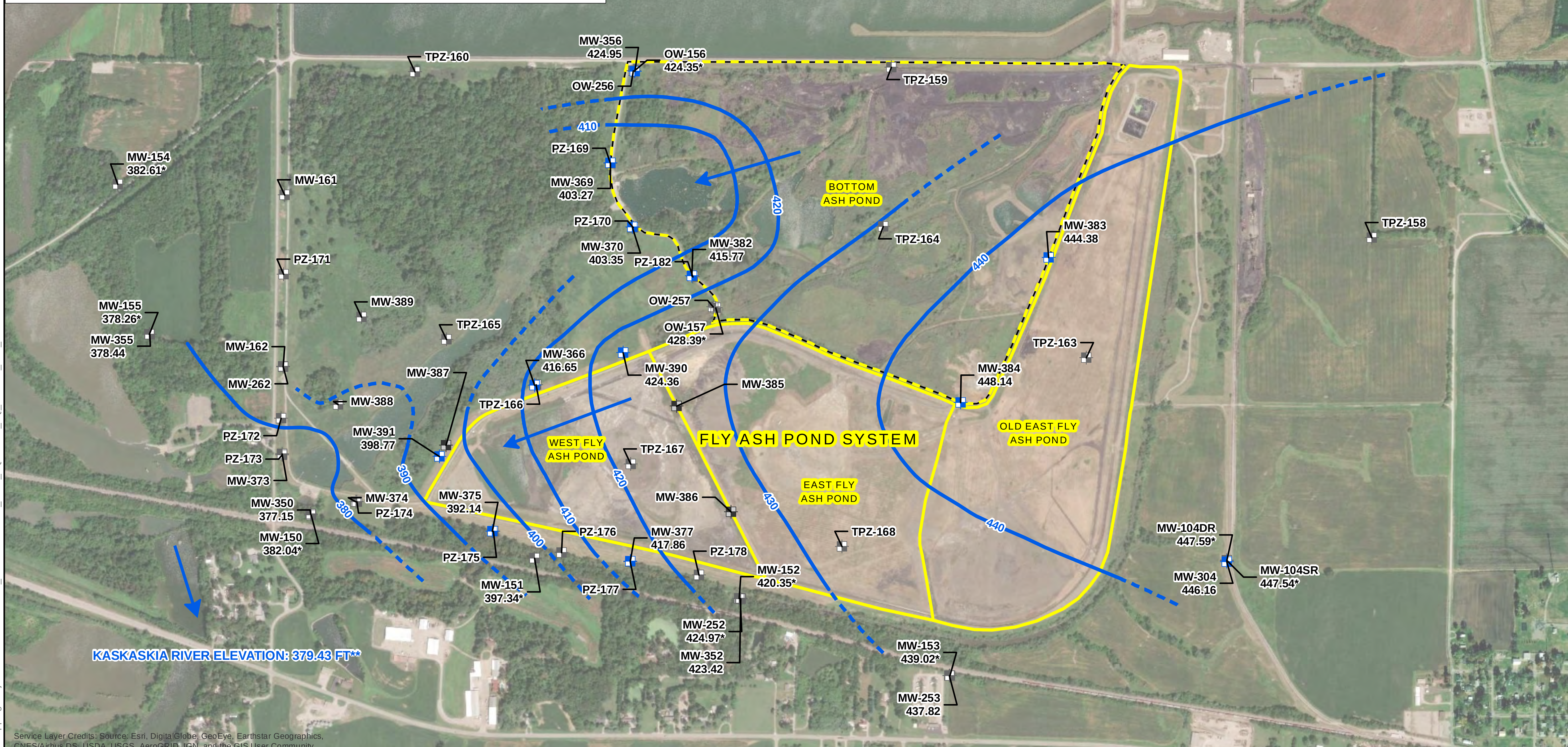
N

0 200 400 800
Feet

BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND
BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)
GROUNDWATER ELEVATION CONTOUR MAP
SEPTEMBER 25, 2018

O'BRIEN & GERE ENGINEERS, INC.

NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.
* = MONITORING WELL GROUNDWATER ELEVATION NOT USED FOR CONTOURING
**RIVER ELEVATION OBTAINED FROM UNITED STATES GEOLOGICAL SURVEY KASKASKIA RIVER NEAR RED BUD, IL GAUGING STATION (05595240). ELEVATION WAS REPORTED IN NGVD29 THEN CONVERTED TO NAVD88. AT THE TIME OF THIS DRAWING, THE DATA WAS PRELIMINARY AND SUBJECT TO CHANGE
NON-CCR RULE WELLS WERE NOT MONITORED FOR ELEVATION. AVAILABLE ELEVATION DATA IS PROVIDED.



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- CCR RULE MONITORING WELL LOCATION
- NON-CCR RULE MONITORING WELL LOCATION
- ABANDONED MONITORING WELL LOCATION
- GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- CCR MONITORED MULTI-UNIT
- CCR MONITORED UNIT

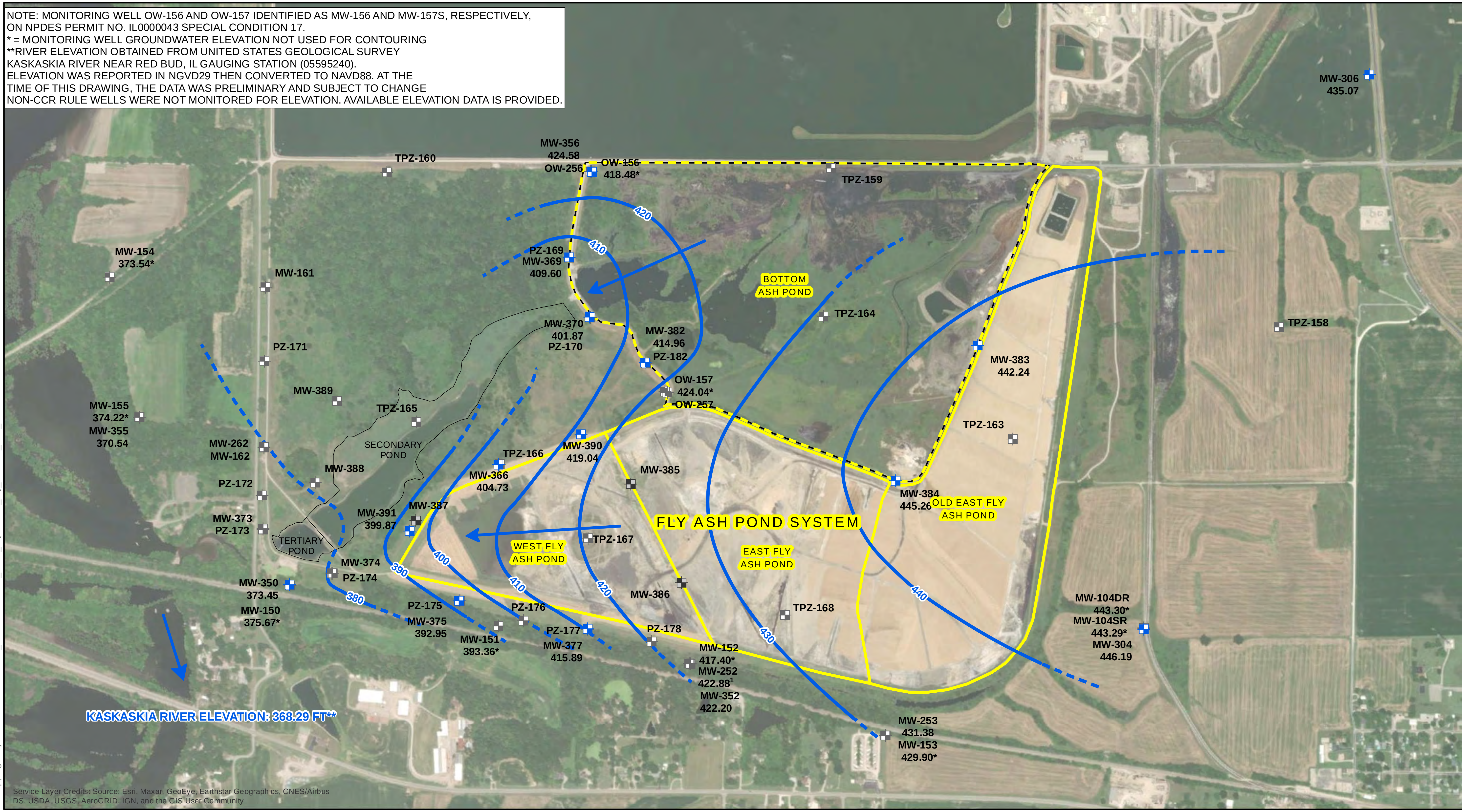
CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

N

0 200 400 800
Feet

BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND
BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)
GROUNDWATER ELEVATION CONTOUR MAP
MARCH 19, 2019

O'BRIEN & GERE ENGINEERS, INC.



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- CCR RULE MONITORING WELL LOCATION
- NON-CCR RULE MONITORING WELL LOCATION
- ABANDONED MONITORING WELL LOCATION
- GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- NON-CCR UNIT
- CCR MONITORED MULTI-UNIT
- CCR MONITORED UNIT

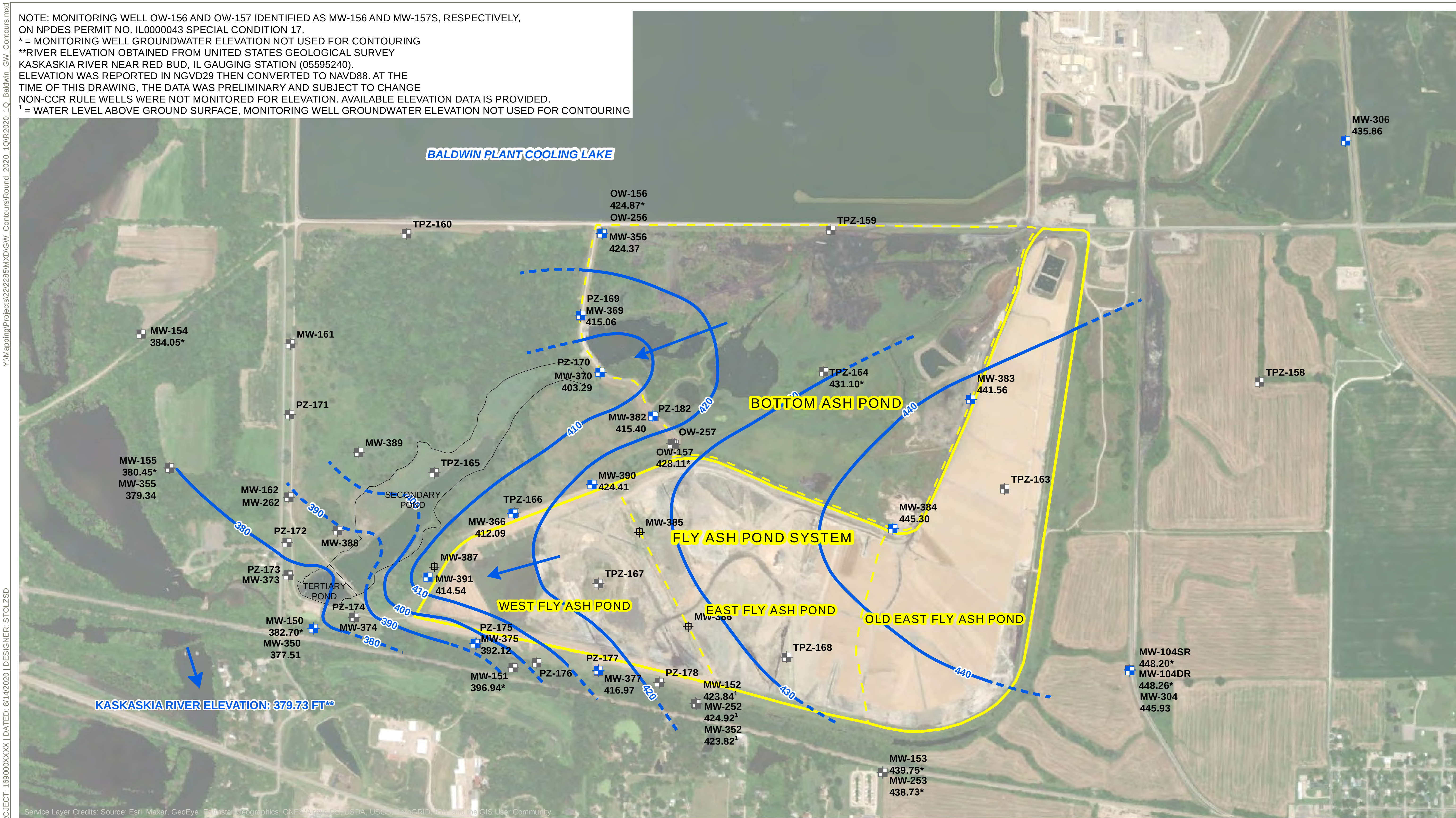
CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

N

0 200 400 800
Feet

BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND
BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)
GROUNDWATER ELEVATION CONTOUR MAP
SEPTEMBER 24, 2019

O'BRIEN & GERE ENGINEERS, INC.



- CCR RULE MONITORING WELL
- NON-CCR RULE MONITORING WELL
- ABANDONED MONITORING WELL
- GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- CCR MONITORED MULTI-UNIT
- CCR MONITORED UNIT
- NON-CCR UNIT

0 400 800 Feet

BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605) GROUNDWATER ELEVATION CONTOUR MAP
MARCH 24, 2020

CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

ATTACHMENT 5 – TABLES SUMMARIZING CONSTITUENT CONCENTRATIONS AT EACH MONITORING WELL

Sample Location	Date Sampled	Boron, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Fluoride, total (mg/L)	pH (s.u.)	Sulfate, total (mg/L)	Total Dissolved Solids (mg/L)
Background Wells								
MW-304	12/29/2015	1.28	9.64	124	1.98	8.0	157	1090
MW-304	3/21/2016	1.27	9.86	131	1.86	8.2	163	1200
MW-304	12/27/2016	1.51	15.4	141	1.61	7.9	177	1230
MW-304	6/21/2016	1.33	14.3	140	1.59	8.1	200	1220
MW-304	9/19/2016	1.95	16.5	138	1.66	7.9	176	1220
MW-304	9/26/2018	1.74	13.1	151	1.64	7.9	201	1420
MW-304	3/16/2017	1.49	6.91	144	1.66	7.9	166	1280
MW-304	6/21/2017	1.55	17.8	152	1.84	7.9	177	1360
MW-304	7/28/2017	1.42	13.2	155	1.75	7.8	187	1330
MW-304	11/28/2017	1.45	11.4	138	1.72	8.0	178	1330
MW-304	6/27/2018	1.75	12.9	151	1.67	7.4	208	1360
MW-304	3/20/2019	1.82	13.7	148	1.88	7.7	177	1390
MW-304	9/25/2019	1.84	18.4	152	1.74	7.9	169	1350
MW-304	3/26/2020	1.66	17.2	153	1.81	7.9	177	1320
MW-306	12/27/2016	0.220	30.7	47	0.58	10.8	26	360
MW-306	6/21/2016	0.478	5.37	33	0.69	10.3	21	408
MW-306	9/19/2016	0.240	35.3	47	0.55	11.0	28	235
MW-306	9/26/2018	0.159	36.9	61	0.54	11.1	34	325
MW-306	3/22/2016	0.634	6.10	34	0.83	9.9	19	482
MW-306	3/16/2017	0.306	19.7	51	0.61	11.2	27	328
MW-306	6/21/2017	0.225	26.3	53	0.62	11.1	30	335
MW-306	8/18/2016	0.322	22.4	41	0.54	10.3	25	314
MW-306	7/28/2017	0.259	15.3	54	0.60	10.9	31	256
MW-306	11/28/2017	0.407	3.40	55	0.65	10.7	39	328
MW-306	6/27/2018	0.139	45.9	64	0.64	10.5	42	376
MW-306	3/20/2019	0.174	50.4	62	0.65	11.4	32	330
MW-306	9/25/2019	0.166	46.0	62	0.59	11.0	37	318
MW-306	3/26/2020	0.180	43.1	63	0.60	11.5	37	288
Downgradient Wells								
MW-356	12/29/2015	1.93	12.7	42	1.91	7.5	47	674
MW-356	3/28/2016	1.83	11.7	41	1.89	7.8	50	666
MW-356	6/23/2016	2.04	12.0	40	1.78	7.6	49	670
MW-356	9/22/2016	2.58	13.7	41	1.78	7.7	51	670
MW-356	12/27/2016	2.06	11.4	40	1.80	7.7	44	678
MW-356	3/15/2017	1.99	11.7	34	1.85	7.8	47	696
MW-356	6/20/2017	1.97	10.6	34	1.88	7.8	45	642
MW-356	7/26/2017	1.93	11.2	34	1.88	7.9	46	670
MW-356	11/27/2017	1.98	12.2	33	1.99	7.6	44	744
MW-356	6/26/2018	2.14	11.4	31	1.96	7.4	46	696
MW-356	9/26/2018	2.29	12.0	36	1.88	7.8	46	718
MW-356	3/19/2019	2.12	11.7	31	2.18	7.8	43	678
MW-356	9/24/2019	2.04	11.6	29	2.00	7.7	38	644
MW-356	3/25/2020	1.94	12.2	29	2.01	7.9	43	654

Analytical Results - Appendix III
Baldwin Bottom Ash Pond

Sample Location	Date Sampled	Boron, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Fluoride, total (mg/L)	pH (s.u.)	Sulfate, total (mg/L)	Total Dissolved Solids (mg/L)
MW-369	12/29/2015	0.729	4.12	154	3.60	8.8	338	1070
MW-369	3/28/2016	1.42	20.4	126	2.69	8.4	220	1280
MW-369	6/23/2016	1.91	27.9	176	2.90	8.5	234	1230
MW-369	9/22/2016	2.40	80.3	89	1.31	8.3	157	784
MW-369	12/27/2016	1.90	54.6	127	1.75	8.5	170	964
MW-369	6/20/2017	1.92	64.1	117	1.54	7.4	154	836
MW-369	7/26/2017	1.92	68.2	89	1.32	7.4	125	700
MW-369	11/27/2017	2.10	74.8	95	1.46	7.5	104	780
MW-369	6/26/2018	1.55	69.3	70	1.09	7.0	107	720
MW-369	9/26/2018	2.14	77.8	71	1.10	7.3	100	704
MW-369	3/19/2019	1.96	70.7	92	1.48	7.3	98	732
MW-369	9/24/2019	0.948	85.0	101	1.08	6.7	90	788
MW-369	3/14/2017	1.98	68.5	94	1.31	7.8	142	784
MW-369	3/25/2020	0.714	92.3	94	0.95	7.1	92	726
MW-370	12/29/2015	1.77	31.6	1120	2.80	7.7	234	2510
MW-370	3/28/2016	1.56	25.8	1140	2.53	7.9	281	2710
MW-370	6/23/2016	2.43	42.1	1100	2.63	8.0	247	2730
MW-370	9/22/2016	1.81	35.4	1120	2.70	7.7	241	2620
MW-370	12/27/2016	1.82	33.6	1140	2.77	7.3	230	2780
MW-370	6/20/2017	1.82	35.1	1240	2.94	7.6	249	2850
MW-370	11/27/2017	1.81	45.9	1290	2.99	7.9	268	2960
MW-370	6/26/2018	1.75	43.1	1390	2.94	7.4	282	3130
MW-370	9/26/2018	2.05	45.5	1530	3.06	7.7	287	3280
MW-370	7/25/2017	1.84	38.2	1280	3.00	7.6	247	2830
MW-370	3/19/2019	2.01	46.7	1280	3.45	7.7	224	2950
MW-370	9/24/2019	1.95	47.0	1290	3.00	7.5	237	2830
MW-370	3/14/2017	1.81	38.1	1120	2.58	7.9	240	2730
MW-370	3/25/2020	1.79	44.5	1340	3.19	7.7	251	2880
MW-382	12/29/2015	1.61	19.3	46	2.77	7.8	457	1120
MW-382	3/28/2016	1.60	17.9	37	2.87	7.9	509	1250
MW-382	6/23/2016	2.17	24.8	39	2.83	8.0	447	1200
MW-382	9/22/2016	2.57	27.3	35	2.78	7.8	481	1170
MW-382	12/27/2016	1.78	18.4	35	2.76	7.7	428	1200
MW-382	6/20/2017	1.71	19.4	39	2.89	7.8	445	1160
MW-382	11/27/2017	1.86	20.3	35	2.91	7.9	443	1240
MW-382	6/26/2018	2.02	17.7	36	2.79	7.4	482	1220
MW-382	9/26/2018	1.77	16.8	40	2.92	7.8	434	1240
MW-382	7/25/2017	1.75	19.0	38	2.88	7.7	450	1180
MW-382	3/19/2019	1.86	21.5	36	3.30	7.6	426	1180
MW-382	9/24/2019	1.78	20.5	34	2.85	7.7	388	1150
MW-382	3/14/2017	1.74	20.6	34	2.76	8.1	451	1200
MW-382	3/25/2020	1.75	19.7	34	3.04	7.9	415	1100

Notes:
1. Abbreviations: mg/L - milligrams per liter; s.u. - standard units.

Sample Location	Date Sampled	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Cadmium ,total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	Radium-226 + Radium 228, tot (pCi/L)	Selenium, total (mg/L)	Thallium, total (mg/L)
Background Wells																
MW-304	12/29/2015	<0.001	0.0019	0.0191	<0.001	<0.001	<0.001	<0.001	1.98	<0.001	0.0568	<0.0002	0.0052	0	<0.001	<0.001
MW-304	3/21/2016	<0.001	0.0016	0.0195	<0.001	<0.001	<0.001	<0.001	1.86	<0.001	0.0541	<0.0002	0.0076	0	<0.001	<0.001
MW-304	12/27/2016	<0.001	0.0019	0.0199	<0.001	<0.001	<0.001	<0.001	1.61	<0.001	0.0646	<0.0002	0.0053	0.11	<0.001	<0.001
MW-304	6/21/2016	<0.001	0.0016	0.0199	<0.001	<0.001	<0.001	<0.001	1.59	<0.001	0.0552	<0.0002	0.0058	0.49	<0.001	<0.001
MW-304	9/19/2016	<0.001	0.0025	0.0238	<0.001	<0.001	<0.001	<0.001	1.66	<0.001	0.0693	<0.0002	0.0069	0.49	<0.001	<0.001
MW-304	9/26/2018	<0.001	0.0025	0.0229	NA	NA	<0.0015	NA	1.64	NA	0.0958	NA	0.0019	0.26	<0.001	NA
MW-304	3/16/2017	<0.001	0.0016	0.0171	<0.001	<0.001	<0.001	<0.001	1.66	<0.001	0.0685	<0.0002	0.0081	1.18	<0.001	<0.001
MW-304	6/21/2017	<0.001	0.0017	0.0206	<0.001	<0.001	<0.001	<0.001	1.84	<0.001	0.0650	<0.0002	0.0039	1.16	<0.001	<0.001
MW-304	7/28/2017	<0.001	0.0021	0.0193	<0.001	<0.001	<0.001	<0.001	1.75	<0.001	0.0650	<0.0002	0.0034	0.99	<0.001	<0.001
MW-304	11/28/2017	NA	NA	NA	NA	NA	NA	NA	1.72	NA	NA	NA	NA	NA	NA	NA
MW-304	6/27/2018	<0.001	0.0021	0.021	<0.001	<0.001	<0.0015	<0.001	1.67	<0.001	0.0874	<0.0002	0.0022	1.23	<0.001	<0.002
MW-304	3/20/2019	<0.001	0.0029	0.0214	<0.001	<0.001	<0.0015	<0.001	1.88	<0.001	0.0833	<0.0002	0.0019	0.55	<0.001	<0.002
MW-304	9/25/2019	<0.001	0.0017	0.0211	<0.001	<0.001	<0.0015	<0.001	1.74	<0.001	0.0836	<0.0002	0.0017	0.42	<0.001	<0.002
MW-304	3/26/2020	<0.001	0.0016	0.0212	<0.001	<0.001	<0.0015	<0.001	1.81	<0.001	0.0782	<0.0002	0.0015	0.95	<0.001	<0.002
MW-306	12/27/2016	<0.001	0.0044	0.0131	<0.001	<0.001	<0.001	<0.001	0.58	<0.001	0.0160	<0.0002	0.0201	0.21	<0.001	<0.001
MW-306	6/21/2016	<0.001	0.0140	0.0097	<0.001	<0.001	0.0011	<0.001	0.69	<0.001	0.0273	<0.0002	0.0072	1.14	<0.001	<0.001
MW-306	9/19/2016	<0.001	0.0045	0.0157	<0.001	<0.001	<0.001	<0.001	0.55	<0.001	0.0201	<0.0002	0.0198	0.12	<0.001	<0.001
MW-306	9/26/2018	<0.001	0.0019	0.0155	NA	NA	<0.0015	NA	0.54	NA	0.0132	NA	0.0252	0.49	<0.001	NA
MW-306	3/22/2016	<0.001	0.0101	0.0113	<0.001	<0.001	0.0011	<0.001	0.83	<0.001	0.0378	<0.0002	0.0067	0.35	<0.001	<0.001
MW-306	3/16/2017	<0.001	0.0153	0.0096	<0.001	<0.001	<0.001	<0.001	0.61	<0.001	0.0170	<0.0002	0.0182	0.90	<0.001	<0.001
MW-306	6/21/2017	<0.001	0.0046	0.0127	<0.001	<0.001	<0.001	<0.001	0.62	<0.001	0.0157	<0.0002	0.0224	0.89	<0.001	<0.001
MW-306	8/18/2016	<0.001	0.0121	0.0125	<0.001	<0.001	<0.001	<0.001	0.54	<0.001	0.0202	<0.0002	0.0126	0.49	<0.001	<0.001
MW-306	7/28/2017	<0.001	0.0057	0.0085	<0.001	<0.001	0.0015	<0.001	0.60	<0.001	0.0159	<0.0002	0.0237	0.14	<0.001	<0.001
MW-306	11/28/2017	NA	NA	NA	NA	NA	NA	NA	0.65	NA	NA	NA	NA	NA	NA	NA
MW-306	6/27/2018	<0.001	0.0024	0.0205	<0.001	<0.001	<0.0015	<0.001	0.64	<0.001	0.0136	<0.0002	0.0281	0.55	<0.001	<0.002
MW-306	3/20/2019	<0.001	0.0030	0.0192	<0.001	<0.001	<0.0015	<0.001	0.65	<0.001	0.0143	<0.0002	0.0299	0.74	<0.001	<0.002
MW-306	9/25/2019	<0.001	0.0021	0.0150	<0.001	<0.001	<0.0015	<0.001	0.59	<0.001	0.0133	<0.0002	0.0267	0.36	<0.001	<0.002
MW-306	3/26/2020	<0.001	0.0023	0.0163	<0.001	<0.001	<0.0015	<0.001	0.60	<0.001	0.0132	<0.0002	0.0269	1.08	<0.001	<0.002
Downgradient Wells																
MW-356	12/29/2015	<0.001	<0.001	0.0297	<0.001	<0.001	<0.001	<0.001	1.91	<0.001	0.0484	<0.0002	0.0023	0.12	<0.001	<0.001
MW-356	3/28/2016	0.0011	0.0012	0.0288	<0.001	<0.001	<0.001	<0.001	1.89	<0.001	0.0408	<0.0002	0.0027	0.146	<0.001	<0.001
MW-356	6/23/2016	<0.001	<0.001	0.0315	<0.001	<0.001	<0.001	<0.001	1.78	<0.001	0.0484	<0.0002	0.0024	0.77	<0.001	<0.001
MW-356	9/22/2016	<0.001	0.0013	0.0334	<0.001	<0.001	<0.001	<0.001	1.78	<0.001	0.0563	<0.0002	0.0024	0.06	<0.001	<0.001
MW-356	12/27/2016	<0.001	0.0012	0.0301	<0.001	<0.001	<0.001	<0.001	1.80	<0.001	0.0523	<0.0002	0.0020	0.04	<0.001	<0.001
MW-356	3/15/2017	<0.001	0.0010	0.0301	<0.001	<0.001	<0.001	<0.001	1.85	<0.001	0.0521	<0.0002	0.0018	0.39	<0.001	<0.001
MW-356	6/20/2017	<0.001	<0.001	0.0297	<0.001	<0.001	<0.001	<0.001	1.88	<0.001	0.0533	<0.0002	0.0014	1.21	<0.001	<0.001
MW-356	7/26/2017	<0.001	<0.001	0.0299	<0.001	<0.001	<0.001	<0.001	1.88	<0.001	0.0544	<0.0002	0.0014	0.83	<0.001	<0.001
MW-356	11/27/2017	NA	NA	NA	NA	NA	NA	NA	1.99	NA	NA	NA	NA	NA	NA	NA
MW-356	6/26/2018	<0.001	<0.001	0.0309	<0.001	<0.001	<0.0015	<0.001	1.96	<0.001	0.0580	<0.0002	<0.0015	0.56	<0.001	<0.002
MW-356	9/26/2018	NA	<0.001	0.0317	NA	NA	NA	NA	1.88	NA	0.0595	NA	<0.0015	0.08	NA	NA
MW-356	3/19/2019	<0.001	0.0011	0.0322	<0.001	<0.001	<0.0015	<0.001	2.18	<0.001	0.0578	<0.0002	<0.0015	0.19	<0.001	<0.002
MW-356	9/24/2019	NA	<0.001	0.0307	NA	NA	<0.0015	NA	2.00	NA	0.0580	NA	<0.0015	0.10	NA	NA
MW-356	3/25/2020	<0.001	<0.001	0.0303	<0.001	<0.001	<0.0015	<0.001	2.01	<0.001	0.0529	<0.0002	<0.0015	2.18	<0.001	<0.002

Analytical Results - Appendix IV
Baldwin Bottom Ash Pond

Sample Location	Date Sampled	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Cadmium ,total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	Radium-226 + Radium 228, tot (pCi/L)	Selenium, total (mg/L)	Thallium, total (mg/L)
MW-369	12/29/2015	0.0038	0.0139	0.0080	<0.001	<0.001	0.0029	<0.001	3.60	<0.001	0.0260	<0.0002	0.0761	0.01	0.0275	<0.001
MW-369	3/28/2016	0.0021	0.0034	0.0208	<0.001	<0.001	<0.001	<0.001	2.69	<0.001	0.0234	<0.0002	0.0300	0.04	0.0096	<0.001
MW-369	6/23/2016	0.0016	0.0038	0.0228	<0.001	<0.001	<0.001	<0.001	2.90	<0.001	0.0308	<0.0002	0.0264	0.89	0.0064	<0.001
MW-369	9/22/2016	<0.001	0.0020	0.0539	<0.001	<0.001	<0.001	<0.001	1.31	<0.001	0.0379	<0.0002	0.0227	0.027	0.003	<0.001
MW-369	12/27/2016	<0.001	0.0024	0.0395	<0.001	<0.001	<0.001	<0.001	1.75	<0.001	0.0311	<0.0002	0.0256	0.02	0.0023	<0.001
MW-369	6/20/2017	0.0021	0.0022	0.0503	<0.001	<0.001	<0.001	<0.001	1.54	<0.001	0.0349	<0.0002	0.0313	0.84	0.001	<0.001
MW-369	7/26/2017	<0.001	0.0016	0.0480	<0.001	<0.001	0.0012	<0.001	1.32	<0.001	0.0354	<0.0002	0.0235	0.75	<0.001	<0.001
MW-369	11/27/2017	NA	NA	NA	NA	NA	NA	NA	1.46	NA	NA	NA	NA	NA	NA	NA
MW-369	6/26/2018	<0.001	0.0015	0.0567	<0.001	<0.001	<0.0015	<0.001	1.09	<0.001	0.0280	<0.0002	0.0207	0.23	<0.001	<0.002
MW-369	9/26/2018	NA	0.0012	0.0562	NA	NA	NA	NA	1.10	NA	0.0376	NA	0.0213	1.05	NA	NA
MW-369	3/19/2019	<0.001	0.0021	0.0562	<0.001	<0.001	<0.0015	<0.001	1.48	<0.001	0.0382	<0.0002	0.0263	0.34	<0.001	<0.002
MW-369	9/24/2019	NA	0.0059	0.0849	NA	NA	<0.0015	NA	1.08	NA	0.0259	NA	0.0186	0.84	NA	NA
MW-369	3/14/2017	<0.001	0.0015	0.0482	<0.001	<0.001	<0.001	<0.001	1.31	<0.001	0.0321	<0.0002	0.0230	1.01	0.0012	<0.001
MW-369	3/25/2020	<0.001	0.0028	0.0918	<0.001	<0.001	<0.0015	<0.001	0.95	<0.001	0.0182	<0.0002	0.0113	1.72	<0.001	<0.002
MW-370	12/29/2015	0.0031	0.0013	0.0443	<0.001	<0.001	<0.001	<0.001	2.80	<0.001	0.115	<0.0002	0.0075	0.14	0.001	<0.001
MW-370	3/28/2016	0.0022	0.0027	0.0445	<0.001	<0.001	<0.001	0.0014	2.53	<0.001	0.0983	<0.0002	0.0296	0.51	<0.001	<0.001
MW-370	6/23/2016	0.0024	0.0030	0.0582	<0.001	<0.001	<0.001	<0.001	2.63	<0.001	0.154	<0.0002	0.0171	0.73	<0.001	<0.001
MW-370	9/22/2016	0.0023	0.0019	0.0431	<0.001	<0.001	<0.001	<0.001	2.70	<0.001	0.178	<0.0002	0.0181	0.35	<0.001	<0.001
MW-370	12/27/2016	<0.001	0.0023	0.0378	<0.001	<0.001	<0.001	<0.001	2.77	<0.001	0.131	<0.0002	0.0236	0.43	<0.001	<0.001
MW-370	6/20/2017	<0.001	0.0019	0.0379	<0.001	<0.001	<0.001	<0.001	2.94	<0.001	0.134	<0.0002	0.0223	1.41	<0.001	<0.001
MW-370	11/27/2017	NA	NA	NA	NA	NA	NA	NA	2.99	NA	NA	NA	NA	NA	NA	NA
MW-370	6/26/2018	<0.001	0.0012	0.0423	<0.001	<0.001	<0.0015	<0.001	2.94	<0.001	0.125	<0.0002	0.0279	0.23	<0.001	<0.002
MW-370	9/26/2018	NA	0.0010	0.0403	NA	NA	NA	NA	3.06	NA	0.142	NA	0.0214	0.73	NA	NA
MW-370	7/25/2017	<0.001	0.0017	0.0370	<0.001	<0.001	<0.001	<0.001	3.00	<0.001	0.137	<0.0002	0.0207	0.84	<0.001	<0.001
MW-370	3/19/2019	<0.001	0.0015	0.0449	<0.001	<0.001	<0.0015	<0.001	3.45	<0.001	0.147	<0.0002	0.0238	0.61	<0.001	<0.002
MW-370	9/24/2019	NA	<0.001	0.0424	NA	NA	<0.0015	NA	3.00	NA	0.149	NA	0.0188	0.75	NA	NA
MW-370	3/14/2017	0.0015	0.0019	0.0390	<0.001	<0.001	<0.001	<0.001	2.58	<0.001	0.126	<0.0002	0.0151	4.84	<0.001	<0.001
MW-370	3/25/2020	<0.001	<0.001	0.0421	<0.001	<0.001	<0.0015	<0.001	3.19	<0.001	0.132	<0.0002	0.0180	2.01	<0.001	<0.002
MW-382	12/29/2015	<0.001	0.0027	0.0204	<0.001	<0.001	0.003	<0.001	2.77	<0.001	0.0517	<0.0002	0.0034	0.15	<0.001	<0.001
MW-382	3/28/2016	<0.001	0.0030	0.0160	<0.001	<0.001	<0.001	<0.001	2.87	<0.001	0.0522	<0.0002	0.0010	0.06	<0.001	<0.001
MW-382	6/23/2016	<0.001	0.0030	0.0221	<0.001	<0.001	0.003	<0.001	2.83	<0.001	0.0705	<0.0002	0.0013	0.45	<0.001	<0.001
MW-382	9/22/2016	<0.001	0.0023	0.0243	<0.001	<0.001	0.005	<0.001	2.78	0.001	0.0723	<0.0002	0.0016	0.65	<0.001	<0.001
MW-382	12/27/2016	<0.001	0.0012	0.0157	<0.001	<0.001	0.0025	<0.001	2.76	<0.001	0.0603	<0.0002	0.0011	0.23	<0.001	<0.001
MW-382	6/20/2017	<0.001	<0.001	0.0155	<0.001	<0.001	0.0018	<0.001	2.89	<0.001	0.0647	<0.0002	<0.001	2.62	<0.001	<0.001
MW-382	11/27/2017	NA	NA	NA	NA	NA	NA	NA	2.91	NA	NA	NA	NA	NA	NA	NA
MW-382	6/26/2018	<0.001	<0.001	0.0141	<0.001	<0.001	<0.0015	<0.001	2.79	<0.001	0.0678	<0.0002	<0.0015	0.54	<0.001	<0.002
MW-382	9/26/2018	NA	<0.001	0.0140	NA	NA	NA	NA	2.92	NA	0.0588	NA	<0.0015	0.63	NA	NA
MW-382	7/25/2017	<0.001	0.0011	0.0155	<0.001	<0.001	0.003	<0.001	2.88	<0.001	0.0610	<0.0002	0.0017	0.97	<0.001	<0.001
MW-382	3/19/2019	<0.001	0.0012	0.0170	<0.001	<0.001	0.0021	<0.001	3.30	<0.001	0.0625	<0.0002	0.0019	0.16	<0.001	<0.002
MW-382	9/24/2019	NA	0.0012	0.0221	NA	NA	0.0044	NA	2.85	NA	0.0623	NA	0.0025	0.51	NA	NA
MW-382	3/14/2017	<0.001	0.0014	0.0176	<0.001	<0.001	0.0021	<0.001	2.76	0.0013	0.0575	<0.0002	0.0018	0.43	<0.001	<0.001
MW-382	3/25/2020	<0.001	0.0014	0.0196	<0.001	<0.001	0.0028	<0.001	3.04	<0.001	0.0561	<0.0002	0.0021	2.33	<0.001	<0.002

Notes:
1. Abbreviations: mg/L - milligrams per liter; NA - not analyzed; pCi/L - picocurie per liter;

Sample Location	Date Sampled	Boron, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Fluoride, total (mg/L)	pH (STD)	Sulfate, total (mg/L)	Total Dissolved Solids (mg/L)
Background Wells								
MW-304	12/29/2015	1.28	9.64	120	2	8	157	1090
MW-304	3/21/2016	1.27	9.86	130	1.9	8.2	163	1200
MW-304	6/21/2016	1.33	14.3	140	1.6	8.1	200	1220
MW-304	9/19/2016	1.95	16.5	140	1.7	7.9	176	1220
MW-304	12/27/2016	1.51	15.4	140	1.6	7.9	177	1230
MW-304	3/16/2017	1.49	6.91	140	1.7	7.9	166	1280
MW-304	6/21/2017	1.55	17.8	150	1.8	7.9	177	1360
MW-304	7/28/2017	1.42	13.2	160	1.8	7.8	187	1330
MW-304	11/28/2017	1.45	11.4	140	1.7	8	178	1330
MW-304	6/27/2018	1.75	12.9	150	1.7	7.4	208	1360
MW-304	9/26/2018	1.74	13.1	150	1.6	7.9	201	1420
MW-304	3/20/2019	1.82	13.7	150	1.9	7.7	177	1390
MW-304	9/25/2019	1.84	18.4	150	1.7	7.9	169	1350
MW-304	3/26/2020	1.66	17.2	150	1.8	7.9	177	1320
MW-306	3/22/2016	0.634	6.1	34	0.83	9.9	19	482
MW-306	6/21/2016	0.478	5.37	33	0.69	10	21	408
MW-306	8/18/2016	0.322	22.4	41	0.54	10	25	314
MW-306	9/19/2016	0.24	35.3	47	0.55	11	28	235
MW-306	12/27/2016	0.22	30.7	47	0.58	11	26	360
MW-306	3/16/2017	0.306	19.7	51	0.61	11	27	328
MW-306	6/21/2017	0.225	26.3	53	0.62	11	30	335
MW-306	7/28/2017	0.259	15.3	54	0.6	11	31	256
MW-306	11/28/2017	0.407	3.4	55	0.65	11	39	328
MW-306	6/27/2018	0.139	45.9	64	0.64	10	42	376
MW-306	9/26/2018	0.159	36.9	61	0.54	11	34	325
MW-306	3/20/2019	0.174	50.4	62	0.65	11	32	330
MW-306	9/25/2019	0.166	46	62	0.59	11	37	318
MW-306	3/26/2020	0.18	43.1	63	0.6	12	37	288
Downgradient Wells								
MW-350	3/26/2020	0.635	52.9	52	0.17	12	71	344
MW-366	1/20/2016	1.42	74.5	9	0.98	6.7	38	416
MW-366	3/23/2016	1.51	72.9	8	1	7.1	33	450
MW-366	6/22/2016	1.3	70.4	12	0.89	7.2	40	434
MW-366	9/20/2016	2.31	103	17	0.98	7.1	49	398
MW-366	12/22/2016	1.69	67.7	14	0.98	7	46	430
MW-366	3/15/2017	1.67	74.4	14	1	7.5	46	478
MW-366	6/20/2017	1.66	70.1	16	1.1	7	64	474
MW-366	7/26/2017	1.66	73	18	1	7.2	77	474
MW-366	11/27/2017	1.79	108	31	0.96	7.3	195	740
MW-366	6/26/2018	1.53	141	50	0.45	6.9	526	1060
MW-366	9/25/2018	1.38	127	47	0.63	7	432	1050
MW-366	3/19/2019	1.37	146	43	0.51	7	397	1030
MW-366	9/25/2019	1.5	166	47	0.56	6.7	464	1130
MW-366	3/26/2020	1.68	168	47	0.4	6.9	488	1090
MW-375	1/20/2016	0.979	14.9	77	1.8	7.7	104	472
MW-375	3/23/2016	1.13	12.1	77	2.1	7.8	128	904
MW-375	6/22/2016	1.27	11.2	90	2.1	7.9	122	934
MW-375	9/20/2016	2.06	18.1	96	2.1	7.8	123	902
MW-375	12/22/2016	1.32	9.63	98	2.3	7.8	103	876
MW-375	3/16/2017	1.24	9.96	93	2.4	7.8	93	904
MW-375	6/21/2017	1.37	8.82	91	2.5	7.7	83	916
MW-375	7/28/2017	1.23	8.97	96	2.4	7.8	85	882
MW-375	11/27/2017	1.26	10.6	90	2.4	7.9	88	928
MW-375	6/27/2018	1.46	24	100	2.2	7.6	243	1110
MW-375	9/25/2018	1.34	19.7	110	2.1	7.8	214	1100
MW-375	3/20/2019	1.38	21	95	2.6	7.8	184	1040
MW-375	9/25/2019	1.39	20.7	97	2.4	7.8	163	1010
MW-375	3/24/2020	1.5	24.7	100	2.4	7.8	209	1000
MW-377	1/19/2016	1.54	54.3	82	1.1	7.5	43	552
MW-377	3/23/2016	1.59	55.1	79	1.1	7.2	44	606
MW-377	6/22/2016	1.79	61	86	1	7.2	41	628
MW-377	9/21/2016	2.01	69.5	98	1.1	7.2	40	592
MW-377	12/22/2016	1.72	55.4	95	1	6.9	39	606
MW-377	3/15/2017	1.67	60.9	90	1.1	7.7	42	628
MW-377	6/21/2017	1.74	53.4	94	1.1	7.1	39	614
MW-377	7/28/2017	1.63	57.4	93	1.1	7.2	39	590

Sample Location	Date Sampled	Boron, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Fluoride, total (mg/L)	pH (STD)	Sulfate, total (mg/L)	Total Dissolved Solids (mg/L)
MW-377	11/28/2017	1.91	63.2	90	1.1	7	41	652
MW-377	6/27/2018	1.74	54.1	93	1.2	7	46	614
MW-377	9/25/2018	1.78	55.9	96	1.1	7.2	41	646
MW-377	3/20/2019	1.73	68.1	90	1.2	7.2	38	614
MW-377	9/25/2019	1.77	57.8	93	1.2	7	39	626
MW-377	3/24/2020	1.79	54	99	1.3	7.2	37	580
MW-383	1/21/2016	1.27	16.2	41	0.82	7.8	212	800
MW-383	3/24/2016	1.33	15.7	39	0.84	7.7	205	828
MW-383	6/23/2016	1.45	14.9	39	0.82	7.8	176	916
MW-383	9/21/2016	2.05	20.2	40	0.83	7.6	192	840
MW-383	12/27/2016	1.49	14.9	41	0.79	7.6	174	910
MW-383	3/16/2017	1.42	16.2	40	0.76	7.7	180	890
MW-383	6/19/2017	1.53	16.1	40	0.81	7.7	177	912
MW-383	7/26/2017	1.26	16.1	40	0.8	7.6	182	890
MW-383	11/28/2017	1.49	18.4	39	0.75	7.6	171	962
MW-383	6/27/2018	1.5	17	39	0.75	7.3	200	926
MW-383	9/25/2018	1.4	16.8	40	0.7	7.6	184	940
MW-383	3/20/2019	1.43	18.4	39	0.78	7.5	166	920
MW-383	9/24/2019	1.39	19.2	41	0.77	7.5	169	922
MW-383	3/25/2020	1.33	18.2	40	0.78	7.6	175	874
MW-384	1/21/2016	1.45	22.6	140	1.5	7.5	178	992
MW-384	3/24/2016	1.29	22.5	110	1.4	7.8	178	1080
MW-384	6/23/2016	1.48	23.2	140	1.4	7.8	135	1110
MW-384	9/21/2016	1.52	22.3	160	1.5	8	142	1080
MW-384	12/27/2016	1.41	19.8	190	2	7.9	160	1220
MW-384	3/16/2017	1.33	20.5	210	2.1	8	156	1230
MW-384	6/19/2017	1.5	19.5	170	1.5	8	130	1120
MW-384	7/25/2017	1.26	19.3	180	1.5	7.6	127	1090
MW-384	11/28/2017	1.92	20.7	230	1.8	7.9	114	1230
MW-384	6/27/2018	1.51	21.4	250	1.6	7.2	124	1200
MW-384	9/25/2018	1.39	19.8	400	3.1	8	82	1510
MW-384	3/20/2019	1.44	21.5	220	1.8	7.5	94	1180
MW-384	9/24/2019	1.36	19.8	200	1.8	8	102	1120
MW-384	3/25/2020	1.43	19.4	230	1.9	8.1	110	1150
MW-390	3/22/2016	1.74	55	24	1.3	7.4	102	590
MW-390	6/23/2016	2.3	53.6	36	1.4	7.6	154	722
MW-390	8/18/2016	1.88	53.1	77	1.4	7.2	169	778
MW-390	9/20/2016	2.18	52.8	61	1.4	7.5	154	704
MW-390	12/22/2016	2.12	49.6	74	1.5	7.5	171	780
MW-390	3/15/2017	0.668	53	120	0.84	7.8	234	898
MW-390	6/20/2017	1.3	57.4	130	1.3	7.2	233	894
MW-390	7/28/2017	1.12	58.6	120	1.2	7.4	222	842
MW-390	11/27/2017	0.854	69.7	110	0.9	7.5	228	898
MW-390	6/26/2018	0.207	68.4	64	0.48	6.9	141	636
MW-390	9/25/2018	0.175	90.4	69	0.49	7	117	660
MW-390	3/19/2019	0.178	89.2	67	0.52	7.2	114	646
MW-390	9/24/2019	0.288	90.9	120	0.64	7.1	171	800
MW-390	3/26/2020	0.182	96.7	87	0.49	6.9	139	654
MW-391	12/22/2016	1.3	22.4	260	2.6	7.6	679	1980
MW-391	3/15/2017	1.43	24.5	270	2.6	8	726	2260
MW-391	6/20/2017	1.88	23.6	300	2.8	7.5	758	2460
MW-391	6/26/2018	8.91	78.9	170	1.8	7.3	1760	3030
MW-391	9/25/2018	8.6	64.6	180	1.9	7.5	1420	3090
MW-391	3/19/2019	6.77	44.7	180	2.6	7.6	1340	3110
MW-391	9/25/2019	6.16	35.5	190	2.6	7.6	1450	2980
MW-391	3/24/2020	5.29	21.4	210	2.8	7.7	1320	2870

Notes:
1. Abbreviations: mg/L - milligrams per liter; NA - not analyzed; s.u. - standard units

Sample Location	Date Sampled	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Cadmium, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	Radium-226 + Radium 228, total (pCi/L)	Selenium, total (mg/L)	Thallium, total (mg/L)
Background Wells																
MW-304	12/29/2015	<0.001	0.0019	0.0191	<0.001	<0.001	<0.001	<0.001	2	<0.001	0.0568	0.0002	0.0052	0	<0.001	<0.001
MW-304	3/21/2016	<0.001	0.0016	0.0195	<0.001	<0.001	<0.001	<0.001	1.9	<0.001	0.0541	0.0002	0.0076	0	<0.001	<0.001
MW-304	6/21/2016	<0.001	0.0016	0.0199	<0.001	<0.001	<0.001	<0.001	1.6	<0.001	0.0552	0.0002	0.0058	0.49	<0.001	<0.001
MW-304	9/19/2016	<0.001	0.0025	0.0238	<0.001	<0.001	<0.001	<0.001	1.7	<0.001	0.0693	0.0002	0.0069	0.49	<0.001	<0.001
MW-304	12/27/2016	<0.001	0.0019	0.0199	<0.001	<0.001	<0.001	<0.001	1.6	<0.001	0.0646	0.0002	0.0053	0.11	<0.001	<0.001
MW-304	3/16/2017	<0.001	0.0016	0.0171	<0.001	<0.001	<0.001	<0.001	1.7	<0.001	0.0685	0.0002	0.0081	1.18	<0.001	<0.001
MW-304	6/21/2017	<0.001	0.0017	0.0206	<0.001	<0.001	<0.001	<0.001	1.8	<0.001	0.065	0.0002	0.0039	1.16	<0.001	<0.001
MW-304	7/28/2017	<0.001	0.0021	0.0193	<0.001	<0.001	<0.001	<0.001	1.8	<0.001	0.065	0.0002	0.0034	0.99	<0.001	<0.001
MW-304	11/28/2017	NA	NA	NA	NA	NA	NA	NA	1.7	NA	NA	NA	NA	NA	NA	NA
MW-304	6/27/2018	<0.001	0.0021	0.021	<0.001	<0.001	<0.0015	<0.001	1.7	<0.001	0.0874	0.0002	0.0022	1.23	<0.001	<0.002
MW-304	9/26/2018	<0.001	0.0025	0.0229	NA	NA	<0.0015	NA	1.6	NA	0.0958	NA	0.0019	0.26	<0.001	NA
MW-304	3/20/2019	<0.001	0.0029	0.0214	<0.001	<0.001	<0.0015	<0.001	1.9	<0.001	0.0833	0.0002	0.0019	0.55	<0.001	<0.002
MW-304	9/25/2019	<0.001	0.0017	0.0211	<0.001	<0.001	<0.0015	<0.001	1.7	<0.001	0.0836	0.0002	0.0017	0.42	<0.001	<0.002
MW-304	3/26/2020	<0.001	0.0016	0.0212	<0.001	<0.001	<0.0015	<0.001	1.8	<0.001	0.0782	0.0002	0.0015	0.95	<0.001	<0.002
MW-306	3/22/2016	<0.001	0.0101	0.0113	<0.001	<0.001	0.0011	<0.001	0.83	<0.001	0.0378	0.0002	0.0067	0.35	<0.001	<0.001
MW-306	6/21/2016	<0.001	0.014	0.0097	<0.001	<0.001	0.0011	<0.001	0.69	<0.001	0.0273	0.0002	0.0072	1.14	<0.001	<0.001
MW-306	8/18/2016	<0.001	0.0121	0.0125	<0.001	<0.001	<0.001	<0.001	0.54	<0.001	0.0202	0.0002	0.0126	0.49	<0.001	<0.001
MW-306	9/19/2016	<0.001	0.0045	0.0157	<0.001	<0.001	<0.001	<0.001	0.55	<0.001	0.0201	0.0002	0.0198	0.12	<0.001	<0.001
MW-306	12/27/2016	<0.001	0.0044	0.0131	<0.001	<0.001	<0.001	<0.001	0.58	<0.001	0.016	0.0002	0.0201	0.21	<0.001	<0.001
MW-306	3/16/2017	<0.001	0.0153	0.0096	<0.001	<0.001	<0.001	<0.001	0.61	<0.001	0.017	0.0002	0.0182	0.9	<0.001	<0.001
MW-306	6/21/2017	<0.001	0.0046	0.0127	<0.001	<0.001	<0.001	<0.001	0.62	<0.001	0.0157	0.0002	0.0224	0.89	<0.001	<0.001
MW-306	7/28/2017	<0.001	0.0057	0.0085	<0.001	<0.001	0.0015	<0.001	0.6	<0.001	0.0159	0.0002	0.0237	0.14	<0.001	<0.001
MW-306	11/28/2017	NA	NA	NA	NA	NA	NA	NA	0.65	NA	NA	NA	NA	NA	NA	NA
MW-306	6/27/2018	<0.001	0.0024	0.0205	<0.001	<0.001	<0.0015	<0.001	0.64	<0.001	0.0136	0.0002	0.0281	0.55	<0.001	<0.002
MW-306	9/26/2018	<0.001	0.0019	0.0155	NA	NA	<0.0015	NA	0.54	NA	0.0132	NA	0.0252	0.49	<0.001	NA
MW-306	3/20/2019	<0.001	0.003	0.0192	<0.001	<0.001	<0.0015	<0.001	0.65	<0.001	0.0143	0.0002	0.0299	0.74	<0.001	<0.002
MW-306	9/25/2019	<0.001	0.0021	0.015	<0.001	<0.001	<0.0015	<0.001	0.59	<0.001	0.0133	0.0002	0.0267	0.36	<0.001	<0.002
MW-306	3/26/2020	<0.001	0.0023	0.0163	<0.001	<0.001	<0.0015	<0.001	0.6	<0.001	0.0132	0.0002	0.0269	1.08	<0.001	<0.002
Downgradient Wells																
MW-350	6/25/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0788	NA	NA	NA	NA	NA
MW-350	3/26/2020	0.003	<0.001	0.244	<0.001	<0.001	<0.0015	<0.001	0.17	<0.001	0.0787	0.0002	0.002	0.83	<0.001	<0.002
MW-366	1/20/2016	<0.001	<0.001	0.0793	<0.001	<0.001	<0.001	0.001	0.98	<0.001	0.0283	0.0002	0.002	0.775	0.0011	<0.001
MW-366	3/23/2016	<0.001	<0.001	0.0827	<0.001	<0.001	<0.001	<0.001	1	<0.001	0.0283	0.0002	0.0013	1.1	<0.001	<0.001
MW-366	6/22/2016	<0.001	<0.001	0.0817	<0.001	<0.001	<0.001	<0.001	0.89	<0.001	0.028	0.0002	0.0037	0.12	<0.001	<0.001
MW-366	9/20/2016	<0.001	0.0013	0.11	<0.001	<0.001	<0.001	0.0014	0.98	<0.001	0.0322	0.0002	0.0043	0.43	<0.001	<0.001
MW-366	12/22/2016	<0.001	<0.001	0.0762	<0.001	<0.001	<0.001	<0.001	0.98	<0.001	0.0333	0.0002	0.0014	1.33	<0.001	<0.001
MW-366	3/15/2017	<0.001	<0.001	0.0764	<0.001	<0.001	<0.001	<0.001	1	<0.001	0.0305	0.0002	0.0011	1.17	<0.001	<0.001
MW-366	6/20/2017	<0.001	<0.001	0.077	<0.001	<0.001	<0.001	<0.001	1.1	<0.001	0.0333	0.0002	0.0016	0.8	<0.001	<0.001
MW-366	7/26/2017	<0.001	<0.001	0.0696	<0.001	<0.001	<0.001	<0.001	1	<0.001	0.0327	0.0002	0.0018	1.08	<0.001	<0.001
MW-366	11/27/2017	NA	NA	NA	NA	NA	NA	NA	0.96	NA	NA	NA	NA	NA	NA	NA

Sample Location	Date Sampled	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Cadmium, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	Radium-226 + Radium 228, total (pCi/L)	Selenium, total (mg/L)	Thallium, total (mg/L)
MW-366	6/26/2018	<0.001	<0.001	0.0441	<0.001	<0.001	<0.0015	<0.001	0.45	<0.001	0.0115	0.0002	0.0078	0.53	<0.001	<0.002
MW-366	9/25/2018	<0.001	<0.001	0.0623	NA	NA	<0.0015	NA	0.63	NA	0.0171	NA	0.0056	3.11	<0.001	NA
MW-366	3/19/2019	<0.001	<0.001	0.0348	<0.001	<0.001	<0.0015	<0.001	0.51	<0.001	0.0101	0.0002	0.0068	0.44	<0.001	<0.002
MW-366	9/25/2019	<0.001	<0.001	0.0617	NA	NA	<0.0015	NA	0.56	NA	0.0177	NA	0.0047	0.91	<0.001	NA
MW-366	3/26/2020	<0.001	<0.001	0.0322	<0.001	<0.001	<0.0015	<0.001	0.4	<0.001	0.0094	0.0002	0.0039	1.4	<0.001	<0.002
MW-375	1/20/2016	0.0031	0.0014	0.0303	<0.001	<0.001	<0.001	<0.001	1.8	<0.001	0.0479	0.0002	0.0156	0.43	0.0029	<0.001
MW-375	3/23/2016	0.0015	0.0014	0.0264	<0.001	<0.001	<0.001	<0.001	2.1	<0.001	0.042	0.0002	0.0197	0.09	0.0016	<0.001
MW-375	6/22/2016	0.0015	0.0016	0.0247	<0.001	<0.001	<0.001	<0.001	2.1	<0.001	0.0495	0.0002	0.0221	0	<0.001	<0.001
MW-375	9/20/2016	0.005	0.0025	0.0375	<0.001	<0.001	<0.001	<0.001	2.1	<0.001	0.062	0.0002	0.0343	0.73	<0.001	<0.001
MW-375	12/22/2016	0.0015	0.0022	0.0239	<0.001	<0.001	<0.001	<0.001	2.3	<0.001	0.0619	0.0002	0.0321	1.17	<0.001	<0.001
MW-375	3/16/2017	0.0013	0.002	0.0237	<0.001	<0.001	<0.001	<0.001	2.4	<0.001	0.06	0.0002	0.0359	0.46	<0.001	<0.001
MW-375	6/21/2017	0.0013	0.0021	0.025	<0.001	<0.001	<0.001	<0.001	2.5	<0.001	0.0679	0.0002	0.0337	1.35	<0.001	<0.001
MW-375	7/28/2017	0.0012	0.0021	0.0243	<0.001	<0.001	<0.001	<0.001	2.4	<0.001	0.0679	0.0002	0.0324	0.3	<0.001	<0.001
MW-375	11/27/2017	NA	NA	NA	NA	NA	NA	NA	2.4	NA	NA	NA	NA	NA	NA	NA
MW-375	6/27/2018	0.0019	0.0014	0.0297	<0.001	<0.001	<0.0015	<0.001	2.2	<0.001	0.0769	0.0002	0.0294	0.35	<0.001	<0.002
MW-375	9/25/2018	0.0016	0.0014	0.0263	NA	NA	<0.0015	NA	2.1	NA	0.0707	NA	0.0266	0.23	<0.001	NA
MW-375	3/20/2019	0.0014	0.002	0.0271	<0.001	<0.001	<0.0015	<0.001	2.6	<0.001	0.0744	0.0002	0.0291	0.72	<0.001	<0.002
MW-375	9/25/2019	0.0017	0.0018	0.0263	NA	NA	<0.0015	NA	2.4	NA	0.0831	NA	0.0248	0.28	<0.001	NA
MW-375	3/24/2020	0.0011	0.0015	0.0259	<0.001	<0.001	<0.0015	<0.001	2.4	<0.001	0.0772	0.0002	0.0239	1.17	<0.001	<0.002
MW-377	1/19/2016	<0.001	<0.001	0.058	<0.001	<0.001	<0.001	<0.001	1.1	<0.001	0.0485	0.0002	0.0023	0.093	<0.001	<0.001
MW-377	3/23/2016	<0.001	0.0017	0.0637	<0.001	<0.001	<0.001	<0.001	1.1	<0.001	0.045	0.0002	0.0025	0.15	<0.001	<0.001
MW-377	6/22/2016	<0.001	0.0014	0.0663	<0.001	<0.001	<0.001	<0.001	1	<0.001	0.0533	0.0002	0.0021	0.353	<0.001	<0.001
MW-377	9/21/2016	<0.001	0.002	0.0755	<0.001	<0.001	<0.001	<0.001	1.1	<0.001	0.0578	0.0002	0.0033	0.86	<0.001	<0.001
MW-377	12/22/2016	<0.001	0.0015	0.0625	<0.001	<0.001	<0.001	<0.001	1	<0.001	0.0509	0.0002	0.0022	0.68	<0.001	<0.001
MW-377	3/15/2017	<0.001	<0.001	0.0646	<0.001	<0.001	<0.001	<0.001	1.1	<0.001	0.0488	0.0002	0.0018	0.02	<0.001	<0.001
MW-377	6/21/2017	<0.001	<0.001	0.0602	<0.001	<0.001	<0.001	<0.001	1.1	<0.001	0.0531	0.0002	0.0014	0.38	<0.001	<0.001
MW-377	7/28/2017	<0.001	<0.001	0.0631	<0.001	<0.001	<0.001	<0.001	1.1	<0.001	0.0532	0.0002	0.0016	0.96	<0.001	<0.001
MW-377	11/28/2017	NA	NA	NA	NA	NA	NA	NA	1.1	NA	NA	NA	NA	NA	NA	NA
MW-377	6/27/2018	<0.001	<0.001	0.0643	<0.001	<0.001	0.0053	<0.001	1.2	<0.001	0.0603	0.0002	<0.0015	1.06	<0.001	<0.002
MW-377	9/25/2018	<0.001	<0.001	0.0608	NA	NA	<0.0015	NA	1.1	NA	0.0584	NA	<0.0015	1.15	<0.001	NA
MW-377	3/20/2019	<0.001	<0.001	0.0672	<0.001	<0.001	<0.0015	<0.001	1.2	<0.001	0.0603	0.0002	<0.0015	0.06	<0.001	<0.002
MW-377	9/25/2019	<0.001	<0.001	0.063	NA	NA	<0.0015	NA	1.2	NA	0.0671	NA	<0.0015	0.71	<0.001	NA
MW-377	3/24/2020	<0.001	<0.001	0.0625	<0.001	<0.001	<0.0015	<0.001	1.3	<0.001	0.0637	0.0002	<0.0015	0.29	<0.001	<0.002
MW-383	1/21/2016	0.0014	0.0014	0.0339	<0.001	<0.001	<0.001	<0.001	0.82	<0.001	0.0324	0.0002	0.0128	0.085	0.0017	<0.001
MW-383	3/24/2016	0.0014	0.001	0.032	<0.001	<0.001	<0.001	<0.001	0.84	<0.001	0.032	0.0002	0.0135	0.17	<0.001	<0.001
MW-383	6/23/2016	0.0012	0.0011	0.0307	<0.001	<0.001	<0.001	<0.001	0.82	<0.001	0.035	0.0002	0.0131	0.17	<0.001	<0.001
MW-383	9/21/2016	<0.001	0.0016	0.036	<0.001	<0.001	<0.001	<0.001	0.83	<0.001	0.0415	0.0002	0.0176	1.46	<0.001	<0.001
MW-383	12/27/2016	<0.001	<0.001	0.031	<0.001	<0.001	<0.001	<0.001	0.79	<0.001	0.0364	0.0002	0.0125	0.71	<0.001	<0.001
MW-383	3/16/2017	<0.001	<0.001	0.0324	<0.001	<0.001	<0.001	<0.001	0.76	<0.001	0.034	0.0002	0.0121	1.07	<0.001	<0.001
MW-383	6/19/2017	<0.001	<0.001	0.0361	<0.001	<0.001	<0.001	<0.001	0.81	<0.001	0.0378	0.0002	0.0109	0.11	<0.001	<0.001
MW-383	7/26/2017	<0.001	0.0013	0.0346	<0.001	<0.001	<0.001	<0.001	0.8	<0.001	0.0318	0.0002	0.0177	0.91	<0.001	<0.001
MW-383	11/28/2017	NA	NA	NA	NA	NA	NA	NA	0.75	NA	NA	NA	NA	NA	NA	NA
MW-383	6/27/2018	<0.001	<0.001	0.0398	<0.001	<0.001	0.0034	<0.001	0.75	<0.001	0.0378	0.0002	0.0097	0.55	<0.001	<0.002
MW-383	9/25/2018	<0.001	<0.001	0.0363	NA	NA	<0.0015	NA	0.7	NA	0.0354	NA	0.009	0.81	<0.001	NA

Sample Location	Date Sampled	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Cadmium, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	Radium-226 + Radium 228, total (pCi/L)	Selenium, total (mg/L)	Thallium, total (mg/L)
MW-383	3/20/2019	<0.001	<0.001	0.0414	<0.001	<0.001	<0.0015	<0.001	0.78	<0.001	0.0387	0.0002	0.0104	0.5	<0.001	<0.002
MW-383	9/24/2019	<0.001	<0.001	0.041	NA	NA	<0.0015	NA	0.77	NA	0.0421	NA	0.01	0.24	<0.001	NA
MW-383	3/25/2020	<0.001	<0.001	0.0421	<0.001	<0.001	<0.0015	<0.001	0.78	<0.001	0.0369	0.0002	0.0097	2.34	<0.001	<0.002
MW-384	1/21/2016	<0.001	<0.001	0.0221	<0.001	<0.001	<0.001	<0.001	1.5	<0.001	0.0375	0.0002	0.009	0.695	<0.001	<0.001
MW-384	3/24/2016	<0.001	<0.001	0.0245	<0.001	<0.001	<0.001	<0.001	1.4	<0.001	0.0367	0.0002	0.01	0.63	<0.001	<0.001
MW-384	6/23/2016	<0.001	<0.001	0.0282	<0.001	<0.001	<0.001	<0.001	1.4	<0.001	0.041	0.0002	0.0093	0.92	<0.001	<0.001
MW-384	9/21/2016	<0.001	<0.001	0.0258	<0.001	<0.001	<0.001	<0.001	1.5	<0.001	0.044	0.0002	0.0169	0.25	<0.001	<0.001
MW-384	12/27/2016	<0.001	<0.001	0.0275	<0.001	<0.001	<0.001	<0.001	2	<0.001	0.0346	0.0002	0.0328	0.34	<0.001	<0.001
MW-384	3/16/2017	<0.001	<0.001	0.0283	<0.001	<0.001	<0.001	<0.001	2.1	<0.001	0.0349	0.0002	0.0191	0.44	<0.001	<0.001
MW-384	6/19/2017	<0.001	<0.001	0.0277	<0.001	<0.001	<0.001	<0.001	1.5	<0.001	0.0404	0.0002	0.0175	0.13	<0.001	<0.001
MW-384	7/25/2017	<0.001	<0.001	0.0264	<0.001	<0.001	<0.001	<0.001	1.5	<0.001	0.0371	0.0002	0.0157	0.56	<0.001	<0.001
MW-384	11/28/2017	NA	NA	NA	NA	NA	NA	NA	1.8	NA	NA	NA	NA	NA	NA	NA
MW-384	6/27/2018	<0.001	<0.001	0.0332	<0.001	<0.001	<0.0015	<0.001	1.6	<0.001	0.0522	0.0002	0.035	0.53	<0.001	<0.002
MW-384	9/25/2018	<0.001	<0.001	0.0285	NA	NA	<0.0015	NA	3.1	NA	0.0392	NA	0.0222	0.99	<0.001	NA
MW-384	3/20/2019	<0.001	<0.001	0.0336	<0.001	<0.001	<0.0015	<0.001	1.8	<0.001	0.0433	0.0002	0.0254	0.47	<0.001	<0.002
MW-384	9/24/2019	<0.001	<0.001	0.0305	NA	NA	<0.0015	NA	1.8	NA	0.0451	NA	0.0198	0.35	<0.001	NA
MW-384	3/25/2020	<0.001	<0.001	0.0322	<0.001	<0.001	<0.0015	<0.001	1.9	<0.001	0.0426	0.0002	0.0247	3.71	<0.001	<0.002
MW-390	3/22/2016	<0.001	<0.001	0.033	<0.001	<0.001	<0.001	0.0019	1.3	<0.001	0.0331	0.0002	0.0017	0.2	0.0013	<0.001
MW-390	6/23/2016	0.0012	0.0013	0.0299	<0.001	<0.001	<0.001	0.0023	1.4	<0.001	0.0386	0.0002	0.0059	0.9	0.0013	<0.001
MW-390	8/18/2016	<0.001	0.0019	0.0289	<0.001	<0.001	<0.001	0.0013	1.4	<0.001	0.04	0.0002	0.0029	0.86	<0.001	<0.001
MW-390	9/20/2016	<0.001	0.002	0.0258	<0.001	<0.001	<0.001	0.0012	1.4	<0.001	0.0493	0.0002	0.0036	0.39	<0.001	<0.001
MW-390	12/22/2016	<0.001	0.0021	0.0228	<0.001	<0.001	<0.001	0.0011	1.5	<0.001	0.0436	0.0002	0.0026	0.66	<0.001	<0.001
MW-390	3/15/2017	<0.001	0.002	0.052	<0.001	<0.001	<0.001	<0.001	0.84	<0.001	0.0273	0.0002	0.0132	1.58	<0.001	<0.001
MW-390	6/20/2017	<0.001	0.0016	0.04	<0.001	<0.001	<0.001	<0.001	1.3	<0.001	0.0401	0.0002	0.0103	0.18	<0.001	<0.001
MW-390	7/28/2017	<0.001	0.0014	0.0385	<0.001	<0.001	<0.001	<0.001	1.2	<0.001	0.0375	0.0002	0.0114	0.86	<0.001	<0.001
MW-390	11/27/2017	NA	NA	NA	NA	NA	NA	NA	0.9	NA	NA	NA	NA	NA	NA	NA
MW-390	6/26/2018	<0.001	0.002	0.0806	<0.001	<0.001	<0.0015	<0.001	0.48	<0.001	0.0136	0.0002	0.0044	0.69	<0.001	<0.002
MW-390	9/25/2018	<0.001	0.0016	0.101	NA	NA	<0.0015	NA	0.49	NA	0.0146	NA	0.0041	0.85	<0.001	NA
MW-390	3/19/2019	<0.001	0.0015	0.0962	<0.001	<0.001	<0.0015	<0.001	0.52	<0.001	0.0153	0.0002	0.0037	0.62	<0.001	<0.002
MW-390	9/24/2019	<0.001	0.0016	0.083	NA	NA	<0.0015	NA	0.64	NA	0.0249	NA	0.0032	1.28	<0.001	NA
MW-390	3/26/2020	<0.001	0.0014	0.0895	<0.001	<0.001	<0.0015	<0.001	0.49	<0.001	0.0161	0.0002	0.003	1.24	<0.001	<0.002
MW-391	12/22/2016	0.0016	0.0017	0.0293	<0.001	<0.001	<0.001	<0.001	2.6	<0.001	0.032	0.0002	0.0797	1.31	0.0166	<0.001
MW-391	3/15/2017	0.0017	0.0015	0.0332	<0.001	<0.001	<0.001	<0.001	2.6	<0.001	0.0355	0.0002	0.0836	0.37	0.0157	<0.001
MW-391	6/20/2017	0.0015	0.0017	0.035	<0.001	<0.001	<0.001	<0.001	2.8	<0.001	0.0498	0.0002	0.086	0.73	0.0154	<0.001
MW-391	6/26/2018	0.0013	0.0012	0.0475	<0.001	<0.001	<0.0015	<0.001	1.8	<0.001	0.114	0.0002	0.0323	0.95	0.0049	<0.002
MW-391	9/25/2018	0.0016	0.0011	0.045	NA	NA	<0.0015	NA	1.9	NA	0.135	NA	0.0383	1.32	0.0045	NA
MW-391	3/19/2019	0.0016	0.002	0.0366	<0.001	<0.001	<0.0015	<0.001	2.6	<0.001	0.128	0.0002	0.0394	0.96	0.0026	<0.002
MW-391	9/25/2019	0.0016	0.0015	0.033	NA	NA	<0.0015	NA	2.6	NA	0.124	NA	0.0423	0.99	0.002	NA
MW-391	3/24/2020	0.0015	0.0015	0.0297	<0.001	<0.001	<0.0015	<0.001	2.8	<0.001	0.127	0.0002	0.0366	1.51	0.0015	<0.002

Notes:
1. Abbreviations: mg/L - milligrams per liter; NA - not analyzed; pCi/L - picocurie per liter

ATTACHMENT 6 – SITE HYDROGEOLOGY AND STRATIGRAPHIC CROSS-SECTIONS OF THE SITE

CONCEPTUAL SITE MODEL AND DESCRIPTION OF SITE HYDROGEOLOGY (BOTTOM ASH POND)

The Baldwin Energy Complex (BEC) conceptual site model (CSM) and Description of Site Hydrogeology for the Bottom Ash Pond (BAP), located near Baldwin, Illinois are described in the following sections.

REGIONAL SETTING

The BEC is located in the Mt. Vernon Hill Country of the Till Plains Section of the Central Lowland Province. The topography of Mt. Vernon Hill Country consists of gently rolling hills and valleys that predominantly follow the surface topography of the underlying bedrock and the surface drainage is primarily toward the Kaskaskia River, located west of the Site. Near the Site, the primary geologic materials encountered from the surficial deposits downward include, lake deposits and fine-grained alluvium of the Equality Formation of the Wisconsinan Glaciation, sand and gravel glacial outwash deposits of the Pearl Formation of the Illinoian Glaciation, till deposits of the Vandalia Till Member of the Glasford Formation of the Illinoian Glaciation, and Pennsylvanian and Mississippian-aged shale and limestone bedrock. Additional regional geologic sequences in the surrounding areas include: the Kaskaskia River bottomlands west of the Site, consisting of alluvium of the Cahokia Formation, glacial outwash of the Henry Formation of the Wisconsinan Glaciation, and Pennsylvanian and Mississippian-aged shale and limestone bedrock; and Upland Areas south and east of the Site, consisting of Peoria Loess and Roxana Silt of the Wisconsinan Glaciation, till deposits of the Vandalia Till Member of the Glasford Formation, and Pennsylvanian and Mississippian-aged shale and limestone bedrock.

SITE GEOLOGY

Geologic units present at the Site include unlithified geologic materials (i.e., Peoria Loess, Equality Formation, and Vandalia Till Member of the Glasford Formation) and Mississippian and Pennsylvanian-aged bedrock as illustrated in the cross-sections attached to this demonstration.

The three principal types of unlithified materials (Upper Groundwater Unit) present above the Bedrock Unit (Uppermost Aquifer), in the vicinity of the BAP, consist of the following, in descending order:

- UNLITHIFIED DEPOSITS (UPPER GROUNDWATER UNIT)
  - Peoria Loess - (silt and silty clay). The Peoria Loess occurs in topographically higher areas and bedrock upland areas and is typically underlain by the Vandalia Till Member of the Glasford Formation. The Peoria Loess is present along the northern end of the BAP and was not noted elsewhere around the ponds. It was categorized as silt and silty clay and ranges from 2 to 23 ft in thickness.
  - Equality Formation - (clay and sandy clay with occasional sand seams and lenses). The stratigraphic position of the Equality Formation varies across the Site and the general position is dependent on the presence or absence of overlying units. The Equality Formation is present in the western and southern portion of the BAP. It is thickest under the southwestern portion of the BAP and pinches out moving east. The Equality Formation was deposited in a slackwater lake formed as a result of back flooding of the Kaskaskia River during flooding events of the Mississippi River. The Equality Formation ranged in thickness from approximately 5 to 25 ft.
  - Vandalia Till Member - (clay and sandy clay diamictons with intermittent and discontinuous sand lenses). The Vandalia Till Member of the Glasford Formation is the lowermost and oldest unlithified geologic material in the vicinity of the Site. The Vandalia Till is a diamicton and occurs beneath the Equality Formation in the central portion of the Site. At the higher topographic elevations

(i.e., bedrock uplands) to the east and southeast of the ash ponds, the Vandalia Till is the principal unlithified geologic material and ranges from approximately 5 to 40 ft thick, but may be mantled in some areas by 4 to 6 ft of the Peoria Loess. The Vandalia Till also exhibits some intermittent and discontinuous sand lenses. The lowermost portion of the Vandalia Till may become shaley within a few feet of the top of bedrock.

- BEDROCK UNIT (UPPERMOST AQUIFER)
  - Bedrock Unit (Uppermost Aquifer) - The Bedrock Unit is the Uppermost Aquifer beneath the Site and consists of Pennsylvanian and Mississippian bedrock, mainly limestone and shale. The shallow bedrock transitions from Mississippian-age limestone and shale beneath the western portion of the Site, to Pennsylvanian-age limestone and shale toward the east. The change from Mississippian bedrock to Pennsylvanian bedrock occurs beneath the central portion of the ash ponds (Willman, 1967). The shallow bedrock is composed of interbedded and undifferentiated limestone and shale. Bedrock topography slopes generally to the west and northwest across the BAP. The topographic relief of the bedrock (change in bedrock elevation beneath the BAP) is approximately 35 ft.

SITE HYDROGEOLOGY

The CCR groundwater monitoring system consists of six monitoring wells installed in the uppermost aquifer and adjacent to the BAP (MW-304, MW-306, MW-356, MW-369, MW-370 and MW-382) (see Monitoring Well Location Map, and Well Construction Diagrams and Drilling Logs attached to this demonstration). The unit utilizes two background monitoring wells (MW-304, MW-306) as part of the CCR groundwater monitoring system.

The Site Uppermost Aquifer is the shallow Pennsylvanian and Mississippian-aged bedrock that immediately underlies the unlithified deposits. Within the boundaries of the Site, only thin and intermittent sand lenses are present within predominantly clay deposits, thus, the unlithified materials do not represent a continuous aquifer unit. Off-site shallow bedrock wells are used for a water supply. The shallow bedrock yields water through interconnected secondary porosity features (e.g. cracks, fractures, crevices, joints, bedding planes and other secondary openings). The shallow bedrock is the only water-bearing unit that is continuous across the Site. Groundwater in the Pennsylvanian and Mississippian-aged bedrock mainly occurs under semi-confined to confined conditions with the overlying unlithified unit behaving as the upper confining unit to the Uppermost Aquifer.

Water quality in the Uppermost Aquifer (i.e., Pennsylvanian and Mississippian-aged bedrock) decreases with increasing depth as water becomes increasingly mineralized. Further, the ability of the unit to store and transmit water is dependent on the density of bedrock features that contribute to secondary porosities and whether those features are interconnected enough to yield water. Therefore, the lower limit of the uppermost aquifer is the depth at which either the groundwater is mineralized to a point that it is no longer a useable water source or the secondary porosities do not yield a sufficient volume of groundwater to produce a useable water supply.

Hydraulic Conductivity

Field measurements indicated that the horizontal hydraulic conductivity for the Upper Groundwater Unit ranged from 3.5 x 10^{-7} to 6.8 x 10^{-4} centimeters per second (cm/s), with a geometric mean of 3.2 x 10^{-5} cm/s. Laboratory testing of vertical hydraulic conductivity measurements from the units that comprise the Upper Groundwater Unit have a geometric mean value of 8.6 x 10^{-7} cm/s. Based on field testing, the geometric mean horizontal hydraulic conductivity for the Uppermost Aquifer (Bedrock Unit) was 5.0 x 10^{-6} cm/s (NRT, 2014).

Groundwater Elevations, Flow Direction and Velocity

A discussion of typical Site groundwater elevations, flow directions and groundwater velocities is included in this section using data collected in March and September of 2019. Groundwater elevation contour maps, including maps illustrating groundwater elevations and flow directions in March and September 2019, are provided as an attachment to this demonstration. Piezometric heads measured in bedrock monitoring wells on March 19, 2019 ranged from 377.15 to 448.14 feet above North American Vertical Datum of 1988 (ft NAVD88). The piezometric head at location MW-352 was above the ground surface on March 19, 2019, indicating MW-352 is a flowing artesian well. Piezometric heads measured in bedrock monitoring wells on September 24, 2019 ranged from 370.54 to 446.19 ft msl NAVD88.

Groundwater flow in the shallow bedrock is generally to the west and southwest, as indicated by elevation measurements collected on March 19, 2019. Changes in groundwater elevation across the Site typically mimic bedrock surface topography. General groundwater flow direction is west toward the Kaskaskia River (i.e., regional discharge area) with localized flow toward bedrock surface lows. For instance, flow is almost due west on the east area of the Site until groundwater reaches the bedrock valley feature at the Secondary and Tertiary Ponds, at which point the flow direction veers toward the bedrock surface low. As indicated by comparison of the March 19, 2019 and September 24, 2019 groundwater elevation contour maps, there is little to no seasonal variation in groundwater flow direction.

A hydraulic conductivity of 5 x 10^{-6} cm/s and a median effective porosity of 30% were used to calculate bedrock groundwater velocities based on data referenced in Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, 2014). Groundwater flow velocity in the vicinity of the BAP was approximately 0.0017 and 0.0009 feet per day (ft/day) as groundwater flowed from east to west across the BAP on March 19, 2019 and September 24, 2019, respectively. Less than 0.0008 ft/day change in groundwater velocity was observed when comparing March 19, 2019 and September 24, 2019.

REFERENCES

Natural Resource Technology, Inc. (NRT), 2014. Groundwater Quality Assessment and Phase II Hydrogeologic Investigation, Baldwin Ash Pond System, Baldwin, Illinois. Prepared for Dynegy Midwest Generation, LLC by Natural Resource Technology, Inc. June 11, 2014.

Willman, H.B. and others. 1967. Geologic Map of Illinois. Illinois State Geological Survey. Champaign, Illinois.

Y:\Mapping\Projects\22\2285_Baldwin\MXD\Figure 1_Cross Section Locations.mxd

PROJECT: 169000XXXX | DATED: 9/16/2020 | DESIGNER: STOLZSD

MONITORING WELL LOCATION
PIEZOMETER WELL LOCATION
CCR MONITORED MULTI-UNIT
CCR MONITORED UNIT
NON-CCR UNIT

PROPERTY BOUNDARY

CROSS-SECTION TRANSECTS
A to A'
B to B'

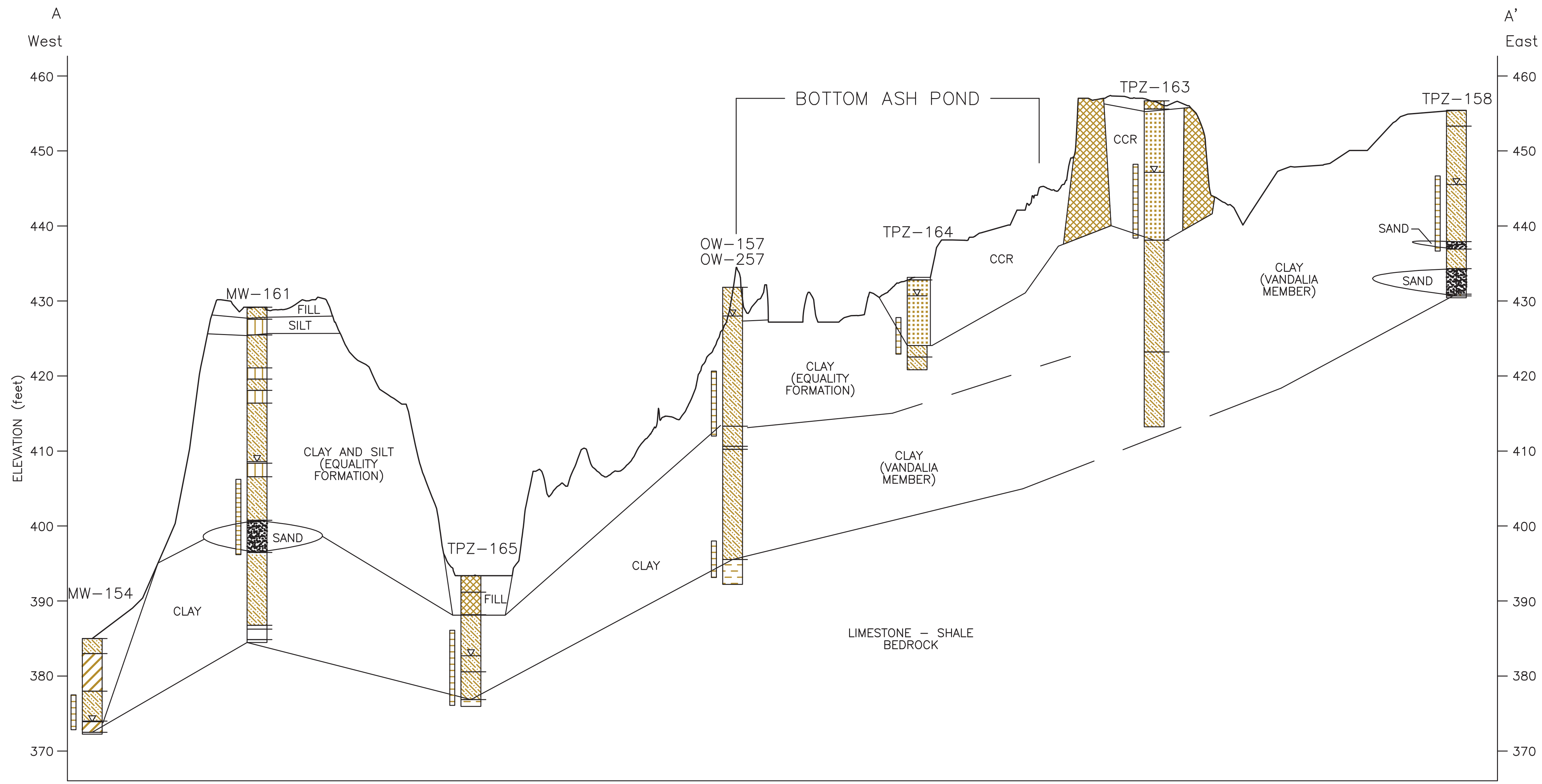
0 350 700 Feet

CROSS SECTION LOCATION MAP

BALDWIN ASH POND SYSTEM
BALDWIN ENERGY COMPLEX
10901 BALDWIN RD, BALDWIN, ILLINOIS

FIGURE 1

RAMBOLL US CORPORATION
A RAMBOLL COMPANY



LEGEND

- COAL COMBUSTION RESIDUALS, CCRs
- FILL
- CLAY (CL)
- CLAY (CH)
- SILT (ML)
- SAND (SP/SM/SW)
- SHALE
- WELL SCREEN INTERVAL

NOTES

1. This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.
2. Scale is approximate.
3. Vertical scale is exaggerated 60X.

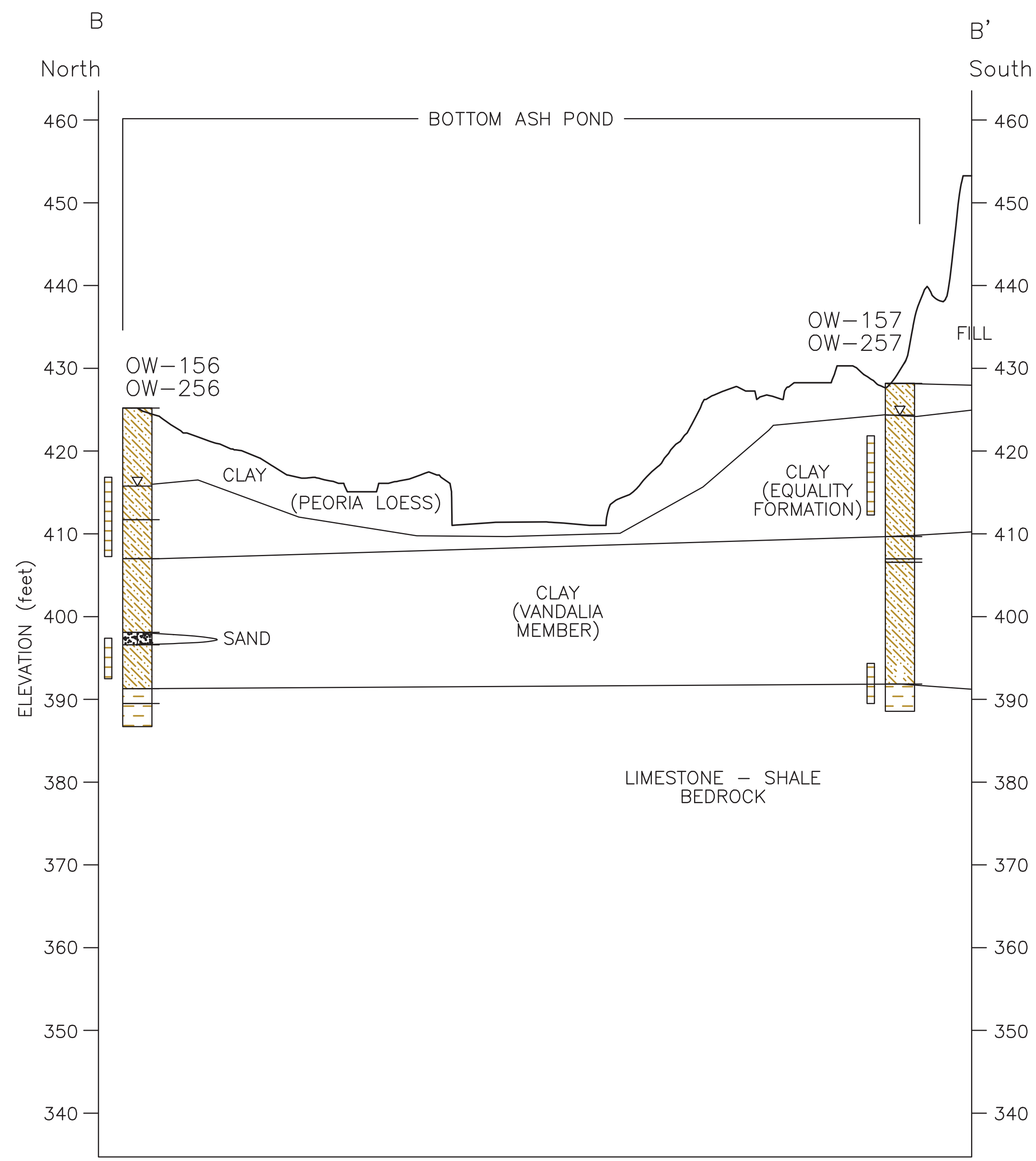
16.6'
0
1,000'

CROSS SECTION A-A'

BALDWIN BOTTOM ASH POND
BALDWIN ENERY COMPLEX
10901 BALDWIN RD, BALDWIN, ILINOIS

FIGURE 2

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

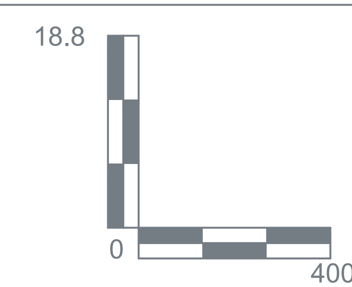


LEGEND

- COAL COMBUSTION RESIDUALS, CCRs
- FILL
- CLAY (CL)
- CLAY (CH)
- SILT (ML)
- SAND (SP/SM/SW)
- SHALE
- WELL SCREEN INTERVAL

NOTES

1. This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.
2. Scale is approximate.
3. Vertical scale is exaggerated 21.25X.



CROSS SECTION B-B'

BALDWIN BOTTOM ASH POND
BALDWIN ENERY COMPLEX
10901 BALDWIN RD, BALDWIN, ILINOIS

FIGURE 3

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

OBG

Hydrogeologic Monitoring Plan

Baldwin Bottom Ash Pond – CCR Unit ID 601
Baldwin Fly Ash Pond System – CCR Multi-Unit ID 605

Baldwin Energy Complex
Baldwin, Illinois

Dynegy Midwest Generation, LLC

October 17, 2017

Natural Resource Technology
AN OBG COMPANY

OCTOBER 17, 2017 | PROJECT #2285

Hydrogeologic Monitoring Plan

Baldwin Bottom Ash Pond – CCR Unit ID 601
Baldwin Fly Ash Pond System – CCR Multi-Unit ID 605

Baldwin Energy Complex
Baldwin, Illinois

Prepared for:
Dynegy Midwest Generation, LLC

STUART J. CRAVENS, PG
Principal Hydrogeologist

JACOB J. WALCZAK, PG
Hydrogeologist

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ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
BEC	Baldwin Energy Complex
CCR	coal combustion residual
CFR	Code of Federal Regulations
CPT	cone penetrometer test
DMG	Dynegy Midwest Generation, LLC
cm/s	centimeters per second
ft	feet
ft MSL	feet above Mean Seal Level
HMP	Hydrogeologic Monitoring Plan
IEPA	Illinois Environmental Protection Agency
NRT	Natural Resource Technology, an OBG Company
RCRA	Resource Conservation and Recovery Act
SAP	Sampling and Analysis Plan
USEPA	United States Environmental Protection Agency

1 INTRODUCTION

1.1 OVERVIEW

This Hydrogeologic Monitoring Plan (HMP) has been prepared by Natural Resource Technology, an OBG Company (NRT) to provide background information necessary to support the groundwater monitoring system established to comply with Part 257.91 of the United States Environmental Protection Agency (USEPA) Final Rule to regulate the disposal of Coal Combustion Residual (CCR) as solid waste under Subtitle D of the Resource Conservation and Recovery Act (RCRA) [40 CFR 257 Subpart D; published in 80 FR 21302-21501, April 17, 2015] for the Baldwin Energy Complex, Baldwin, Illinois. Baldwin Energy Complex (BEC) is owned by Dynegy Midwest Generation, LLC (DMG). This HMP will apply specifically to the following CCR Units or CCR Multi-Units: Baldwin Bottom Ash Pond (CCR Unit 601) and Baldwin Fly Ash Pond System (CCR Multi-Unit 605), as defined further below.

1.2 PREVIOUS INVESTIGATIONS AND REPORTS

Numerous hydrogeologic investigations have been performed concerning the CCR Units or Multi-Units located at the BEC. The information presented in this HMP includes data collected in support of the monitoring well network established for development of the SAP and supplements comprehensive data collection and evaluations from prior hydrogeologic investigation reports (recent to oldest), including, but not limited to, the following:

- ***NRT, March 31, 2016. Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan - Baldwin Fly Ash Pond System.*** A supplemental hydrogeologic investigation and groundwater monitoring plan to support a Closure Plan for fly ash ponds located at BEC.
- ***30% Design Data Report for the Dynegy Baldwin Energy Complex; West Fly Ash Pond, East Fly Ash Pond, and Old East Fly Ash Pond CCR Units.*** A geotechnical program consisting of installation of auger borings, CPT soundings and piezometers to obtain information for compliance with requirements of the federal CCR rule.
- ***NRT, June 11, 2014. Groundwater Quality Assessment and Phase II Hydrogeologic Investigation, Baldwin Ash Pond System.*** A Phase II assessment to further assess the hydrogeology and groundwater quality in the vicinity of the ash pond system at BEC, following the proposed scope of work (March 22, 2013) approved, with clarifications, by Illinois EPA, June 18, 2013).
- ***Dynegy, March 22, 2013. Proposed Scope of Work – Baldwin Ash Impoundment System.*** A plan for conducting a more comprehensive hydrogeologic investigation along with development of a groundwater model to evaluate various pond closure scenarios on groundwater quality in the vicinity of the ash pond system; accepted, with clarifications, by Illinois EPA August 31, 2011.
- ***Kelron Environmental, June 30, 2012. Groundwater Quality Assessment and Initial Hydrogeologic Investigation – Baldwin Ash Pond System.*** Assessed the hydrogeology and groundwater quality in the vicinity of the ash pond system. Thirteen monitoring wells were installed around the perimeter of the ash pond system and sampled quarterly to assess upgradient and downgradient groundwater quality (full inorganic parameter list in IAC 35 Part 620.410). Submitted to Illinois EPA.
- ***Kelron Environmental, April 16, 2012. Off-Site Groundwater Quality Results – Baldwin Energy Complex.*** Off-site groundwater quality investigation, south and southwest of the ash pond system, to assess shallow off-site groundwater quality for the presence of inorganic parameters related to CCRs. Submitted to Illinois EPA.
- ***Kelron Environmental and NRT, June 7, 2010. Water Well Survey – Baldwin Ash Pond System.*** A survey identifying water wells located within 2,500 feet (ft) of the BEC's ash pond system. The water well survey was prepared in accordance with the "Right to Know" Potable Water Well Survey procedures of 35 IAC 1600.210(b)(1) and 1600.210(b)(2). Submitted to Illinois EPA.
- ***Kelron Environmental and NRT, May 26, 2010. Hydrogeologic Assessment and Groundwater Monitoring Plan – Baldwin Ash Pond System.*** A plan for initial evaluation of groundwater quality in the vicinity of the

ash pond system along with an initial hydrogeologic characterization; accepted, with clarifications, by Illinois EPA August 31, 2011.

This HMP provides a summary of data collected concurrent with the submittal of the Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan (NRT, March 31, 2016). The HMP supports the monitoring well network established for development of the SAPs through providing the following background information:

- Site Geology and Hydrogeology
- Aquifer Properties
- Monitoring Network Placement and Rationale

1.3 SITE LOCATION AND DESCRIPTION

BEC is located within Sections 2, 3, 4, 9, 10, 11, 14, 15 and 16, Township 4 South, Range 7 West of Randolph County, Illinois and Sections 33, 34 and 35, Township 3 South, Range 7 West of St. Clair County, Illinois. The CCR Units and Multi-Units are approximately one-half mile west-northwest of the Village of Baldwin, Illinois (Figure 1). The CCR Units and Multi-Units associated with BEC are situated east of and adjacent to the Kaskaskia River. The area is also bounded by Baldwin Road, farmland, and strip mining areas to the east, the Village of Baldwin to the southeast, Illinois Central Gulf railroad tracks and State Route 154 to the south and St. Clair/Randolph County Line to the north.

1.4 DESCRIPTION OF CCR UNITS

The CCR Units at BEC consist of the active Baldwin Bottom Ash Pond (CCR Unit ID 601) and Baldwin Fly Ash Pond System (CCR Multi-Unit ID 605), and will hereafter be referred to collectively as the ‘Site’. The Bottom Ash Pond CCR Unit covers an area of approximately 177 acres and is located in the north central to northeast area of the Site and the Baldwin Fly Ash Pond System covers a total area of approximately 232 acres and is located in the northeast, southeast and south central area of the Site.

1.4.1 Baldwin Bottom Ash Pond (CCR Unit ID 601)

Baldwin Bottom Ash Pond is classified as an active unlined CCR surface impoundment (Figure 1). Baldwin Bottom Ash Pond is surrounded by a perimeter road and is bounded to the north by the Baldwin Plant Cooling Lake, to the east and south by Baldwin Fly Ash Pond System. Baldwin Bottom Ash Pond is also bounded to the west by the easternmost wooded area that surrounds the Secondary and Tertiary Ponds.

1.4.2 Baldwin Fly Ash Pond System (CCR Multi-Unit ID 605)

Baldwin Fly Ash Pond System is an unlined CCR surface impoundment (Figure 1). A closure plan for the Baldwin Fly Ash Pond System was approved by the Illinois Environmental Protection Agency (IEPA); see Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan (NRT, March 31, 2016) for details related to the closure plan. The Baldwin Fly Ash Pond System (CCR Multi-Unit 605) consists of three fly ash pond CCR Units, including the inactive East Fly Ash Pond, inactive Old East Fly Ash Pond and currently active West Fly Ash Pond. Baldwin Fly Ash Pond System is surrounded by a perimeter road and is bounded to the northwest by wooded and vegetated areas surrounding the Secondary Pond, to the north by the Baldwin Bottom Ash Pond and to the northeast by the Baldwin Energy Complex. The area is also bounded by farmland, strip mining areas and the Illinois Central Gulf railroad tracks to the east. The area is further bounded to the south by Illinois Central Gulf railroad tracks and State Route 154.

The use of this multi-unit system is equally capable of detecting monitoring constituents at the waste boundary of all three CCR units combined as three individual groundwater monitoring systems. The three basins within the multi-unit are adjacent to each other and additional wells encompassing each basin would likely not provide any added benefit. In addition, it would likely be technically challenging to identify and separate out impacts, if any, from the individual basins.

2 GEOLOGY AND HYDROGEOLOGY

The site characterization activities performed at the Site concurrent with the Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan (NRT, March 31, 2016) have included the following:

- 30% Design Package for Dynegy Baldwin Energy Complex; West Fly Ash Pond, East Fly Ash Pond, and Old East Fly Ash Pond CCR (AECOM, December 17, 2015)
- CCR monitoring network well installation and borehole logging (NRT, March 2016)

The results of these supplemental site investigations are discussed below.

2.1 GEOLOGY

Geologic units present at the ash pond system include fill, ash generated at BEC, unlithified geologic materials (i.e. Cahokia Alluvium, Equality Formation, and Vandalia Till Member of the Glasford Formation) and Mississippian and Pennsylvanian-aged bedrock.

2.1.1 Regional Setting

The BEC is located in the Mt. Vernon Hill Country of the Till Plains Section of the Central Lowland Province. The topography of Mt. Vernon Hill Country consists of gently rolling hills and valleys that predominantly follow the surface topography of the underlying bedrock and the surface drainage is primarily toward the Kaskaskia River, located west of the Site. Near the Site, the primary geologic materials encountered from the surficial deposits downward include, lake deposits and fine-grained alluvium of the Equality Formation of the Wisconsinan Glaciation, sand and gravel glacial outwash deposits of the Pearl Formation of the Illinoisan Glaciation, till deposits of the Vandalia Till Member of the Glasford Formation of the Illinoisan Glaciation, and Pennsylvanian and Mississippian-aged shale and limestone bedrock. Additional regional geologic sequences in the surrounding areas include: the Kaskaskia River bottomlands west of the Site, consisting of alluvium of the Cahokia Formation, glacial outwash of the Henry Formation of the Wisconsinan Glaciation, and Pennsylvanian and Mississippian-aged shale and limestone bedrock; and Upland Areas south and east of the Site, consisting of Peoria Loess and Roxana Silt of the Wisconsinan Glaciation, till deposits of the Vandalia Till Member of the Glasford Formation, and Pennsylvanian and Mississippian-aged shale and limestone bedrock.

2.1.2 Site Geology

Geologic units present in the vicinity of the BEC include: fill; ash generated at the BEC; unlithified alluvial clay, sandy clay and clayey sand (i.e. Cahokia Formation); unlithified silt and silty clay (i.e. Peoria Loess); unlithified clay and sandy clay with occasional sand seams and lenses (i.e. Equality Formation); unlithified clay and sandy clay diamictons with intermittent and discontinuous sand lenses (i.e. Vandalia Till Member of the Glasford Formation); and Pennsylvanian and Mississippian-aged shale and limestone bedrock.

According to data collected in the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014), fill and ash generated at the BEC occur within the CCR Units and Multi-Units, as well as in constructed levees berms and embankments. The predominantly clay alluvial deposits of the Cahokia Formation represent the uppermost unlithified unit at the Site and ranges in thickness from 13 to 27 feet where present. Silt and silty clay of the Peoria Loess typically occur in areas of topographic highs and are commonly underlain with till of the Vandalia Till Member of the Glasford Formation. The Peoria Loess silt and silty clays have an average thickness of 10 feet where present. The stratigraphic position of the Equality Formation varies across the Site and the general position is dependent on the presence or absence of overlying units. The predominantly clay and sandy clays of the Equality Formation lie stratigraphically between the Cahokia Formation and bedrock in the southwestern area of the Site, but also occur as the uppermost unlithified unit in the south central area, where the Cahokia Formation pinches-out. Furthermore, the Equality Formation may also represent the middle unlithified unit (where the unit occurs between the Peoria Loess and Vandalia Till) or uppermost unlithified layer (where the Cahokia Formation and Peoria Loess deposits do not occur) in the central portion of the Site. The Equality Formation typically ranges in thickness from 8 to 20 feet. The predominantly clay and silty clay of the Vandalia Till occurs as the lowermost unlithified unit occurring immediately above the Pennsylvanian and

Mississippian-aged bedrock. The Vandalia Till typically occurs in thickness ranging from 11 to 37 feet in the vicinity of the Site.

In addition to data collected as part of the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014), AECOM (2015) completed a geotechnical investigation that included additional borings that were reported in the 30% design data package for the ash ponds. The geotechnical exploratory program included the following:

- 26 auger borings at the Baldwin Fly Ash Pond System and Bottom Ash Pond. In addition, 3 hand auger borings were completed.
- 82 Cone Penetrometer Testing (CPT) soundings at the Baldwin Fly Ash Pond System, Secondary Pond, Tertiary Pond and Bottom Ash Pond. Thirteen (13) vibrating wire piezometers were installed at selected boring locations.

The geotechnical exploration locations are shown on AECOM Figure D-01 in Appendix A.

Representative samples from the borings were submitted to AECOM of Conshohocken, Pennsylvania and Terrasense of Totowa, New Jersey for laboratory testing on the soil samples for geotechnical properties. A summary of the AECOM geotechnical laboratory test results on the soil samples is provided in Appendix B. Boring logs and other geotechnical testing data were submitted to the Illinois EPA as part of the the Baldwin Fly Ash Pond System closure plan.

Furthermore, as described in detail in the Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan - Baldwin Fly Ash Pond System (NRT, March 31, 2016), an investigation consisting of 11 borings (typically extending to the bedrock surface) within the unlithified material was performed to further evaluate the presence of sand layers. As a result of the investigation one locally continuous unsaturated sand lens up to 7.9 feet thick was identified on the western limits of the Site; all other sand seams identified were discontinuous and ranged from 0.2 to 1 foot thick. NRT also completed CCR monitoring network well installation and borehole logging at 16 bedrock locations at the Site from September 2015 through March 2016. Details of the findings from the well installation and borehole logging of these wells were reported in the Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan - Baldwin Fly Ash Pond System. In general, the results verified that bedrock at the Site consists of layered shale and limestone. Depth to bedrock at the 16 locations ranged from 13 to 64 feet below ground surface; the range was in agreement with the range of 13 to 54 feet reported in the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, 2014). The bedrock topography map developed from the data (Figure 2) indicates bedrock generally slopes to the west and southwest across the Site with a relief of approximately 45 feet. Details of Site geology are also provided in cross-sections AA' through EE' (Figures 3 and 4A-4E).

The boring logs, well construction forms, and other related monitoring well forms are available in the Operating Records as required by Title 40 CFR Part 257 Section 257.91 for each monitored CCR Unit.

2.2 HYDROGEOLOGY

The hydrogeology of the ash pond system was comprehensively addressed in the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014). Findings from the NRT 2014 report were also summarized in the Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan - Baldwin Fly Ash Pond System (NRT, March 31, 2016).

2.2.1 Uppermost Aquifer

The Site uppermost aquifer is the shallow Pennsylvanian and Mississippian-aged bedrock that immediately underlies the unlithified deposits. Within the boundaries of the Site only thin and intermittent sand lenses are present within predominantly clay deposits, thus, the unlithified materials do not represent a continuous aquifer unit. Off-site shallow bedrock wells are used for a water supply. The shallow bedrock yields water through interconnected secondary porosity features (e.g. cracks, fractures, crevices, joints, bedding planes and other secondary openings). The shallow bedrock is the only water-bearing unit that is continuous across the Site, therefore, is the only viable aquifer that is consistent with the US Environmental Protection Agency (USEPA) definition in 40 CFR Part 257.53 (USEPA, 2015). Groundwater in the Pennsylvanian and Mississippian-aged bedrock mainly occurs under semi-confined to confined conditions with the overlying unlithified unit behaving as the upper confining unit to the uppermost aquifer.

2.2.2 Lower Limit of Aquifer

Water quality in the uppermost aquifer (i.e. Pennsylvanian and Mississippian-aged bedrock) decreases with increasing depth as water becomes increasingly mineralized. Further, the ability of the unit to store and transmit water is dependent on the density of bedrock features that contribute to secondary porosities and whether those features are interconnected enough to yield water. Therefore, the lower limit of the uppermost aquifer is the depth at which either the groundwater is mineralized to a point that it is no longer a useable water source or the secondary porosities do not yield a sufficient volume of groundwater to produce a useable water supply.

2.2.3 Hydraulic Conductivity

Falling/rising head tests were completed in wells screened in the shallow bedrock (i.e. Pennsylvanian and Mississippian-aged shale and limestone) as part of the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014) to determine the hydraulic conductivity of the bedrock unit in the vicinity of the Site. A table summarizing the falling/rising head test results is included in Table 1. The range of hydraulic conductivity values determined within the shallow bedrock from well locations (MW-350, MW-352, and MW-355) was 1.7×10^{-6} to 3.5×10^{-5} centimeters per second (cm/s). The geometric mean of the hydraulic conductivity at the bedrock monitoring wells was 5×10^{-6} cm/s. According to NRT (June 11, 2014), typical porosities of shale and limestone range from 1 to 20 percent and 5 to 55 percent, respectively.

2.2.4 Groundwater Elevations, Flow Direction and Velocity

Piezometric heads measured in bedrock monitoring wells on March 21, 2016 ranged from 373.8 to 449.5 feet above Mean Sea Level (ft MSL) (NAVD88). The piezometric head at location MW-352 was above the ground surface, indicating MW-352 is a flowing artesian well. The remaining piezometric heads ranged from less than 1 foot below ground surface to 29 feet below ground surface on March 21, 2016.

Groundwater flow in the shallow bedrock is generally to the west and southwest, based on elevation measurements collected on March 2, 2016 (Figure 5). Changes in groundwater elevation across the Site typically mimic bedrock surface topography (Figure 2). General groundwater flow direction is west toward the Kaskaskia River (i.e. regional discharge area) with localized flow toward bedrock surface lows. For instance, flow is almost due west on the east area of the Site until groundwater reaches the bedrock valley feature at the Secondary and Tertiary Ponds, at which point the flow direction veers toward the bedrock surface low. As indicated in the December 2015 and January 2016 groundwater elevation contour maps (Figures 6 and 7), there is little to no seasonal variation in groundwater flow direction when compared to the March 2016 groundwater elevation contour map.

Horizontal hydraulic gradients ranged from approximately 0.01 to 0.02 feet per feet (ft/ft) as groundwater flowed from east to west across the Site (Table 2) from December 2015 to March 2016. In general, less than 0.01 ft/ft change in horizontal hydraulic gradients was observed over the period from December 2015 to March 2016.

Vertical gradients determined between the unlithified deposits and bedrock uppermost aquifer as part of the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014) typically indicate a downward gradient (Table 3). Two of the nested well pairs, MW-150/MW-350 and MW-155/MW-355, used in the analysis were located to the far southwest or far west (off-site). The nested well pairs are located in areas where semi-confined conditions may occur near the Site discharge area (i.e. southwest of the Tertiary Pond) or the regional discharge area (i.e. the Kaskaskia River). The other nested well pair used in the analysis, MW-252/MW-352, indicated both downward and upward gradients over time. Well MW-252 is screened in the Vandalia Till and the bedrock in the area of the Site is likely under confined conditions as indicated by the observed occurrences of upward vertical gradients. Also, groundwater levels collected on

March 21, 2016 at MW-352 indicated artesian groundwater conditions, providing further evidence of confined aquifer conditions near MW-352.

A hydraulic conductivity of 5 x 10^{-6} cm/s and a median effective porosity of 30 percent were used to calculate bedrock groundwater velocities based on data referenced in Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014). Groundwater flow velocity ranged from approximately 0.0005 to 0.001 ft/day as groundwater flowed from east to west across the Site (Table 2) from December 2015 to March 2016. In general, less than 0.0004 ft/day change in groundwater velocity was observed for the period from December 2015 to March 2016 at any particular area of the Site.

3 GROUNDWATER MONITORING

In September 2015, NRT began an assessment of the existing monitoring well network(s) at Baldwin Energy Complex with respect to the existing CCR units. Included in the assessment was a review of the current placement and number of monitoring wells with respect to individual and contiguous CCR units as well as potential locations for new monitoring wells, as appropriate. The discussion below summarizes the results of the supplemental well installations.

3.1 CCR Monitoring Well Network

The 40 CFR Part 257 well network consists of thirteen monitoring wells installed in the uppermost aquifer and adjacent to Baldwin Bottom Ash Pond (MW-304, MW-306, MW-356, MW-369, MW-370 and MW-382) and Baldwin Fly Ash Pond System (MW-304, MW-306, MW-366, MW-375, MW-377, MW-383, MW-384, MW-390 and MW-391). Baldwin Bottom Ash Pond and Baldwin Fly Ash Pond System utilize the same two upgradient monitoring wells (MW-304 and MW-306) as part of their CCR Monitoring Well Network. The boring logs, well construction forms and other related monitoring well forms are available in the Operating Records as required by Title 40 CFR Part 257 Section 257.91 for each monitored CCR Unit or CCR Multi-Unit. The 40 CFR Part 257 groundwater monitoring network well locations are shown on Figure 1. Details on the procedures and techniques used to fulfill the groundwater sampling and analysis program requirements are found in the SAPs for Baldwin Bottom Ash Pond and Baldwin Fly Ash Pond System. The well depths, well screen intervals, depth to groundwater and monitored units at the 40 CFR Part 257 monitoring well network locations are summarized below:

Table 4: CCR Groundwater Monitoring Well Information

Well Number	Well Depth (ft bgs)	Well Screen Interval (ft bgs)	Depth to Water (ft bgs)	Unit Monitored	Screened Interval Lithology
MW-304	55	45 - 55	8.0	Baldwin Bottom Ash Pond and Baldwin Fly Ash Pond System Upgradient Bedrock	Shale and Limestone
MW-306	86	71 - 86	14.6		
MW-356	66	56 - 66	0.4	Baldwin Bottom Ash Pond Downgradient Bedrock	Shale and Limestone
MW-369	66	56 - 66	56.6		
MW-370	63	53 - 63	16.5		
MW-382	66	56 - 66	13.7		
MW-366	52	42 - 52	10.9	Baldwin Fly Ash Pond System Downgradient Bedrock	Shale and Limestone
MW-375	67	57 - 67	28.6		
MW-377	56	46 - 56	0.3		
MW-383	68	58 - 68	13.4		
MW-384	70.5	60.5 – 70.5	7.2		
MW-390	65	50 - 65	21.0		
MW-391	70	55 - 70	NM		

Groundwater depth measurements shown are from March 21, 2016.
NM indicates groundwater elevation was not measured.
Groundwater elevations at some wells may not have stabilized at time of measurement.

REFERENCES

AECOM, December 17, 2015. 30% Design Data Report for the Dynegy Baldwin Energy Complex; West Fly Ash Pond, East Fly Ash Pond, and Old East Fly Ash Pond CCR Units.

Dynegy, March 22, 2013. Proposed Scope of Work – Baldwin Ash Impoundment System

Kelron Environmental and NRT, May 26, 2010. Hydrogeologic Assessment and Groundwater Monitoring Plan – Baldwin Ash Pond System

Kelron Environmental and NRT, June 7, 2010. Water Well Survey – Baldwin Ash Pond System

Kelron Environmental, April 16, 2012. Off-Site Groundwater Quality Results – Baldwin Energy Complex

Kelron Environmental, June 30, 2012. Groundwater Quality Assessment and Initial Hydrogeologic Investigation – Baldwin Ash Pond System

NRT, June 11, 2014. Groundwater Quality Assessment and Phase II Hydrogeologic Investigation, Baldwin Ash Pond System

NRT, March 31, 2016. Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan - Baldwin Fly Ash Pond System

USEPA, 2015, Disposal of Coal Combustion Residuals from Electric Utilities, Final Rule, 40 CFR Parts 257 and 261, Hazardous and Solid Waste Management System, April 2015.

Tables

Table 1. Summary of Horizontal and Verical Permeability Test Results
Baldwin Energy Complex
Hydrogeologic Monitoring Plan

Horizontal Hydraulic Conductivity: Field Test Results

Monitoring Well Number	Depth Interval Tested (feet)	Analysis Method	Lithologic Layer	Primary Lithologies within Screened Well Interval	Horizontal Hydraulic Conductivity (cm/sec)
Hydrogeologic Unit 2: Unlithified Deposits					
MW-104DR	23.2 - 28.2	Bouwer-Rice	Vandalia Till Member	Sand (fine-medium), Sandy Clay, and Silty Clay	6.8E-04
MW-151	6.1 - 15.8	Bouwer-Rice	Cahokia Formation	Sandy Clay, Silty Clay and Clay	1.1E-05
MW-152	7.5 - 16.7	Bouwer-Rice	Equality Formation	Clay	7.0E-05
OW-156	7.9 - 17.2	Bouwer-Rice	Equality Formation	Clay and Silty Clay	4.3E-05
OW-157	7.8 - 17.1	Bouwer-Rice	Equality Formation	Clay and Silty Clay	1.3E-04
MW-161	23.3 - 32.8	Bouwer-Rice	Equality Formation	Silty Clay, Sand with Silt	8.1E-05
TPZ-166	15.3 - 24.7	Bouwer-Rice	Vandalia Till Member	Silty Clay	1.9E-05
MW-252	44.4 - 49.0	Bouwer-Rice	Vandalia Till Member	Clay	1.9E-06
MW-253	29.9 - 34.5	Bouwer-Rice	Vandalia Till Member	Clay, shaley	3.5E-07
OW-256	28.0 - 32.5	Bouwer-Rice	Vandalia Till Member	Silty Clay, Sand (fine-medium)	2.2E-04
OW-257	34.0 - 38.5	Bouwer-Rice / KGS Model	Vandalia Till Member	Silty Clay	3.3E-06
MW-262	42.1 - 46.6	Bouwer-Rice	Vandalia Till Member	Sand with Silt, Sand, Silty Clay	6.0E-04
				Geometric Mean Hydraulic Conductivity	**3.2E-05**
Hydrogeologic Unit 3: Upper Bedrock					
MW-350	41.6 - 46.2	Bouwer-Rice	Mississippian Bedrock	Limestone, massive, hard to very hard; RQD = 96% (Excellent)	2.1E-06
MW-352	67.9 - 72.5	Bouwer-Rice	Pennsylvanian or Mississippian Bedrock	Limestone, medium hard to hard; RQD = 57% (Fair)	1.7E-06
MW-355	27.4 - 32.0	Bouwer-Rice	Mississippian Bedrock	Limestone, medium soft, fossiliferous; RQD = 57% (Fair)	3.5E-05
				Geometric Mean Hydraulic Conductivity	**5.0E-06**

Vertical Hydraulic Conductivity: Laboratory Test Results

Boring ID	Depth Interval Tested (feet)	Geotechnical Laboratory (Analysis Date)	Lithologic Layer	Primary Lithologies within Screened Well Interval	Vertical Hydraulic Conductivity (cm/sec)
Hydrogeologic Unit 1: Fill Unit					
TPZ-163	1.5 - 3.5	Geotechnology (2013)	Ash Pond System: Fly Ash / Bottom Ash	Ash (USCS classification: Silty Sand, fine grained)	2.5E-04
TPZ-164	3.0 - 5.0	Geotechnology (2013)	Ash Pond System: Bottom Ash	Ash (USCS classification: Sandy Silt, fine grained sand)	6.5E-04
TPZ-167	29.0 - 30.0	Geotechnology (2013)	Ash Pond System: Fly Ash	Ash (USCS classification: Silt)	9.7E-06
TPZ-168	3.0 - 5.0	Geotechnology (2013)	Ash Pond System: Fly Ash	Ash (USCS classification: Sandy Silt, fine-medium grained sand)	4.2E-04
				Geometric Mean Hydraulic Conductivity	**1.6E-04**
Hydrogeologic Unit 2: Unlithified Deposits					
MW-154	8.0 - 9.2	Shively Geotechnical (2010)	Cahokia Formation	Sandy Clay with gravel	7.8E-06
MW-350	18.0 - 20.0	Shively Geotechnical (2010)	Cahokia Formation	Clay	3.4E-07
TPZ-164	10.0 - 12.0	Geotechnology (2013)	Equality Formation	Clay	1.3E-06
MW-252	44.0 - 46.0	Shively Geotechnical (2010)	Vandalia Member	Clay	6.3E-09
MW-262	33.5 - 35.5	Geotechnology (2013)	Vandalia Member	Clay	9.9E-09
TPZ-163	28.0 - 30.0	Geotechnology (2013)	Vandalia Member	Clay, trace fine sand	4.2E-04
TPZ-165	8.0 - 10.0	Geotechnology (2013)	Vandalia Member	Clay, trace sand	5.3E-06
TPZ-167	32.0 - 34.0	Geotechnology (2013)	Vandalia Member	Clay with sand	6.2E-07
				Geometric Mean Hydraulic Conductivity	**8.6E-07**

Notes:
cm/sec centimeters per second.

Reference:
Bouwer-Rice Bouwer and Rice Analytical Method for Unconfined Aquifers, 1976. (note: also used for Confined Aquifers).
KGS Model KGS overdamped slug test analysis model (Hyder et al., 1994).
Shively Geotechnical (2010): see Appendix D of NRT, June 11, 2014. Groundwater Quality Assessment and Phase II Hydrogeologic Investigation, Baldwin Ash Pond System
Geotechnology (2013): see Appendix D of NRT, June 11, 2014. Groundwater Quality Assessment and Phase II Hydrogeologic Investigation, Baldwin Ash Pond System
Data source was the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014)

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Table 2. Groundwater Horizontal Hydraulic Gradients and Flow Velocities
Baldwin Energy Complex
December 2015, January 2016, and March 2016
Hydrogeologic Monitoring Plan

December 29, 2015					
Area	**Approximate Flow Direction**	**Average Hydraulic Conductivity (cm/s)**	**Horizontal Hydraulic Gradient**	**Effective Porosity**	**Velocity (ft/day)**
Baldwin Bottom Ash Pond - East	**NW**	5E-06	0.02	0.30	0.0009
Baldwin Bottom Ash Pond - West	**SW**	5E-06	0.02	0.30	0.001
January 19, 2016					
Area	**Approximate Flow Direction**	**Average Hydraulic Conductivity (cm/s)**	**Horizontal Hydraulic Gradient**	**Effective Porosity**	**Velocity (ft/day)**
Baldwin Fly Ash Pond System - West	**W**	5E-06	0.01	0.30	0.0006
March 2, 2016					
Area	**Approximate Flow Direction**	**Average Hydraulic Conductivity (cm/s)**	**Horizontal Hydraulic Gradient**	**Effective Porosity**	**Velocity (ft/day)**
Baldwin Bottom Ash Pond - East	**NW**	5E-06	0.01	0.30	0.0005
Baldwin Fly Ash Pond System - West	**W**	5E-06	0.01	0.30	0.0005
Baldwin Bottom Ash Pond - West	**SW**	5E-06	0.02	0.30	0.0009

Note:

1) cm/sec x 2,835 = feet/day

2) Source of hydraulic conductivity values was the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014)

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Table 3. Vertical Hydraulic Gradients
Baldwin Energy Complex
Hydrogeologic Monitoring Plan

Monitoring Wells for Gradient Calculations across Screened Hydrogeologic Units		Screen Midpoint Elevations (feet)		Groundwater Level Measurements (Elevation in Feet)																	
				11/15-16/2010		3/22-23/2011		6/6-8/2011		9/12-14/2011		12/6-8/2011		3/6-8/2012		9/16-17/2013		11/20-21/2013		02/18-19/2014	
Shallow	**Deep**	**Shallow**	**Deep**	Shallow	Deep	Shallow	Deep	Shallow	Deep	Shallow	Deep	Shallow	Deep	Shallow	Deep	Shallow	Deep	Shallow	Deep	Shallow	Deep
MW-104SR	MW-104DR	442.83	428.47	441.54	441.54	448.10	448.04	446.22	446.24	- -	- -	- -	- -	- -	- -	441.58	440.65	440.86	440.94	446.35	446.42
MW-153	MW-253	427.60	410.53	429.29	- -	437.07	436.99	433.82	435.97	429.47	433.15	435.68	435.13	- -	- -	429.35	432.15	430.62	432.85	434.26	434.58
MW-152	MW-252	410.29	375.56	417.77	419.07	420.04	425.07	418.70	425.07	416.79	422.82	420.17	425.07	419.99	423.13	416.74	- -	418.32	422.93	419.86	424.82
MW-252	MW-352	375.56	352.15	419.07	- -	425.07	419.06	425.07	421.29	422.82	422.84	425.07	422.14	423.13	423.54	- -	415.86	422.93	422.55	424.82	424.19
MW-150	MW-350	374.00	350.21	377.11	372.52	380.04	375.84	380.44	379.37	376.01	374.30	379.00	374.62	378.74	374.40	375.51	374.05	376.86	374.28	378.05	374.49
MW-155	MW-355	375.50	361.11	372.85	369.97	376.54	372.70	379.85	379.09	373.66	370.03	374.13	370.66	376.34	371.08	372.27	369.27	- -	369.50	372.39	369.99
OW-156	OW-256	412.60	394.96	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	418.69	415.75	420.36	417.93	423.68	421.50
OW-157	OW-257	417.44	391.94	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	424.92	424.36	427.00	425.84	428.81	427.06

Monitoring Wells for Gradient Calculations across Screened Hydrogeologic Units		Monitored Geologic Unit**		Hydrogeologic Unit***		Vertical Groundwater Gradient Between Designated Units (feet/feet)									**Average Groundwater Gradient (feet/feet)**
						11/15-16/10	03/22-23/11	06/6-8/11	09/12-14/11	12/6-8/11	03/6-8/12	9/16-17/2013	11/20-21/2013	2/18-19/2014	
Shallow	**Deep**	**Shallow**	**Deep**	**Shallow**	**Deep**										
MW-104SR	MW-104DR	Vandalia	Vandalia	2	2	- -	- -	- -	0.015	0.018	0.018	0.065	**-0.006**	**-0.005**	0.02
MW-153	MW-253	Vandalia	Vandalia	2	2	- -	0.005	**-0.126**	**-0.236***	0.032	- -	**-0.164**	**-0.131**	**-0.019**	**-0.07**
MW-152	MW-252	Equality	Vandalia	2	2	**-0.037**	**-0.145**	**-0.183**	**-0.174**	**-0.141**	**-0.090**	- -	**-0.133**	**-0.143**	**-0.13**
MW-252	MW-352	Vandalia	Bedrock	2	3	- -	0.027	0.017	**-0.001**	0.125	**-0.018**	- -	0.016	0.027	0.03
MW-150	MW-350	Cahokia	Bedrock	2	3	0.012*	0.177	0.045	0.076*	0.184	0.183*	0.004*	0.007*	0.010*	0.08
MW-155	MW-355	Cahokia	Bedrock	2	3	0.008*	0.010*	0.002*	0.276*	0.307*	0.424*	0.008*	- -	0.006*	0.13
OW-156	OW-256	Equality	Vandalia	2	2	- - -	- - -	- - -	- - -	- - -	- - -	0.167	0.138	0.124	0.14
OW-157	OW-257	Equality	Vandalia	2	2	- - -	- - -	- - -	- - -	- - -	- - -	0.022	0.045	0.069	0.05

Notes:

-0.02 Vertical gradient is upwards between the screened well intervals and formations indicated.
0.04 Vertical gradient is downwards between the screened well intervals and formations indicated.
* Water level in shallow well was below top of screen. Midpoint elevation calculated based on water level elevation and bottom of screen.
\- - No data collected on date, water level not static, or incorrectly measured/transcribed.
\- - - Deep wells OW-256 and OW-257 not constructed until August 2014.
Data source was the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014)

** Monitored Geologic Unit Designations
- Bedrock — Pennsylvanian or Mississippian age limestone and shale.
- Cahokia — Cahokia Formation.
- Equality — Equality Formation.
- Vandalia — Vandalia Till Member.

*** Hydrogeologic Unit Designations
- 2 — Upper Groundwater Unit
- 3 — Bedrock Unit

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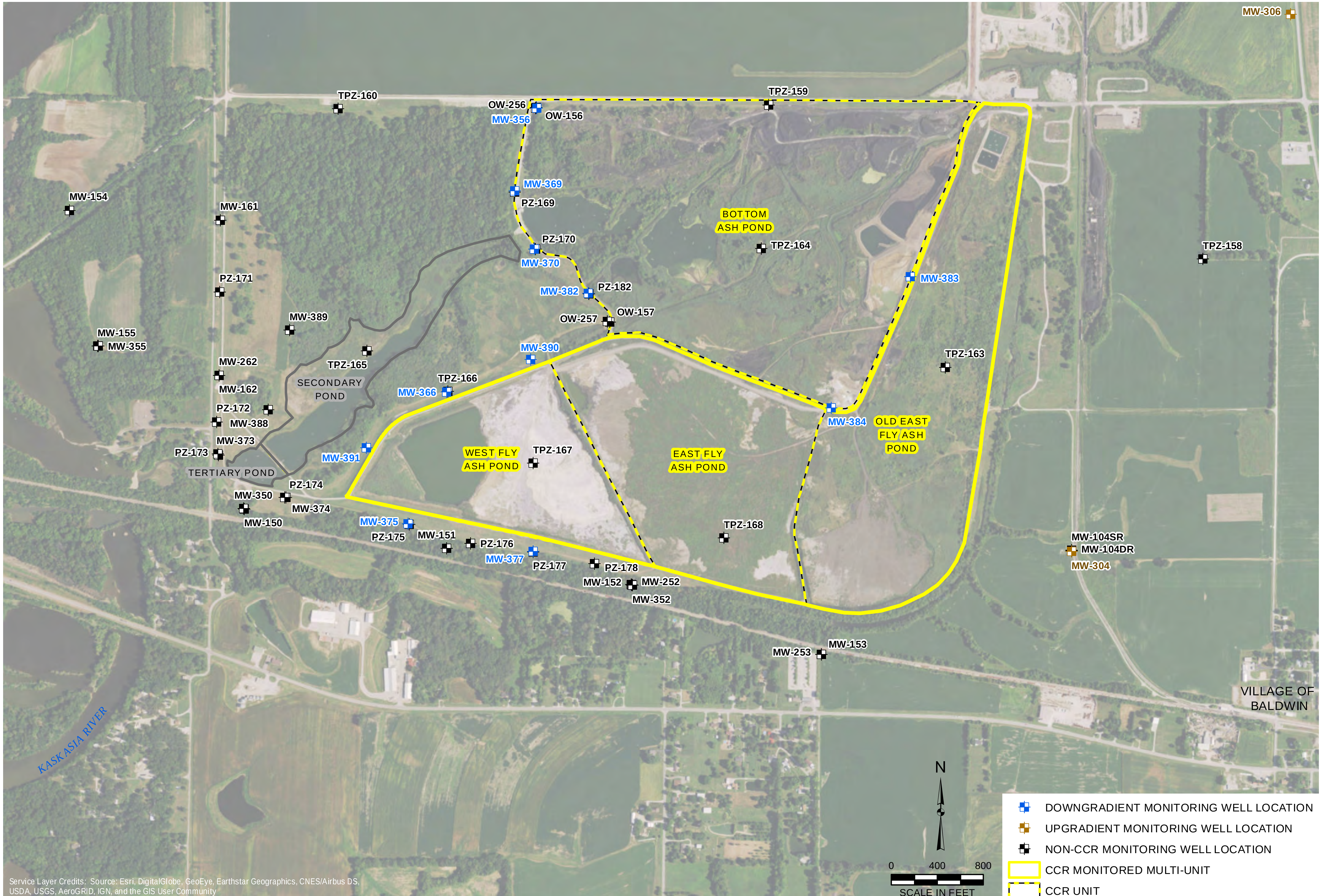
Figures



DRAWN BY/DATE:
SDS 4/25/16
REVIEWED BY/DATE:
JJW 10/2/17
APPROVED BY/DATE:
SJC 10/2/2017

GROUNDWATER SAMPLING WELL LOCATION MAP

HYDROGEOLOGIC MONITORING PLAN
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285.7/1.1

FIGURE NO: 1

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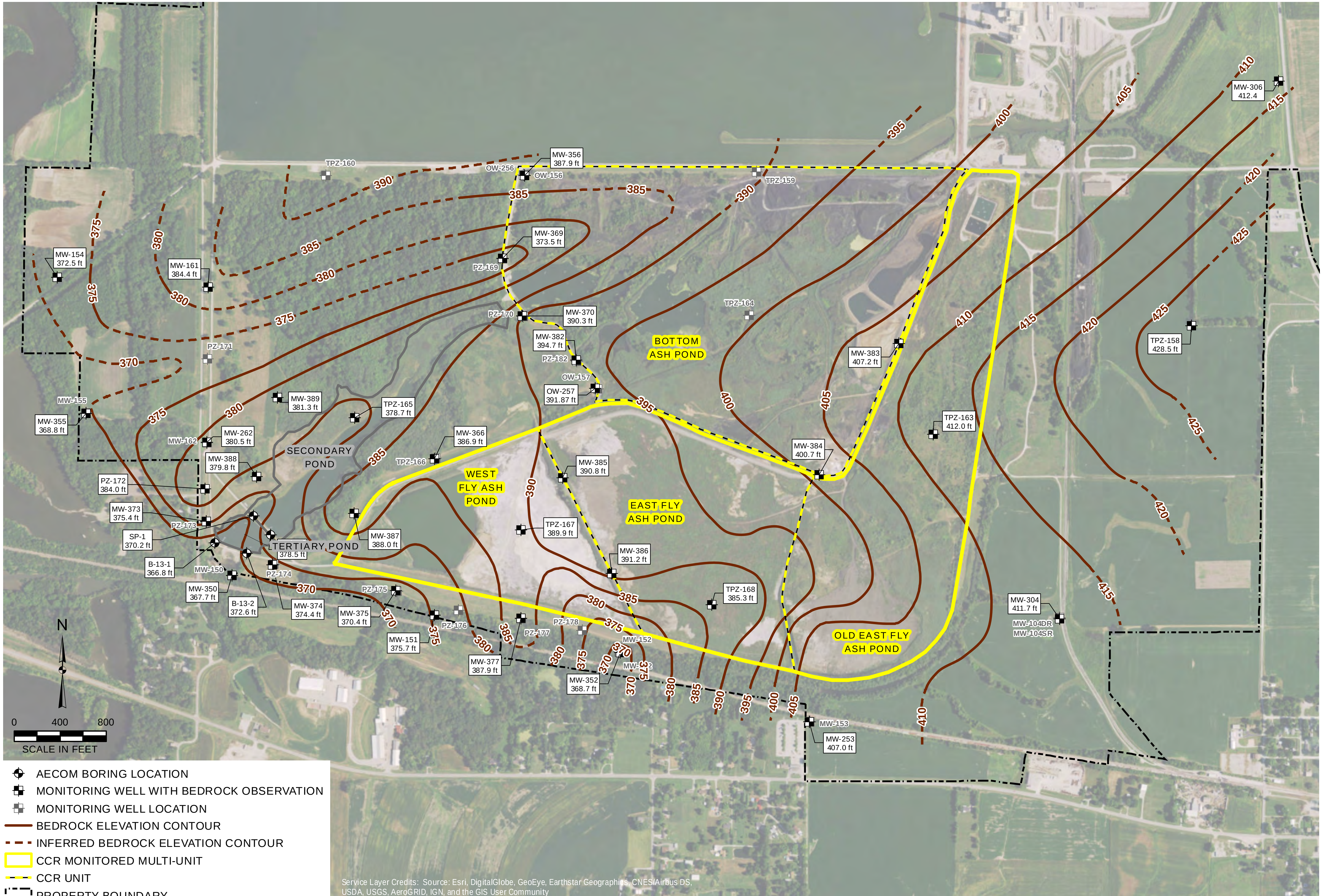
Y:\Mapping\Projects\22\2285_Baldwin\MXD\SAP\Figure 1_Groundwater Sampling Well Location Map_REV.mxd Author: MejiaMD; Date/Time: 10/3/2017, 11:14:53 AM



DRAWN BY/DATE: TDC 2/25/16
REVIEWED BY/DATE: JJW 2/26/16
APPROVED BY/DATE: SJC 9/27/17

BEDROCK TOPOGRAPHY

HYDROGEOLOGIC MONITORING PLAN
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285.7/1.1

FIGURE NO: 2

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Y:\Mapping\Projects\22\2285_Baldwin\MXD\SAP\Figure 2_Bedrock Topography.mxd Author: MejiacMD; Date/Time: 10/3/2017, 1:59:09 PM

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

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DRAWN BY/DATE: TDC 4/30/14
REVIEWED BY/DATE: SJC 4/27/14
APPROVED BY/DATE: SJC 9/29/17

CROSS SECTION LOCATION MAP

HYDROGEOLOGIC MONITORING PLAN
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285.7/1.1

FIGURE NO: 3

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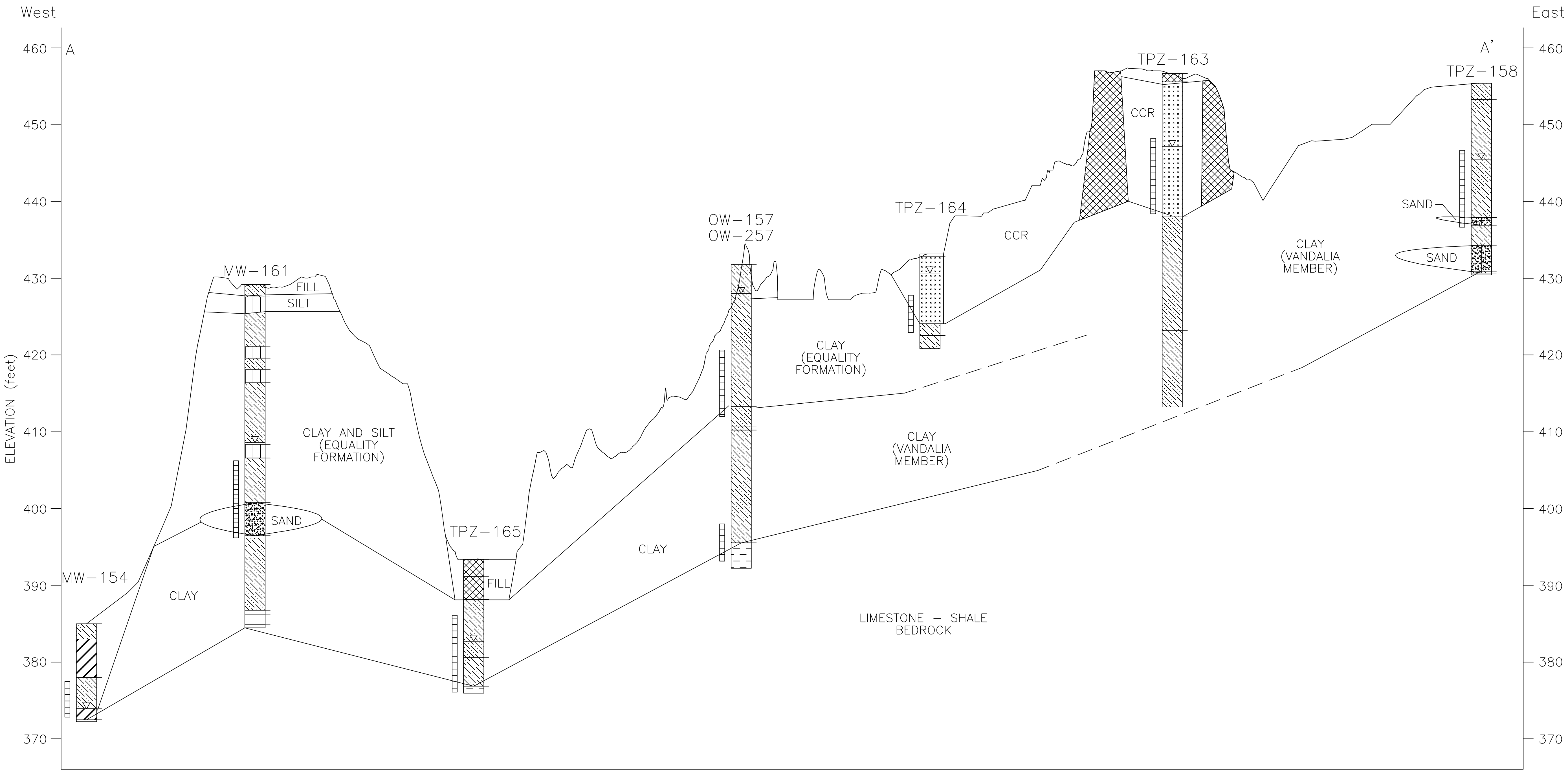

LEGEND

- WELL SCREEN INTERVAL
- FILL
- CLAY, CL
- CLAY, CH
- SAND, SP/SM/SW
- SHALE
- SILT, ML
- COAL COMBUSTION RESIDUALS, CCRs

NOTE: This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.

0 400 800
FEET
(HORIZONTAL SCALE IS APPROXIMATE)

DRAWN BY/DATE: TDC 5/15/14
REVIEWED BY/DATE: SJC 5/16/14
APPROVED BY/DATE: SJC 9/29/17

GEOLOGIC CROSS SECTION A-A'

HYDROGEOLOGIC MONITORING PLAN
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285.7/1.1

FIGURE NO: 4A

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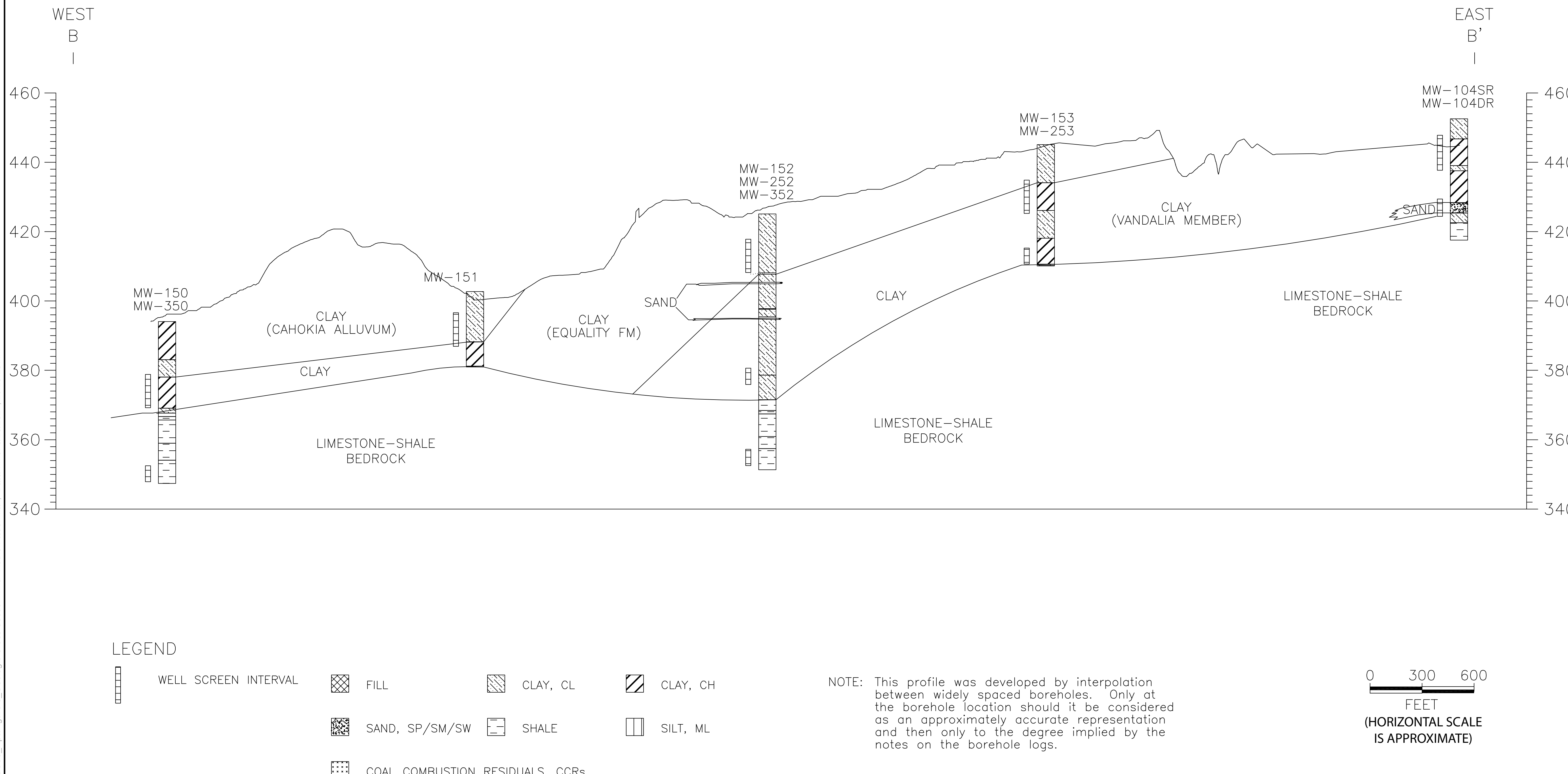

NOTE: This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.

DRAWN BY/DATE: TDC 5/15/14
REVIEWED BY/DATE: SJC 5/16/14
APPROVED BY/DATE: SJC 9/29/17

GEOLOGIC CROSS SECTION B-B'

HYDROGEOLOGIC MONITORING PLAN
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285.7/1.1

FIGURE NO: 4B

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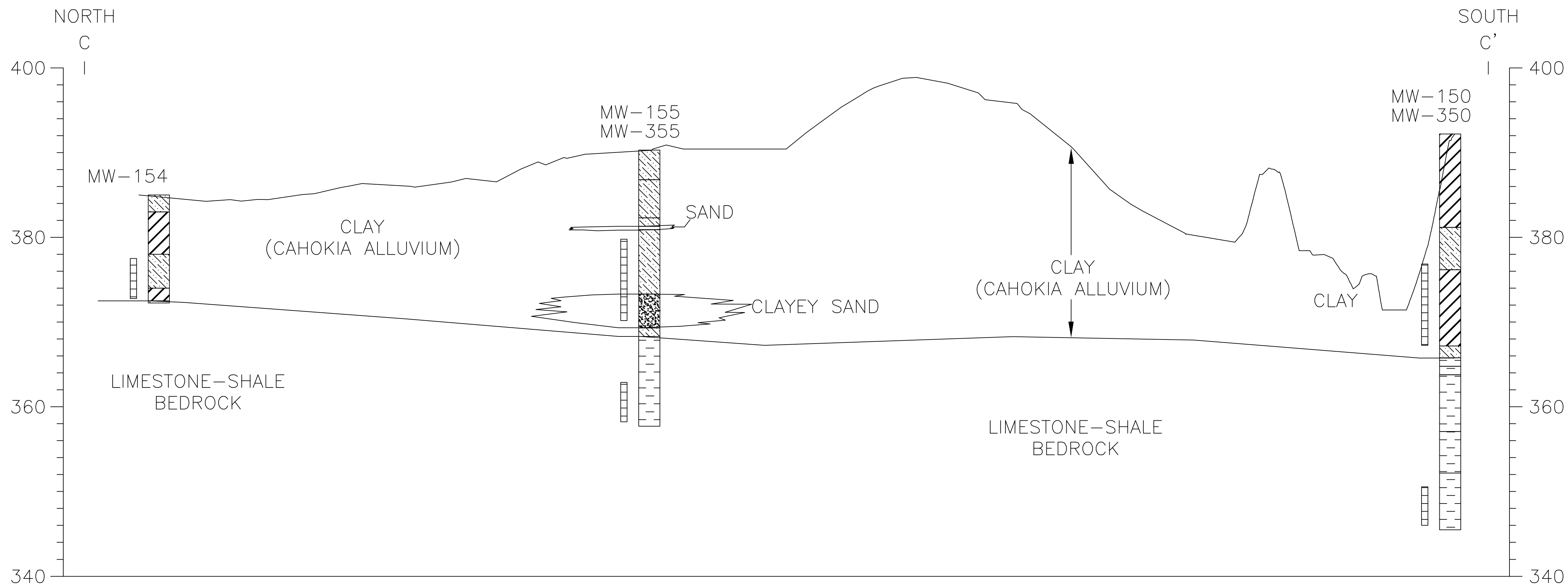

LEGEND

- WELL SCREEN INTERVAL
- FILL
- CLAY, CL
- CLAY, CH
- SAND, SP/SM/SW
- SHALE
- SILT, ML
- COAL COMBUSTION RESIDUALS, CCRs

NOTE: This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.

0 150 300
FEET
(HORIZONTAL SCALE IS APPROXIMATE)

DRAWN BY/DATE: TDC 5/15/14
REVIEWED BY/DATE: SJC 5/16/14
APPROVED BY/DATE: SJC 9/29/17

GEOLOGIC CROSS SECTION C-C'

HYDROGEOLOGIC MONITORING PLAN
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285.7/1.1

FIGURE NO: 4C

Natural Resource Technology
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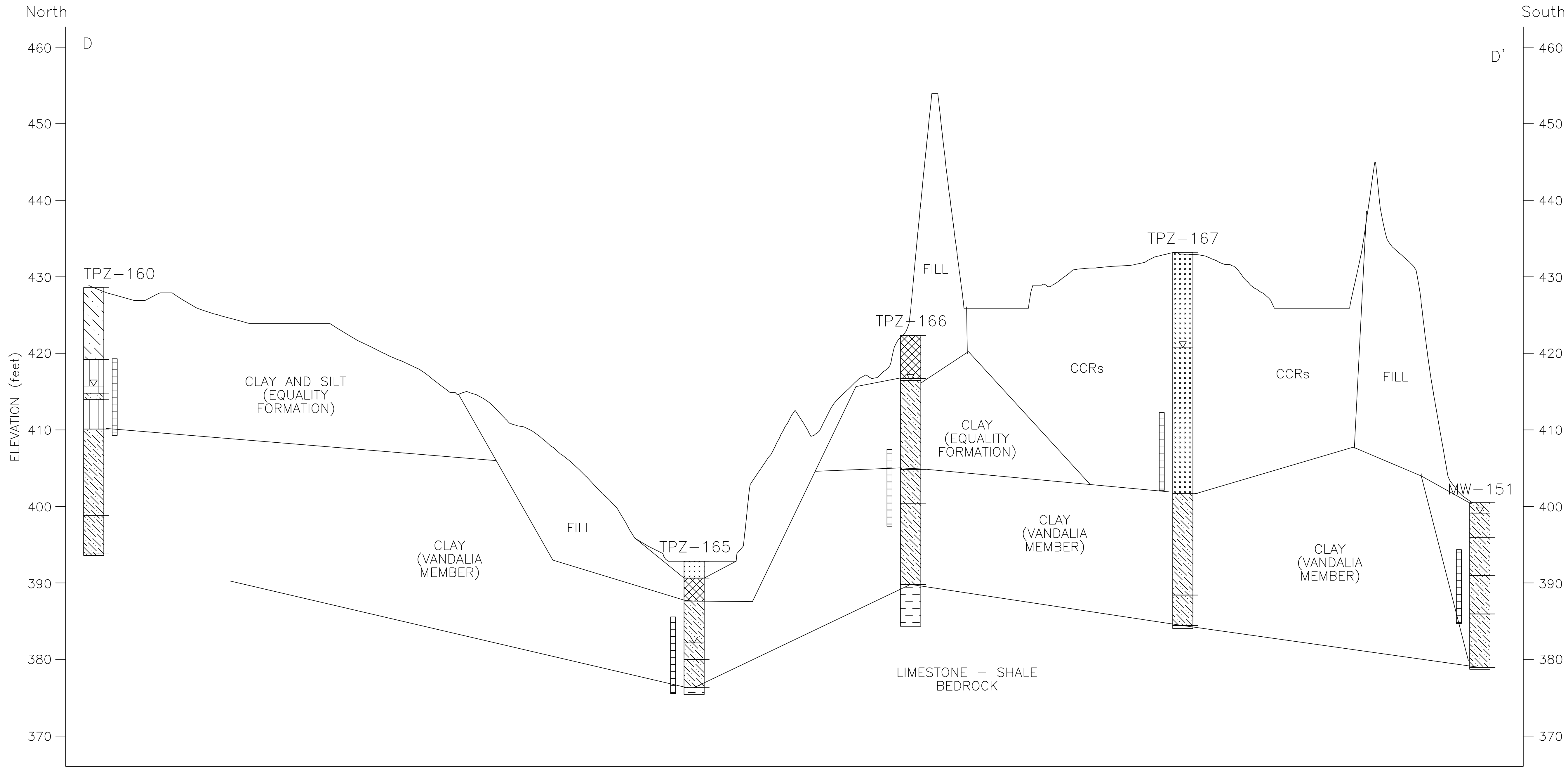


LEGEND

WELL SCREEN INTERVAL

FILL

CLAY, CL

CLAY, CH

SAND, SP/SM/SW

SHALE

SILT, ML

COAL COMBUSTION RESIDUALS, CCRs

NOTE: This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.

0 200 400
FEET
(HORIZONTAL SCALE IS APPROXIMATE)

DRAWN BY/DATE: TDC 5/15/14
REVIEWED BY/DATE: SJC 5/16/14
APPROVED BY/DATE: SJC 9/29/17

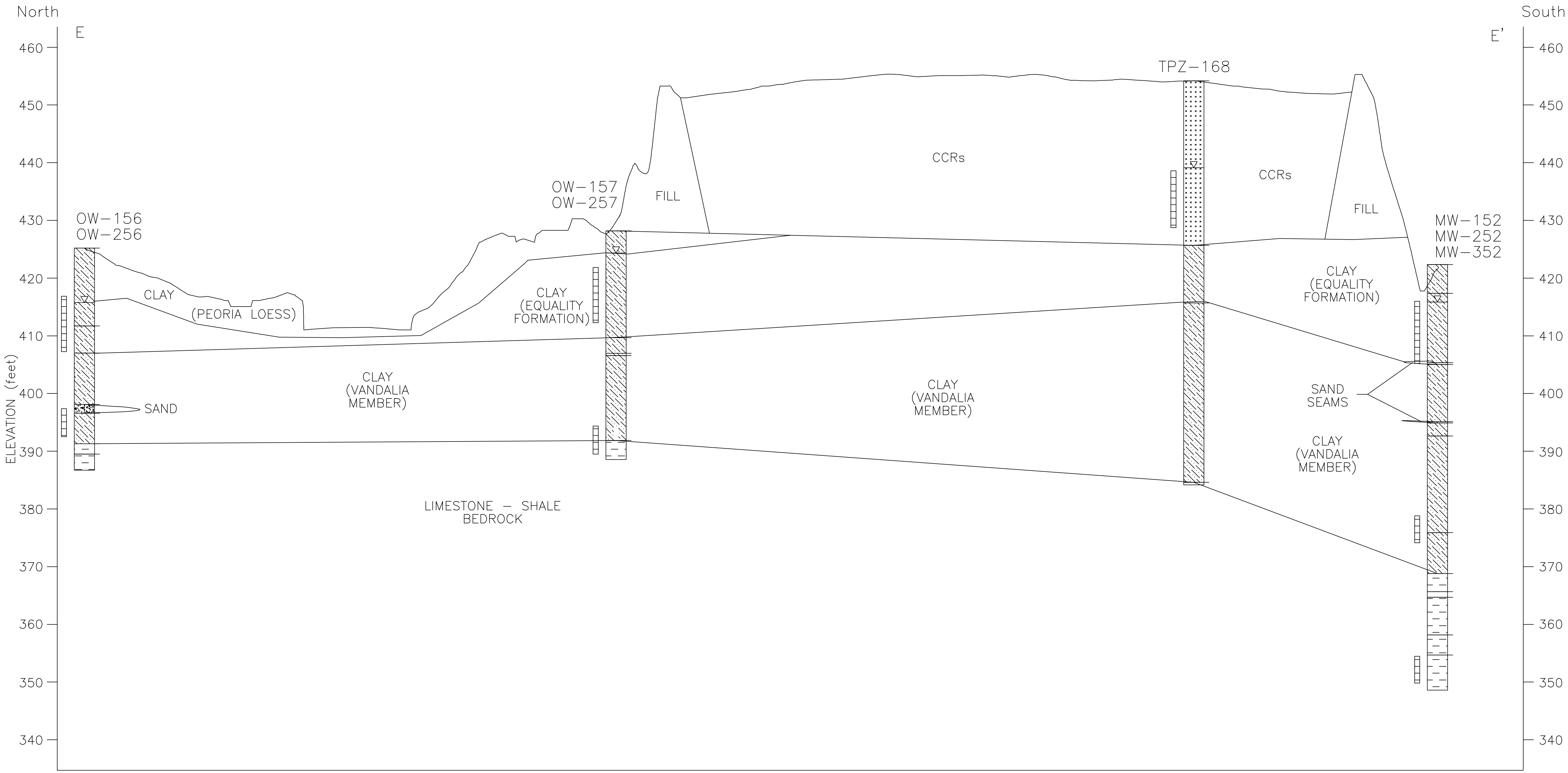
GEOLOGIC CROSS SECTION D-D'

HYDROGEOLOGIC MONITORING PLAN
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285.7/1.1

FIGURE NO: 4D

Natural Resource Technology
AN OBG COMPANY



LEGEND

- WELL SCREEN INTERVAL
- FILL
- CLAY, CL
- CLAY, CH
- SAND, SP/SM/SW
- SHALE
- SILT, ML
- COAL COMBUSTION RESIDUALS, CCRs

NOTE: This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.

0 200 400
FEET
(HORIZONTAL SCALE IS APPROXIMATE)

DRAWN BY/DATE:
TDC 5/15/14
REVIEWED BY/DATE:
SJC 5/16/14
APPROVED BY/DATE:
SJC 9/29/17

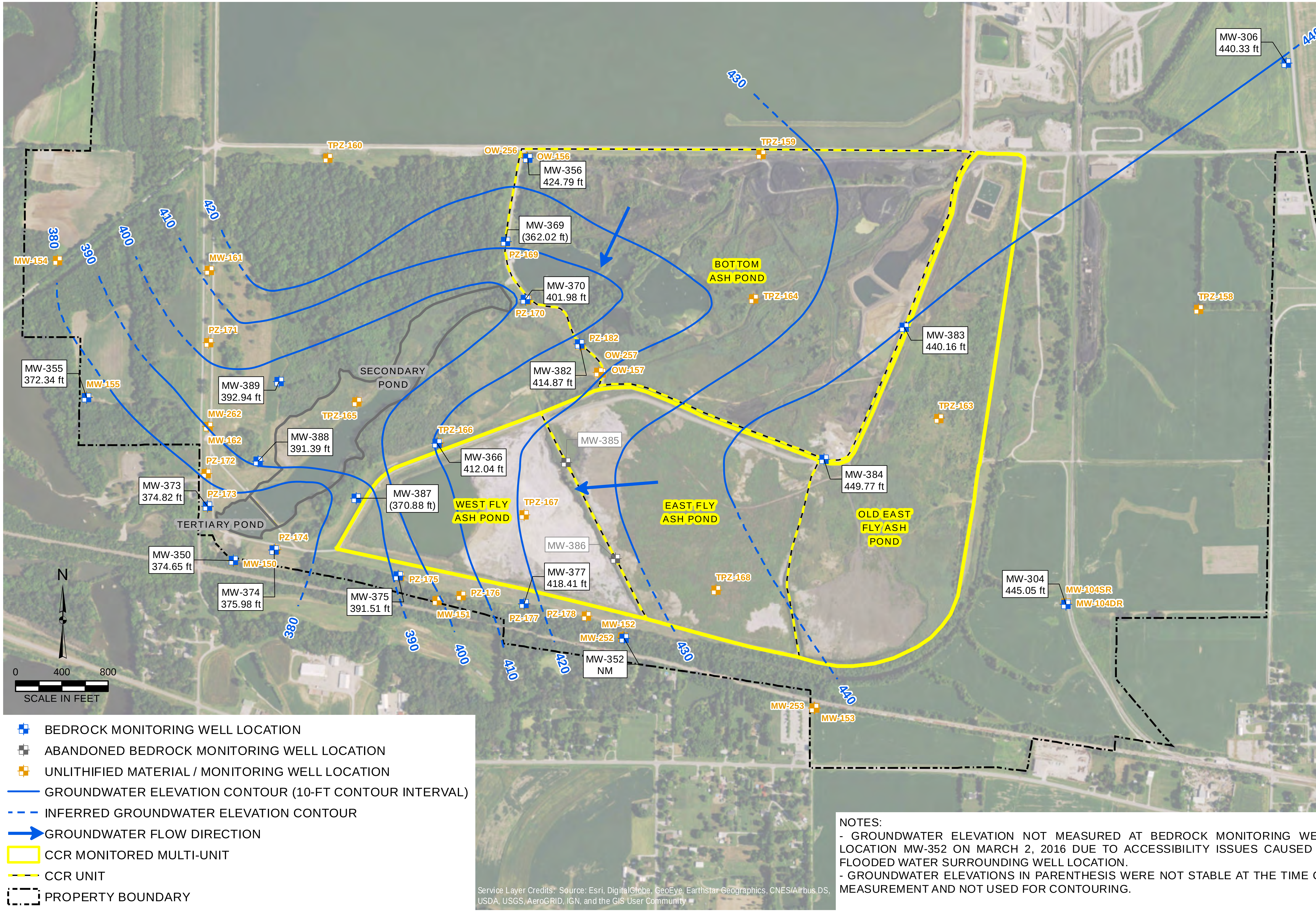
GEOLOGIC CROSS SECTION E-E'

HYDROGEOLOGIC MONITORING PLAN
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285.7/1.1

FIGURE NO: 4E

Natural Resource Technology
AN OBG COMPANY



BEDROCK MONITORING WELL LOCATION
ABANDONED BEDROCK MONITORING WELL LOCATION
UNLITHIFIED MATERIAL / MONITORING WELL LOCATION
GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
CCR MONITORED MULTI-UNIT
CCR UNIT
PROPERTY BOUNDARY

NOTES:
- GROUNDWATER ELEVATION NOT MEASURED AT BEDROCK MONITORING WELL LOCATION MW-352 ON MARCH 2, 2016 DUE TO ACCESSIBILITY ISSUES CAUSED BY FLOODED WATER SURROUNDING WELL LOCATION.
- GROUNDWATER ELEVATIONS IN PARENTHESIS WERE NOT STABLE AT THE TIME OF MEASUREMENT AND NOT USED FOR CONTOURING.

DRAWN BY/DATE: TDC 3/7/16
REVIEWED BY/DATE: JJW 3/7/16
APPROVED BY/DATE: SJC 9/27/17

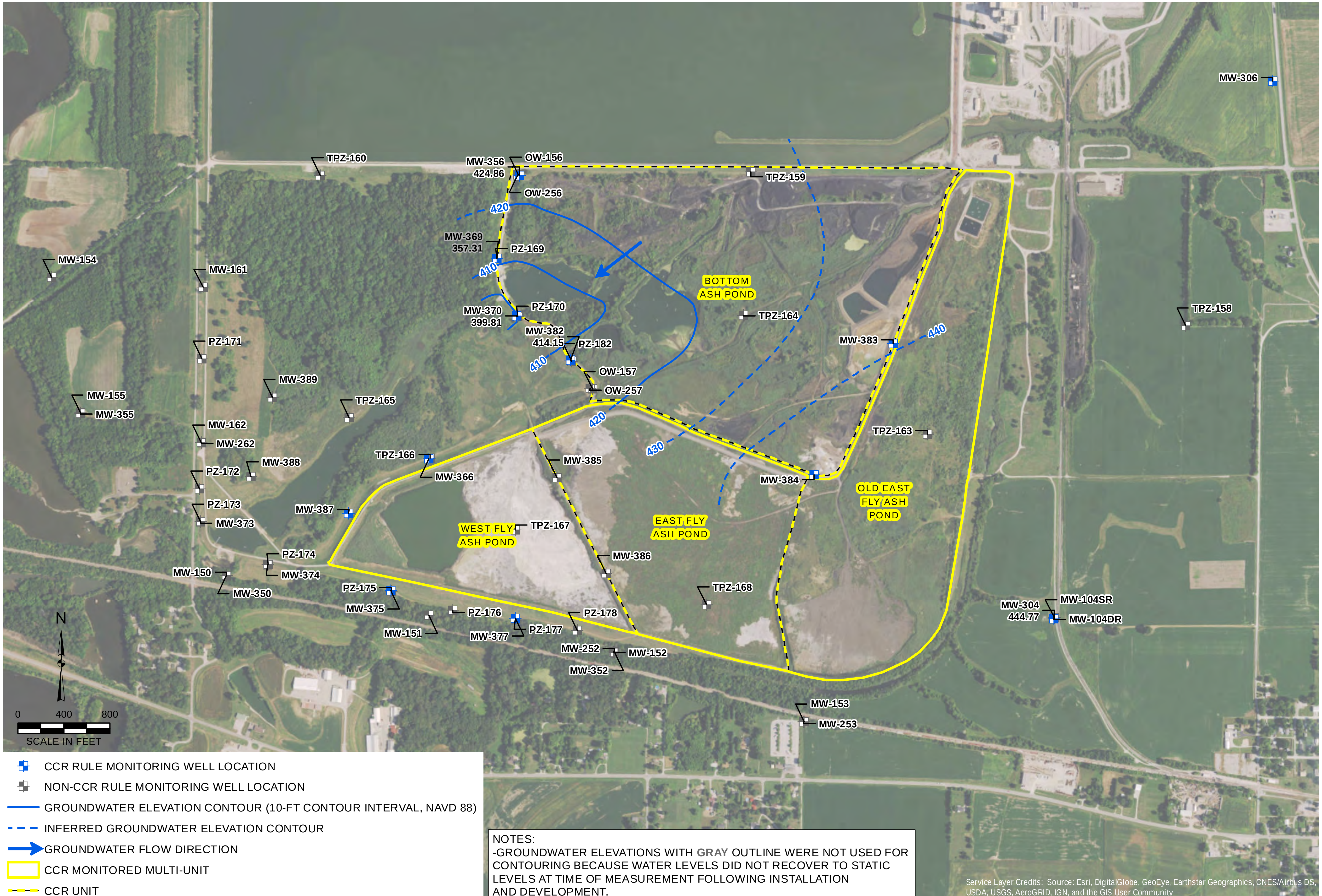
UPPERMOST AQUIFER UNIT GORUNDWATER ELEVATION CONTOUR MAP
MARCH 2, 2016

HYDROGEOLOGIC MONITORING PLAN
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285.7/1.1

FIGURE NO: 5

Natural Resource Technology
AN OBG COMPANY



NOTES:
-GROUNDWATER ELEVATIONS WITH GRAY OUTLINE WERE NOT USED FOR CONTOURING BECAUSE WATER LEVELS DID NOT RECOVER TO STATIC LEVELS AT TIME OF MEASUREMENT FOLLOWING INSTALLATION AND DEVELOPMENT.

DRAWN BY/DATE: SDS 1/24/17
REVIEWED BY/DATE: TBN 1/25/17
APPROVED BY/DATE: SJC 9/27/17

UPPERMOST AQUIFER UNIT GROUNDWATER ELEVATION CONTOUR MAP
DECEMBER 29, 2015

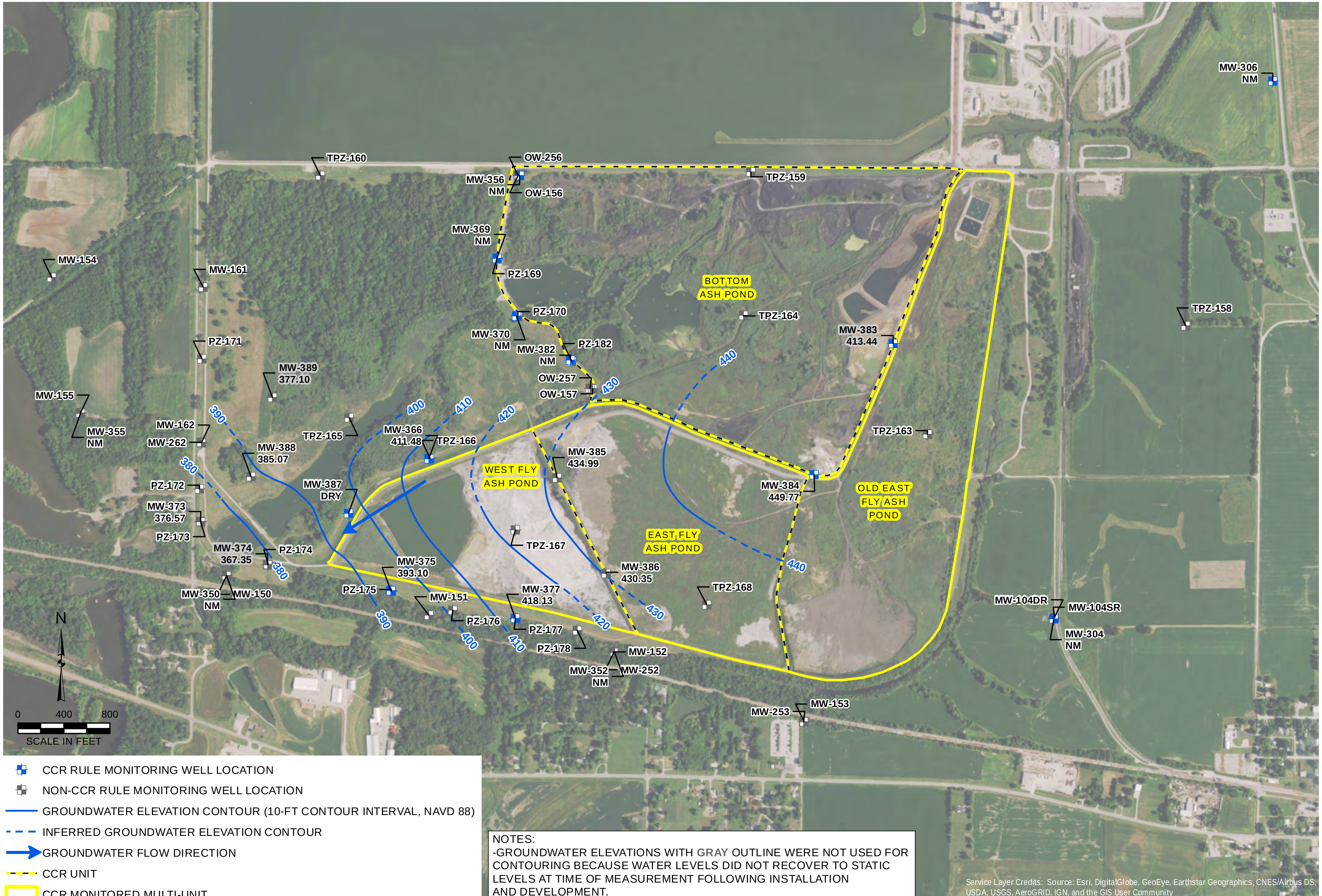
HYDROGEOLOGIC MONITORING PLAN
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285.7/1.1

FIGURE NO: 6

Natural Resource Technology
AN OBG COMPANY

Y:\Mapping\Projects\22\2285_Baldwin\MXD\SAP\Figure 6_Uppermost Aquifer Contour Map Dec 2015.mxd Author: MejiasMD; Date/Time: 10/3/2017, 1:56:00 PM



DRAWN BY/DATE: SDS 1/24/17
REVIEWED BY/DATE: TBN 1/25/17
APPROVED BY/DATE: SJC 10/3/17

UPPERMOST AQUIFER UNIT GROUNDWATER ELEVATION CONTOUR MAP
JANUARY 19, 2016

HYDROGEOLOGIC MONITORING PLAN
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285.7/1.1

FIGURE NO: 7

Natural Resource Technology
AN OBG COMPANY

Y:\Mapping\Projects\22\2285_Baldwin\MXD\SAP\Figure 7_Uppermost Aquifer Contour Map Jan 2016.mxd Author: MejiacMD; Date/Time: 10/3/2017, 1:56:28 PM

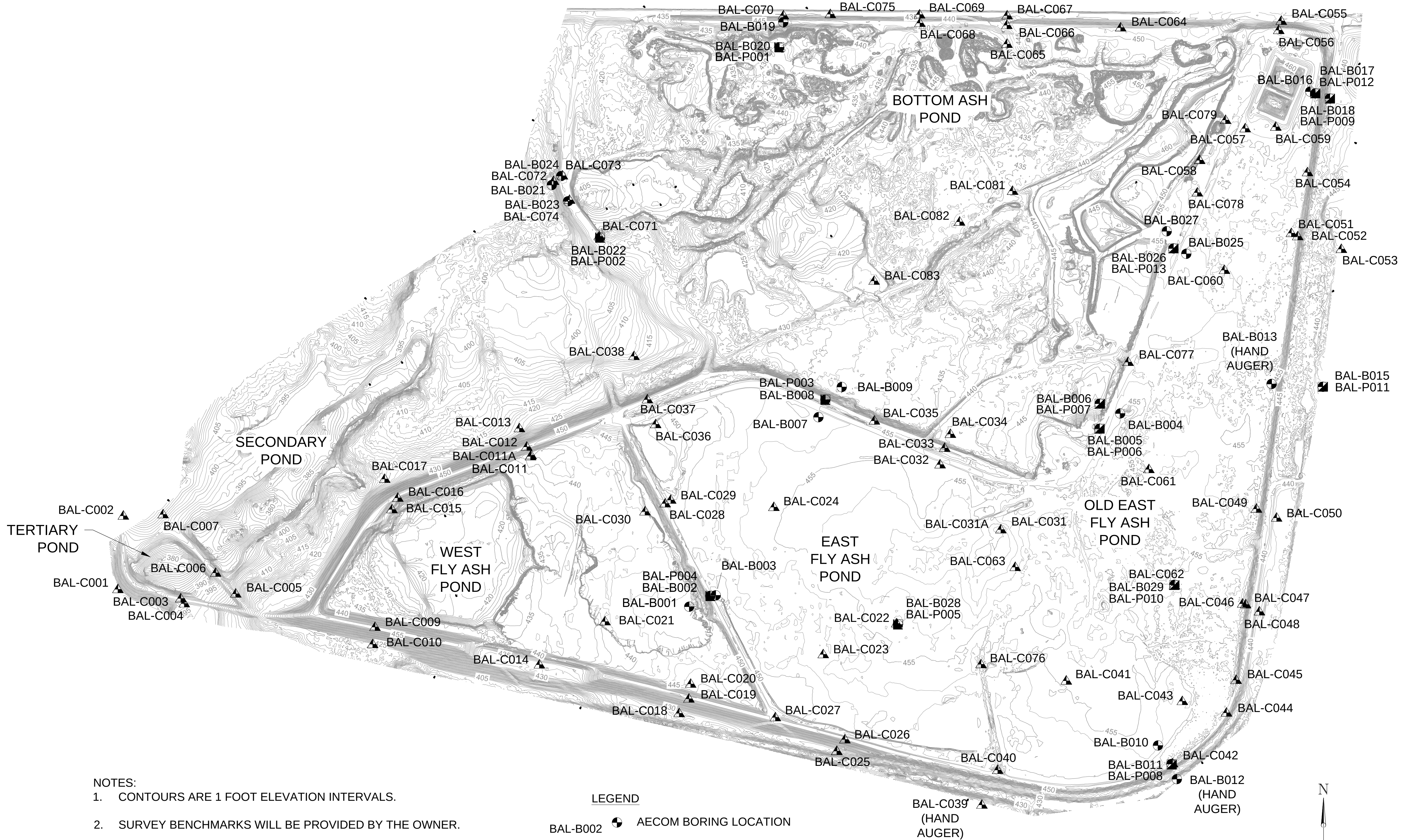
Appendix A

Geotechnical Exploration Locations

Appendix A From:
AECOM, December 17, 2015. 30% Design Data Report for the Dynegy Baldwin Energy Complex; West Fly Ash Pond, East Fly Ash Pond, and Old East Fly Ash Pond CCR Units.

DEGUIRE, DAVID, 12/16/2015 10:15 AM

AECOM DRAWING PATH: P:\Projects\Geotech\60428794_DynegyCCR\04Tasks\00 Program Tasks\01_Templates\CADD\DYNEGY CAD STANDARDS\7.04_Plan_Sheets\D-01 EXPLORATION LOCATIONS.dwg



NOTES:
1. CONTOURS ARE 1 FOOT ELEVATION INTERVALS.
2. SURVEY BENCHMARKS WILL BE PROVIDED BY THE OWNER.
3. EXISTING CONTOURS SHOWN ARE FROM AERIAL SURVEY COMPLETED BY SURDEX ON AUGUST 17, 2015 AND BATHYMETRIC SURVEY COMPLETED BY WEAVER CONSULTANTS GROUP ON SEPTEMBER 22, 2015.

LEGEND

BAL-B002	AECOM BORING LOCATION
BAL-P004	AECOM PIEZOMETER LOCATION
BAL-C021	AECOM CONE PENETRATION TEST (CPT) LOCATION

AECOM
1001 Highlands Plaza Drive, Suite 300
St. Louis, Mo. 63110
314 429-0100 (phone)
314-429-0462 (fax)

DYNEGY
Dynegy Inc.
1500 EastPort Plaza Drive
Collinsville, IL 62234

CCR RULE ASSESSMENT OF PLANTS

BALDWIN POWER PLANT
BALDWIN, IL

30% DESIGN DRAWINGS FOR CLOSURE OF EAST ASH POND, OLD EAST ASH POND, AND WEST ASH POND

ISSUED FOR BIDDING DATE BY

ISSUED FOR CONSTRUCTION DATE BY

REVISIONS

NO.	DESCRIPTION	DATE
△		
△		
△		
△		
△		

AECOM PROJECT NO:	60440742
DRAWN BY:	DJD
DESIGNED BY:	DJD
CHECKED BY:	SAV
DATE CREATED:	2015-10-13
PLOT DATE:	2015-10-13
SCALE:	1" = 300'
ACAD VER:	2014

SHEET TITLE

EXPLORATION LOCATIONS

D-01

SHEET 1 OF 3

Appendix B

Summary of Geotechnical Laboratory Test Results

Appendix B From:
AECOM, December 17, 2015. 30% Design Data Report for the Dynegy Baldwin Energy Complex; West Fly Ash Pond, East Fly Ash Pond, and Old East Fly Ash Pond CCR Units.

Project: Dynergy CCR-Baldwin | **Project No.: 60440739**

Summary of Laboratory Test Results

BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	IDENTIFICATION TESTS										PERMEA-BILITY (cm/sec)	STRENGTH			CONSOLIDATION INITIAL CONDITIONS		REMARKS/ TEST ID
				WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)		Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	VOID RATIO (-)	SATUR-ATION (%)	
BAL-B001	S-4	7.5-9		66.9				SM	31.5	5										
BAL-B001	S-6	15-18		37.9				CL	93.9	6										
BAL-B001	ST-2	35-37									125.6									
BAL-B001	ST-2	35.35		23.1																
BAL-B001	ST-2A	35.6		23.8	63	15	48	CH			126.6	102.3		1.30E-08						P10576
BAL-B001	ST-2	35.9		23.2																
BAL-B001	ST-2	36.15		22.4				CH			128.4	104.9			UU@6.2	1.6	10.9			UU245g
BAL-B001	S-10	45.0-46.5	Brown silty CLAY, trace gravel	16.6																
BAL-B001	S-11	50.0-51.5	Brown silty, CLAY with gravel	12.4																
BAL-B001	S-14	65.0-66.5	Gray brown silty CLAY with fine gravel	19.0																
BAL-B001	S-16	75.0-75.5	Gray brown silty CLAY with fine gravel	12.5																
BAL-B002	S-1	0.0-1.5	Brown silty CLAY, trace sand and gravel	19.5																
BAL-B002	S-2	2.5-4.0	Brown silty CLAY, trace sand and gravel	16.5																
BAL-B002	S-3	5.0-6.5	Brown silty CLAY, trace sand and gravel	19.1	36	19														
BAL-B002	ST-1	8-10									120.5									
BAL-B002	ST-1A	8.25		19.1				CH	91.8	29										dispersion
BAL-B002	ST-1B	8.8		25.9	54	16	38	CH			120.1	95.4			UU@1.1	1	15			UU257i
BAL-B002	S-4	10.0-11.5	Brown silty CLAY, trace sand and gravel	21.0																
BAL-B002	ST-2	15-17									130.3									
BAL-B002	ST-2A	15.45		21.8	46	14	32	CL			123.3	101.2			UU@1.9	0.7	15			UU257j
BAL-B002	S-5	20.0-21.5	Brown silty CLAY, trace sand and gravel	21.7																
BAL-B002	S-6	25.0-26.5	Brown sandy silty CLAY	40.3																
BAL-B002	ST-3	27.5-30									113.5									
BAL-B002	ST-3A	27.75		34.8				ML			111.5	82.7			CIU@3.4	1.3	16.5			T3850
BAL-B002	ST-3B	28.1		26.4				ML			118.5	93.8						0.69	97	C15141
BAL-B002	ST-3C	28.45		32.1	21	21	NP	ML			114.9	87	2.491		CIU@3.5	2.9	19.6			T3851
BAL-B002	ST-3D	28.9		25.5				ML			122	97.2			CIU@3.6	10.1	24.8			T3852
BAL-B002	S-7	30.0-31.5	Brown sandy silty CLAY with gravel	47.9																
BAL-B002	S-8	35.0-36.5	Brown sandy silty CLAY with gravel	36.8																
BAL-B002	S-9	40-41.5		38.6				CL	94.3	5										
BAL-B002	S-10	45.0-46.5	Dark brown silty CLAY, trace sand	32.6																
BAL-B002	S-11	50.0-51.5	Dark brown silty CLAY, trace sand	25.0																
BAL-B002	S-12	55.0-56.5	Brown silty CLAY, trace sand	24.0	42	23														
BAL-B002	S-13	60.0-61.5	Dark brown silty CLAY with gravel, trace organics	33.3																
BAL-B002	S-14	70.0-71.5	Gray silty CLAY, trace sand	16.5																
BAL-B002	S-15	75.0-76.0	Gray silty CLAY, trace sand	17.4	45	24														
BAL-B003	S-4	10.0-11.5	Brown CLAY with fine gravel	22.3	39	17														
BAL-B003	ST-2	15-17									125.3									
BAL-B003	ST-2	15.35		25.4																
BAL-B003	ST-2A	15.6																		
BAL-B003	ST-2	15.95		23.4																
BAL-B003	ST-2B	16.2		24.7	58	15	43	CH			124.8	100.1			UU@1.9	0.8	15			UU230d
BAL-B003	S-6	30.0-31.5	Brown CLAY	40.7				CL	97	7										
BAL-B003	S-8	40.0-41.5	Brown sandy silty CLAY	43.6									2.43							
BAL-B003	S-10	50.0-51.5	Brown fat CLAY, trace sand and gravel	19.3	39	17														
BAL-B003	S-12	60.0-61.5	Light brown silty CLAY	26.9																
BAL-B003	S-13	65.0-66.5	Light gray silty CLAY	21.6	57	30														
BAL-B003	S-14	70.0-75.4	Light gray silty CLAY	18.7																
BAL-B004	S-2	2.5-4		10.3				SW-SM	5.4	0										
BAL-B004	ST-2	25-27									118.1									
BAL-B004	ST-2A	25.35		37.1				PT			115.8	84.5			CIU@3.0	1.4	12.1			T3892
BAL-B004	ST-2B	25.85		23.6	47	14	33	CL			127	102.7			CIU@3.1	1.4	12.3			T3893
BAL-B004	ST-2C	26.35		29.9				CL			119.2	91.8			CIU@3.2	1.8	19			T3894
BAL-B004	S-8	30-31.5		31.4	37	18	19	CL												
BAL-B004	S-9	35.0-36.5	Light gray silty CLAY, trace sand	19.4	38	15														
BAL-B004	S-11	45.0-46.5	Light brown silty CLAY with gravel	20.3																
BAL-B005	S-1	0.0-1.5	Dark brown silty coarse SAND with gravel	9.8																
BAL-B005	S-2	2.5-4.0	Brown silty CLAY	25.7																
BAL-B005	ST-1	5.0-7.0									108.7									
BAL-B005	ST-1	5.75		24.3																UU275A

Summary of Laboratory Test Results

BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	IDENTIFICATION TESTS										PERMEA-BILITY (cm/sec)	STRENGTH			CONSOLIDATION INITIAL CONDITIONS		REMARKS/ TEST ID
				WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)		Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	VOID RATIO (-)	SATUR-ATION (%)	
BAL-B005	ST-1B	6		22	60	17	43	CH			126.5	103.7			UU@0.7	1.9	15			
BAL-B005	S-3	7.5-9.0	Brown silty CLAY	26.2																
BAL-B005	ST-2	10.0-12.0									115.1									
BAL-B005	ST-2A	10.3		25.8				CH			121.4	96.5			CIU@0.8	0.7	19.8			T3910
BAL-B005	ST-2B	10.85		24.8	60	16	44	CH			123.7	99.1			CIU@1.2	1.4	19.6			T3911
BAL-B005	S-4	15.0-16.5	Brown silty CLAY, trace sand	25.1																
BAL-B005	S-5	20.0-21.5	Brown gray silty CLAY	27.5																
BAL-B005	S-6	25.0-26.5	Brown silty CLAY	24.1																
BAL-B005	S-7	30.0-31.5	Brown silty CLAY	21.2	36	18														
BAL-B005	S-8	35.0-36.5	Brown silty CLAY	21.9																
BAL-B005	S-9	40.0-41.5	Brown silty CLAY	16.7																
BAL-B005	S-10	45.0-46.5	Gray silty CLAY	16.6																
BAL-B005	S-11	50.0-51.5	Gray silty CLAY	22.0																
BAL-B005	S-12	55.0-56.5	Gray silty CLAY, trace sand	16.6	44	25														
BAL-B005	S-13	60.0-60.4	Gray brown silty CLAY	18.8																
BAL-B006	S-1	0.0-1.5		11.6				SC	20.9	2										
BAL-B006	S-2	2.5-4.0		67.9				SC	44.4	4										
BAL-B006	S-3	5.0-6.5		31.6				SM	18.5	1										
BAL-B006	S-4	7.5-9.0		24.9				SC	12.8	0										
BAL-B006	S-5	10.0-11.5		19.9				CL	53.4	6										
BAL-B006	S-6	12.5-15	Gray brown silty CLAY, trace sand and fine gravel	21.2																
BAL-B006	ST-1	15.0-17.0									129									
BAL-B006	ST-1	15.15		25.2																
BAL-B006	ST-1	15.7		23.5																
BAL-B006	ST-1B	15.95		17.9				CL			135	114.5			UU@1.4	1.7	15			UU275G
BAL-B006	ST-1	16.25		15.9																
BAL-B006	S-7	20.0-21.5	Gray brown silty CLAY, trace sand and fine gravel	20.8																
BAL-B006	S-8	25.0-26.5	Light brown silty CLAY, trace sand and fine gravel	20	32	14														
BAL-B006	ST-2	30.0-32									139.5									
BAL-B006	ST-2A	30.25		13.4	29	15	14	CL			138.3	122			CIU@2.0	6.1	17.4			T3886
BAL-B006	ST-2B	30.6		13				CL			135.3	119.7	2.682					0.398	87	C15157
BAL-B006	ST-2C	31		13.3				CL			134.8	119			CIU@2.2	7.2	21.8			T3887
BAL-B006	ST-2D	31.5		14				CL			137	120.1			CIU@2.4	5	18.5			T3888
BAL-B006	S-9	35.0-36.5	Light brown silty CLAY, trace sand and fine gravel	29.6																
BAL-B006	S-10	40.0-41.5	Gray silty CLAY, trace sand	22.4																
BAL-B006	S-11	45.0-46.5	Gray CLAY, trace sand	19.1	56	23														
BAL-B006	S-12	50-51.5	Gray silty GRAVEL	9.1																
BAL-B007	S-3	5.5-7.0		65.4	NP	NP														
BAL-B007	ST-1	30-32									123									
BAL-B007	ST-1A	30.4		25				CL			125.8	100.6			CIU@3.6	2.2	15.2			T3857
BAL-B007	ST-1B	30.95		25.8	48	17	31	CL			126.6	100.6	2.609		CIU@3.7	2.9	14.7			T3859
BAL-B007	ST-1C	31.35		22.8				CL			123	100.1						0.661	92	C15142
BAL-B007	ST-1D	31.8		26				CL			125.8	99.8			CIU@3.8	2.5	16.7			T3858
BAL-B008	S-1	0.0-1.5	Brown silty CLAY, trace sand	15.4																
BAL-B008	S-2	2.5-4.0	Brown silty, CLAY, trace sand	21.8																
BAL-B008	S-3	5.0-6.5	Brown silty CLAY, trace sand and fine gravel	21.6	48	21														
BAL-B008	S-4	10.0-11.5	Brown silty CLAY, trace sand and fine gravel	19.6																
BAL-B008	ST-1	10-12																		
BAL-B008	ST-1A	10.35		25.7				CH	84.2	25										dispersion
BAL-B008	ST-1B	10.8		23.1	65	17	48	CH			127.5	103.6		5.50E-09						P10595
BAL-B008	S-5	20.0-21.5	Brown silty CLAY, trace sand and fine gravel	22.5																
BAL-B008	ST-2	20-22									119.5									
BAL-B008	ST-2	20.05		43.5																
BAL-B008	ST-2A	20.3		23.4	58	18	40	CH			125.7	101.9			UU@2.5	0.4	15			UU278e
BAL-B008	S-6	25.0-26.5	Brown silty CLAY, trace sand and fine gravel	20.8																
BAL-B008	S-7	30.0-31.5	Brown silty CLAY, trace sand and fine gravel	26.2	38	17														
BAL-B008	S-8	35.0-36.5	Brown silty CLAY, trace sand and fine gravel	22.9																
BAL-B008	S-9	40.0-41.5	Brown silty CLAY, trace sand and fine gravel	20.8																
BAL-B008	S-10	45.0-46.5	Brown silty CLAY, trace sand and fine gravel	22.1																
BAL-B008	S-11	50.0-51.5	Brown silty CLAY, trace sand and fine gravel	18.0																
BAL-B008	S-12	55.0-56.5	Light brown SILTY SAND	19.2				SM	16											

Summary of Laboratory Test Results

BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	IDENTIFICATION TESTS										PERMEA-BILITY (cm/sec)	STRENGTH			CONSOLIDATION INITIAL CONDITIONS		REMARKS/ TEST ID
				WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)		Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	VOID RATIO (-)	SATUR-ATION (%)	
BAL-B008	S-13	60.0-61.5	Gray silty CLAY, trace sand	17.8	42	25														
BAL-B008	S-14	65.0-66.5	Gray silty CLAY, trace sand	14.0																
BAL-B009	S-1	0-1.5		85.3				MH	78.3	10										
BAL-B009	ST-2	10.5-12.5									122.5									
BAL-B009	ST-2A	10.65		4.3				CL												
BAL-B009	ST-2	10.9		24.9																
BAL-B009	ST-2B	11.15		25.2				CL			124.9	99.8			CIU@1.3	1.8	16.9			T3863
BAL-B009	ST-2	11.45		28																
BAL-B009	ST-2C	11.7		26.3				CL			124.1	98.3			CIU@1.4	1.6	14.6			T3889
BAL-B009	ST-2	12		24.1																
BAL-B009	ST-2D	12.25		26.3	40	19	21	CL	95.2	20	123.6	97.8			CIU@1.5	2.1	14.2			dispersion T3864
BAL-B009	ST-3	25-27									113.6									
BAL-B009	ST-3	25.25		22.1	49	14	35	CL			125.9	103.1			UU@3.1	0.7	15			UU278g
BAL-B009	ST-3	25.85		19.5																
BAL-B009	S-7	30.0-31.5	Brown POORLY GRADED GRAVEL	14.5				GP	3											
BAL-B009	S-8	35.0-36.5	Gray silty CLAY, trace sand	23.2	49	25														
BAL-B009	S-9	40.0-41.5	Gray silty CLAY, trace sand	21.2																
BAL-B010	S-2	2.5-4		50.2				SC	28.4	4										
BAL-B010	S-5	15-16.5		42.5				CL	98.3	7										
BAL-B010	ST-2	20-22									123.9									
BAL-B010	ST-2	20.5		24.7																
BAL-B010	ST-2	21.05		22.1																
BAL-B010	ST-2B	21.3		22.2	42	18	24	CL			124.2	101.7		2.40E-06						P10578
BAL-B010	ST-2	21.6		21.9																
BAL-B010	ST-2C	21.85		20.9				CL			124.9	103.3			UU@2.5	2	3.8			UU246d
BAL-B010	S-8	30.0-31.5	Light brown silty CLAY with sand and gravel	18.6	30	14														
BAL-B010	S-9	35.0-36.5	Brown silty CLAY with sand and gravel	15.0	22	14														
BAL-B010	S-11	45.0-46.5	Light brown silty CLAY with sand and gravel	21.7																
BAL-B010	S-12	50.0-51.5	Brown silty CLAY, trace sand	18.2																
BAL-B011	S-1	0.0-1.5	Brown silty CLAY, trace sand	13.0																
BAL-B011	S-2	2.5-4		23.0				CL	95.2	27										
BAL-B011	S-4	7.5-9.0	Brown silty CLAY, trace sand	18.8																
BAL-B011	S-5	10.0-11.5	Gray brown silty CLAY, trace sand	19.9																
BAL-B011	ST-1	15-17									122.8									
BAL-B011	ST-1A	15.2		25.8							123.3	98		1.80E-09						P10594
BAL-B011	ST-1B	15.7		24.8				CL			125.1	100.2			CIU@1.8	2.5	12.1			T3903
BAL-B011	ST-1C	16.2		24.9				CL			122.3	98			CIU@1.9	2.8	20.1			T3904
BAL-B011	ST-1	16.55		25.4																
BAL-B011	ST-1D	16.8		25.6	46	18	28	CL			121.3	96.6			CIU@2.0	1.7	19.2			T3905
BAL-B011	S-6	20.0-21.5	Gray brown silty CLAY, trace sand	21.7																
BAL-B011	S-7	30.0-31.5	Brown silty CLAY, trace sand	17.8																
BAL-B011	S-8	35.0-36.5	Brown silty sandy CLAY with gravel	8.8	19	11														
BAL-B011	S-9	42.5-44.0	Light brown silty CLAY, trace sand	18.2	49	24														
BAL-B011	S-10	47.5-49.0	Gray silty CLAY, trace sand	19.8																
BAL-B012	S-3	2.0-3.0	Brown silty CLAY, trace sand	22.0	54	24														
BAL-B012	S-7	6.0-7.0	Light brown silty CLAY	20.7	34	18														
BAL-B012	S-10	9.0-10.0	Light brown silty CLAY	21.3																
BAL-B015	S-1	0.0-1.5	Light brown sandy silty CLAY with find gravel and organics	12.5																
BAL-B015	S-2	2.5-4.0	Light brown sandy silty CLAY	21.5																
BAL-B015	ST-1	5.0-7.0									124.7									
BAL-B015	ST-1	5.6		24.8																
BAL-B015	ST-1	6.15		43																
BAL-B015	ST-1C	6.4		21.3	44	17	27	CL			129.1	106.4			UU@0.7	2.3	15			UU275D
BAL-B015	S-3	7.5-9.0	Light brown sandy silty CLAY	22.8																
BAL-B015	S-4	10.0-11.5	Light brown sandy silty CLAY, trace gravel	21.0																
BAL-B015	ST-2	11.5-13.5									128.6									
BAL-B015	ST-2	11.8		19.5																
BAL-B015	ST-2A	12.05		20.8				CH			129.5	107.2			CIU@1.0	1.8	18.7			T3912
BAL-B015	ST-2	12.35		20.8																
BAL-B015	ST-2B	12.6		20.1				CH			129.9	108.2			CIU@1.2	1.8	20.4			T3913
BAL-B015	ST-2	12.9		20.7																

Summary of Laboratory Test Results

BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	IDENTIFICATION TESTS: WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)	PERMEA-BILITY (cm/sec)	STRENGTH: Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	CONSOLIDATION INITIAL CONDITIONS: VOID RATIO (-)	SATUR-ATION (%)	REMARKS/ TEST ID
BAL-B015	ST-2C	13.15		21.1	53	14	39	CH			128.8	106.4			CIU@1.4	1.9	20.1			T3914
BAL-B015	S-5	15.0-16.5	Light brown sandy silty CLAY, trace gravel	23.0																
BAL-B015	S-6	20.0-21.5	Light brown sandy silty CLAY with gravel	18.8																
BAL-B015	S-7	25.0-26.5	Light brown gray silty CLAY, trace sand and gravel	17.1	37	15														
BAL-B015	S-8	30.0-31.5	Light brown silty CLAY, with sand and gravel	23.7																
BAL-B015	S-9	35.0-36.5	Brown silty CLAY, trace sand	23.5																
BAL-B015	S-10	40.0-41.5	Gray brown silty CLAY	20.1																
BAL-B015	S-11	45.0-46.5	Light brown sandy silty CLAY with medium gravel	25.9																
BAL-B015	S-12	50.0-51.5	Gray fat CLAY	21.7	87	33														
BAL-B016	ST-1	4.0-6.0									114.6									
BAL-B016	ST-1	4.15		15.7																
BAL-B016	ST-1A	4.4		15				ML			128	111.3			CIU@0.5	0.8	21.2			T3825
BAL-B016	ST-1	4.7		19.8																
BAL-B016	ST-1B	4.95		27.6				ML			115.4	90.5			CIU@0.6	2.1	18			T3826
BAL-B016	ST-1	5.25		33.3																
BAL-B016	ST-1C	5.5		31.8	24	22	2	ML			107.7	81.7			CIU@0.7	1.9	11.1			T3827
BAL-B016	S-3B	7.5-9.0	Brown SILT	41.3				ML	96	6										
BAL-B016	ST-2	10.0-12.0									103.4									
BAL-B016	ST-2	10.15		44.3																
BAL-B016	ST-2	10.65		49.8																
BAL-B016	ST-2	11.15		54.9																
BAL-B016	ST-2B	10.9		62.1	-	29	NP	ML			96.8	59.7						1.562	97	C15119
BAL-B016	S-4	15.0-16.5		31.3																
BAL-B016	S-5	20.0-21.5	Dark brown SILT	29				ML	90	4										
BAL-B016	S-8	35.0-36.5		22.6																
BAL-B016	S-10	45.0-46.5		17.9																
BAL-B016	S-11	50.0-51.5		14.5	30	15														
BAL-B016	S-12	55.0-56.5		10.3	34	14														
BAL-B016	S-14	65.0-66.5		18.2																
BAL-B017	S-1	0.0-1.5		11.5				ML												
BAL-B017	S-2	2.5-4.0		14.7				ML	73.5	9										
BAL-B017	S-3	5.0-6.5		21.4				ML	67	4										
BAL-B017	S-4	7.5-9.0		28.9				ML	94.2	6										
BAL-B017	ST-1	10.0-12.0									108.5									
BAL-B017	ST-1	11.3		28.4																
BAL-B017	ST-1C	11.55		35	23	25	NP	ML	95.4	7	112.2	83.1			UU@0.8	0.4	15			UU278H
BAL-B017	S-5	15.0-16.5	Brown silty CLAY	30.5																
BAL-B017	S-6	20.0-21.5	Brown silty CLAY with fine gravel	21.4	33	15														
BAL-B017	ST-2	25.5-27.5									122.1									
BAL-B017	ST-2	25.9		30.3																
BAL-B017	ST-2A	26.15		22.6				CL			125.4	102.3			CIU@2.2	6.7	20.1			T3921
BAL-B017	ST-2	26.45		21.9																
BAL-B017	ST-2B	26.7		23.5	44	15	29	CL			124.5	100.8		1.70E-08	CIU@2.4	2	19.7			T3922
BAL-B017	ST-2	27		25																
BAL-B017	ST-2C	27.25		25.4				CL			124.4	99.2			CIU@2.6	1.8	12.9			T3923
BAL-B017	S-7	30.0-31.5	Brown silty CLAY with fine gravel	30.5																
BAL-B017	S-8	35.0-36.5	Brown silty CLAY with fine gravel	21.2	43	11														
BAL-B017	S-9	40.0-41.5	Gray brown sandy silty CLAY with fine gravel	18.1																
BAL-B017	S-10	45.0-45.1	Gray brown sandy silty CLAY with fine gravel	15.6																
BAL-B017	S-11	50.0-51.5	Gray brown sandy silty CLAY with fine gravel	22.6																
BAL-B017	S-12	55.0-56.5	Brown sandy silty CLAY with fine gravel	10.3	28	9														
BAL-B018	S-2	5.0-6.5	Light brown silty CLAY	30.0	37	20														
BAL-B018	ST-2	25-27									126.1									
BAL-B018	ST-2B	25.95		27.4				CH			123.3	96.8			CIU@3.0	0.9	22.7			T3890
BAL-B018	ST-2C	26.55		18.1	54	13	41	CH			129.7	109.9			CIU@3.2	2.2	18.2			T3865
BAL-B018	S-7	35.0-36.5	Light brown silty CLAY	23.6																
BAL-B018	S-8	40.0-41.5	Gray silty CLAY, trace sand	17.7	47	25														
BAL-B018	S-9	45.0-46.5	Gray silty CLAY, trace sand	18.4																
BAL-B019	S-1	0.0-1.5		15.3																
BAL-B019	S-3	5.0-6.5		22.4	40	19														
BAL-B019	S-7	15.0-16.5		17.5																

Summary of Laboratory Test Results

BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	IDENTIFICATION TESTS: WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)	PERMEA-BILITY (cm/sec)	STRENGTH: Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	CONSOLIDATION INITIAL CONDITIONS: VOID RATIO (-)	SATUR-ATION (%)	REMARKS/ TEST ID
BAL-B019	ST-1	25-27.5									128.1									
BAL-B019	ST-1	25.45		24.3																
BAL-B019	ST-1	26		25.1																
BAL-B019	ST-1	26.55		23.9																
BAL-B019	ST-1C	26.8		24.5	38	17	21	CL			124.8	100.3			UU@3.1	1.5	14.6			UU231a
BAL-B019	ST-2	35-37.5									118.4									
BAL-B019	ST-2	35.35		34.7																
BAL-B019	ST-2	35.9		25.6																
BAL-B019	ST-2	36.5		22.3																
BAL-B019	ST-2C	36.8		22.1	55	15	40	CH			126.8	103.8			UU@4.1	2	8.8			UU231b
BAL-B019	S-11	45.0-46.5		16.7	33	16														
BAL-B019	S-13	55.0-56.5		18.6	40	18														
BAL-B019	S-14	60.0-61.5		21.9	43	26														
BAL-B019	S-16	70.0-71.0		15.4																
BAL-B019	S-18	80.0-80.8		17.5																
BAL-B020	S-2A	2.5-4		19.5				SP-SM	10.8	1										
BAL-B020	ST-2	9-11									121.1									
BAL-B020	ST-2A	9.4		30.8				CH			120.4	92.1			CIU@1.1	0.9	19			T3901
BAL-B020	ST-2B	9.9		25.6	51	17	34	CH			123.5	98.3			CIU@1.2	1.2	18.8			T3895
BAL-B020	ST-2C	10.4		24.7				CH			125.8	100.9			CIU@1.3	1.3	17.9			T3896
BAL-B020	S-5	20.0-21.5	Brown SANDY LEAN CLAY	22.6	38	16		CL	67											
BAL-B020	S-7B	30.0-31.5	Brown CLAY with SAND	18.7				CL	78											
BAL-B020	S-10	45.0-46.5	Gray silty sandy CLAY with fine gravel	11.2																
BAL-B020	S-13	60.0-61.5	Gray silty CLAY	21.6	73	36														
BAL-B020	S-17	80.0-81.5	Gray silty CLAY	21.3																
BAL-B021	ST-1	2.5-4.5									117.5									
BAL-B021	ST-1A	2.75		20.6				CL			125.8	104.3			CIU@0.3	0.6	18			T3834
BAL-B021	ST-1B	3.25		22.4	49	15	34	CL			124.9	102			CIU@0.54	0.9	20.5			T3835
BAL-B021	S-3	7.5-9.0		20.8	43	17														
BAL-B021	S-5	15.0-16.5		20.7																
BAL-B021	S-6	20.0-21.5		20.5																
BAL-B021	S-9	35.0-36.5		18.6	42	23														
BAL-B022	S-3	5.0-6.5	Brown silty CLAY, trace fine gravel	22.0	28	18														
BAL-B022	ST-1	10-12									130.3									
BAL-B022	ST-1	10.35		21.1																
BAL-B022	ST-1A	10.6		20.7				CL			129.4	107.2			CIU@1.2	2.2	20.1			T3906
BAL-B022	ST-1	10.9		19.9																
BAL-B022	ST-1B	11.15		19.1	40	15	25	CL	80.3	22	130.3	109.4			CIU@1.3	2	15.3			dispersion T3907
BAL-B022	ST-1	11.45		18.7																
BAL-B022	ST-1C	11.7		18.4				CL			130.7	110.4			CIU@1.4	2.5	20.2			T3908
BAL-B022	S-8	35.0-36.5	Gray silty CLAY, trace gravel	23.6	58	25														
BAL-B022	S-10	45.0-45.8	Gray silty CLAY, trace gravel	16.6																
BAL-B023	S-3	5.0-6.5		18.6	37	14														
BAL-B023	ST-1	10.0-12.5									129									
BAL-B023	ST-1	10.3		23.7																
BAL-B023	ST-1A	10.55		22.6	51	15	36	CH			127.7	104.1			UU@1.3	2.1	15			UU230b
BAL-B023	ST-1	10.85		22.3																
BAL-B023	ST-1B	11.1																		
BAL-B023	S-6	20.0-21.5		22.3	34	18														
BAL-B023	ST-2	25-27.5									132.8									
BAL-B023	ST-2B	25.65		17.9				CL			132.2	112.1			CIU@3.0	2.6	21.4			T3828
BAL-B023	ST-2C	26.05		16.2	36	14	22	CL			133.4	114.8			CIU@3.2	2.5	21			T3829
BAL-B023	S-7	30.0-31.5		26.7	59	30														
BAL-B023	S-8	35.0-36.5		17.8																
BAL-B023	S-11	50.0-50.8		16.1																
BAL-B024	S-4	7.5-9.0		18.7																
BAL-B024	S-6	15.0-16.5		24.1	41	19														
BAL-B024	ST-1	20.0-22.5									128									
BAL-B024	ST-1	20.45		28.1																
BAL-B024	ST-1A	20.7		19.4				CL			130	108.9			CIU@2.4	2.8	17.7			T3831
BAL-B024	ST-1	21.05		20.0																

Summary of Laboratory Test Results

BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	IDENTIFICATION TESTS										PERMEA-BILITY (cm/sec)	STRENGTH			CONSOLIDATION INITIAL CONDITIONS		REMARKS/ TEST ID
				WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)		Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	VOID RATIO (-)	SATUR-ATION (%)	
BAL-B024	ST-1B	21.3		20.5	49	13	36	CL			129.6	107.6			CIU@2.5	2.8	11			T3832
BAL-B024	ST-1	21.6		20.6																
BAL-B024	ST-1C	21.9		19.4				CL			128.6	107.7			CIU@2.6	2.3	6.2			T3833
BAL-B024	S-7	25.0-26.5		18.1																
BAL-B024	S-10	40.0-41.5		14.5	45	23														
BAL-B024	S-12	50.0-51.5		22.6																
BAL-B025	ST-1	7.5-9.5									112.5									
BAL-B025	ST-1	7.75		22.4																
BAL-B025	ST-1A	8		22.0				CL	74.3	4										
BAL-B025	ST-1	8.3		25.6																
BAL-B025	ST-1	8.85		55.1																
BAL-B025	S-4	10.0-11.5		40.4									2.46							
BAL-B025	S-7	25.0-26.5		26.5	40	20														
BAL-B025	S-9B	40.0-41.5		19.3	32	16														
BAL-B025	S-11	50.0-51.5		24.2																
BAL-B025	S-12	55.0-56.5		16.7	43	21														
BAL-B026	S-4	7.5-9		9.4				SM	14.6											
BAL-B026	S-6	15-16.5		19.4				SW-SM	5.8											
BAL-B026	ST-1	20-22																		
BAL-B026	ST-1	20.45		37.3																
BAL-B026	ST-1	21		27.3																
BAL-B026	ST-1	21.55		23.5																
BAL-B026	ST-1C	21.8		20.1				CL	97.5	28	128	106.5			UU@2.6	2	8.7			UU257k
BAL-B026	S-7A	25-26.5		32.9				CL	78.9											
BAL-B026	ST-2	35-37									126.3									
BAL-B026	ST-2A	35.35		23.6				CH			125.4	101.4			CIU@4.2	2	19			T3860
BAL-B026	ST-2B	35.9		24.0				CH			125.9	101.6			CIU@4.3	2.1	19.2			T3861
BAL-B026	ST-2C	36.25		23.5	61	14	47	CH			124.3	100.6	2.675					0.649	96	C15144
BAL-B026	ST-2D	36.8		22.9				CH			126.4	102.9			CIU@4.4	1.9	15.9			T3862
BAL-B026	S-9	40.0-41.5	Brown silty CLAY, trace gravel	17.8	48	13														
BAL-B026	S-11	50.0-51.5	Brown silty CLAY, trace gravel	23.5	49	19														
BAL-B026	S-12	55.0-56.5	Brown silty CLAY, trace gravel	16.6	43	17														
BAL-B026	S-15	70.0-71.5	Gray silty CLAY, trace sand	16.5																
BAL-B027	S-1	0-1.5		17.7				SW-SM	5.3											
BAL-B027	S-7	20-21.5		16.7				SP	0.2											
BAL-B027	ST-1	25-27									124.6									
BAL-B027	ST-1	25.55		21.1																
BAL-B027	ST-1	26.1		21.8																
BAL-B027	ST-1C	26.35		21.4				CL			128.5	105.9			UU@3.1	3.3	11.9			UU275e
BAL-B027	ST-1	26.65		21.1																
BAL-B027	ST-1D	26.9		21.2	43	16	27	CL			127.7	105.4		5.00E-09						P10596
BAL-B027	ST-2	35-37									127.3									
BAL-B027	ST-2	35.3		19.1																
BAL-B027	ST-2	35.85		19.9																
BAL-B027	ST-2	36.4		19.8																
BAL-B027	ST-2C	36.65		20.3	47	15	32	CL			130	108			UU@4.3	1.6	15			UU275f
BAL-B027	S-10	45.0-46.5	Light brown silty CLAY	24.1																
BAL-B027	S-12	55.0-56.5	Gray silty CLAY, trace sand	17.4	47	21														
BAL-B027	S-13	60.0-61.5	Gray silty CLAY, trace sand	19.4																
BAL-B028	S-1	0-1.5		72.5																
BAL-B028	S-2	2.5-4.0		70.8				ML	67.5	11										
BAL-B028	ST-1	5.0-7.0									89.5									
BAL-B028	ST-1	5.4		104.4																
BAL-B028	ST-1	5.95		76.6																
BAL-B028	ST-1	6.55		114.3																
BAL-B028	ST-1C	6.8		90.7	47	53	NP	ML	81.4		90.7	47.6			CYCTRX@0.7					CTXS488
BAL-B028	S-3	7.5-9.0		103.7				ML	75.6	13										
BAL-B028	ST-2	9.0-11.0									89.5									
BAL-B028	ST-2A	9.3		48.5				ML	67.9		104.4	70.3			CYCTRX@1.0					CTXS487
BAL-B028	ST-2B	9.95		65	47	52	NP	ML			101.8	61.7	2.684					1.716	102	C15154
BAL-B028	S-4	15-17		39.6				ML	64.3	6										

Summary of Laboratory Test Results

BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	IDENTIFICATION TESTS: WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)	PERMEA-BILITY (cm/sec)	STRENGTH: Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	CONSOLIDATION INITIAL CONDITIONS: VOID RATIO (-)	SATUR-ATION (%)	REMARKS/ TEST ID
BAL-B028	S-5	20-22		34.9				ML	97.7	8										
BAL-B028	S-6A&B	25-26.5		50.6				CL	89.4	9										
BAL-B028	S-7	30.0-31.5	Brown silty Clay	26.7																
BAL-B028	S-8	35.0-36.5	Brown silty CLAY with sand and gravel	20.3	40	18														
BAL-B028	S-9	40.0-41.5	Brown silty CLAY with sand and gravel	20.7																
BAL-B028	S-10	45.0-46.5	Brown silty CLAY with sand and gravel	16.5																
BAL-B028	S-11	50.0-51.5	Brown silty CLAY with sand and gravel	20.2																
BAL-B028	S-12	55.0-56.5	Gray silty CLAY, trace sand	21.0																
BAL-B028	S-13	60.0-61.5	Gray silty CLAY with sand and gravel	16.7																
BAL-B028	S-14	65.0-66.5	Gray silty CLAY, trace gravel	18.9	39	25														
BAL-B028	S-15	70.0-71.5	Gray silty CLAY, trace gravel	18.5																
BAL-B028	S-16	75.0-76.5	Gray silty CLAY, trace gravel	20.9																
BAL-B028	S-17	80.0-81.5	Gray silty CLAY, trace gravel	17.8																
BAL-B028	S-18	85.5-86.0	Gray silty CLAY, trace gravel	17.7																
BAL-B029	S-1	0.0-1.5		20.6	42	19	23	CL												
BAL-B029	S-2	2.0-4.0		31				CL	95.7	6										
BAL-B029	S-3	7.5-9.0		31.9				ML	86	7										
BAL-B029	S-4	10.0-11.5		34.1				ML	94.5	8										
BAL-B029	S-5	20.0-21.5	Gray sandy silty CLAY	22.1	32	16														
BAL-B029	S-6	25.0-26.5	Gray brown sandy silty CLAY	19.8																
BAL-B029	S-7	30.0-31.5	Gray brown sandy silty CLAY	21.9	47	22														
BAL-B029	S-8	35.0-56.5	Brown sandy CLAY with gravel	10.9																
BAL-B029	S-9	40.0-41.5	Brown sandy CLAY with gravel	26.3	56	20														
BAL-B029	S-11	50.0-51.5	Brown gray sandy silty CLAY	21.8																
BAL-C039	S-1	0.0-1.0	Brown silty CLAY, trace sand	34.0	52	26														
BAL-C039	S-2	2.0-3.0	Brown silty CLAY with organics	24.5	37	16														
BAL-C039	S-6	5.0-6.0	Brown silty CLAY with organics, trace sand and gravel	21.7																

NOTE: Laboratory tests were performed by AECOM, Conshoshocken, Pennsylvania and Terrasense, Totowa, New Jersey.

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ATTACHMENT 7 – ASSESSMENT OF CORRECTIVE MEASURES (FLY ASH POND SYSTEM)

Intended for
Dynegy Midwest Generation, LLC

Date
November 30, 2020

Project No.
1940072855

CORRECTIVE MEASURES ASSESSMENT REVISION 2

BALDWIN FLY ASH POND SYSTEM

BALDWIN ENERGY COMPLEX
10901 BALDWIN ROAD
BALDWIN, ILLINOIS

Bright ideas. Sustainable change.

CORRECTIVE MEASURES ASSESSMENT REVISION 2
BALDWIN FLY ASH POND SYSTEM

Project Name	**Baldwin Fly Ash Pond System**
Project No.	**1940072855**
Recipient	**Dynegy Midwest Generation, LLC**
Document Type	**Corrective Measures Assessment**
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DOCUMENT REVISION RECORD

Issue No.	Date	Details of Revisions
Revision 0	September 5, 2019	• Original Document
Revision 1	November 15, 2019	Typographical edits, addition of a citation in References section, and Table 1 formatting edit as follows: • Revised first paragraph line three of Section 1.2.5 on document page 3 of 14 from "measusre" to "measure" • Revised seventh bullet line six of paragraph two in Section 2.4 on document page 6 of 14 from "Ash Pond 2" to "the Baldwin Fly Ash Pond System," • Removed last partial sentence of paragraph four in Section 3.2.1 on document page 8 of 14, "Based on MNA case histories evaluated for 24 inorganic constituents, including most Appendix III and Appendix IV constituents, in other industries," • Revised third bullet line two of paragraph two in Section 5.1 on document page 13 of 14 from "appendix IV" to "Appendix IV" • Revised lines five and six of last paragraph in Section 5.1 on document page 13 of 14 from "Ash Pond 2" to "the Baldwin Fly Ash Pond System" • Added citation for "Willman, H.B. and others. 1967. Geologic Map of Illinois. Illinois State Geological Survey. Champaign, Illinois." in References section on document page 14 of 14 • Revised Table 1 border formatting column 7 row 3
Revision 2	November 30, 2020	• Revised as follows: • Section 2 – added additional geology/hydrogeology information, including Appendices A through D, added reference to lithium SSLs, added plume delineation information, including Tables 1 and 2 and Figures 2, 3, and 4. • Section 3 – removed discussion of in-situ solidification /stabilization (ISS) because it is not applicable to bedrock as a groundwater corrective measure. Separated permeable reactive barrier and in-situ chemical treatment into separate sections for discussion • Section 4 - focused on application of evaluation criteria added to Section 1 to potential groundwater corrective measures referenced in Section 3, added Appendix E with independent evaluation of MNA • Section 5 – focused on potential groundwater corrective measures referenced in Sections 3 and 4 • Table 3 – focused on application of evaluation criteria added to Section 1 to potential groundwater corrective measures referenced in Section 3

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APPENDICES

1. INTRODUCTION

Ramboll Americas Engineering Solutions Inc., formerly known as O'Brien & Gere Engineers, Inc (Ramboll), has prepared this revision of the Corrective Measures Assessment (CMA) for the Baldwin Fly Ash Pond System located at the Baldwin Energy Complex (BEC, the Site). This CMA report complies with the requirements of Title 40 of the Code of Federal Regulations (C.F.R.) § 257, Subpart D, Standards for the Disposal of Coal Combustion Residuals (CCR) in Landfills and Surface Impoundments (CCR Rule). Under the CCR Rule, owners and operators of existing CCR surface impoundments (SIs) must initiate a CMA, in accordance with 40 C.F.R. § 257.96, when one or more Appendix IV constituents are detected at statistically significant levels (SSLs) above groundwater protection standards (GWPS) in the Uppermost Aquifer, and the owner or operator has not completed an alternate source demonstration demonstrating that a source other than the CCR unit has caused the contamination. This CMA is responsive to the 40 C.F.R. § 257.96 requirements for assessing potential corrective measures to address the exceedance of the GWPS for lithium in the Uppermost Aquifer.

In March 2016, Dynegy Midwest Generation, LLC (DMG) submitted the Closure and Post-Closure Care Plan for the Baldwin Fly Ash Pond System (Closure Plan [AECOM, 2016]) to the Illinois Environmental Protection Agency (IEPA). The Closure Plan set forth source control measures and sought approval to close the Fly Ash Pond System by leaving CCR in place and constructing a final cover system of earthen material. The final cover system has lower permeability than the subsoils underlying the CCR, will control the potential for water infiltration into the closed CCR unit, and allows drainage of water off of, and water out of, the closed CCR unit. The Closure Plan included provisions for performing groundwater monitoring to assess natural attenuation and maintenance of the final cover system as measures to address exceedances of GWPS. The IEPA subsequently approved the Closure Plan in a letter to Dynegy Operating Company dated August 16, 2016 (IEPA, 2016). Construction of the final cover system was completed November 17, 2020.

This CMA is the next step in developing a long-term corrective action plan to address lithium SSLs in the Uppermost Aquifer. Source control measures have been completed, including pumping to remove surface water, dewatering the CCR, relocating and/or reshaping the existing CCR to achieve acceptable grades for closure, and constructing an earthen cover system (additional details are discussed in Section 2). This CMA has been prepared to evaluate applicable remedial measures to address the lithium SSLs in the Uppermost Aquifer. The results of the CMA will be used to select a remedy for the Uppermost Aquifer, consistent with 40 C.F.R. § 257.96 and § 257.97 requirements.

1.1 Corrective Measures Assessment Objectives and Methodology

The objective of this CMA is to evaluate appropriate corrective measure(s) to address impacted groundwater in the Uppermost Aquifer potentially associated with the Fly Ash Pond System at the BEC. The CMA evaluates the effectiveness of the corrective measures in meeting the requirements and objectives of the remedy, as described under 40 C.F.R. § 257.96(c), by addressing the following evaluation criteria:

- Performance
- Reliability

- Ease of implementation
- Potential impacts of appropriate potential remedies (safety impacts, cross-media impacts, and control of exposure to any residual contamination)
- Time required to begin and complete the remedy
- Institutional requirements that may substantially affect implementation of the remedy(s) (permitting, environmental or public health requirements)

The CMA provides a systematic, rational method for evaluating potential corrective measures. The assessment process documented herein: a) identifies the site-specific conditions that will influence the effectiveness of the potential corrective measures (Section 2); b) identifies applicable corrective measures (Section 3); c) assesses the corrective measures against the evaluation criteria to select potentially feasible corrective measures (Section 4); and d) summarizes the remedy selection process and future actions (Section 5).

1.2 Evaluation Criteria

The evaluation criteria are defined below to provide a common understanding and consistent application. The evaluation included qualitative and/or semi-quantitative screening of the corrective measures relative to their general performance, reliability and ease of implementation characteristics, and their potential impacts, timeframes and institutional requirements. Evaluations were at a generalized level of detail in order to screen out corrective measures that were not expected to meet 40 C.F.R. § 257.97 design criteria, while retaining corrective measures that would meet the design criteria.

This evaluation considered the elements qualitatively, applying engineering judgement with respect to known site conditions, to provide a reasoned set of corrective measures that could be used, either individually or in combination, to supplement the source control measures and achieve GWPS in the most effective and protective manner.

1.2.1 Performance

The performance of potentially applicable corrective measures was evaluated for the:

1. Potential to ensure that any environmental releases to groundwater, surface water, soil and air will be at or below relevant regulatory and health-based benchmarks for human and ecological receptors.
2. Degree to which the corrective measure isolates, removes or contains SSLs identified in the Uppermost Aquifer.
3. Ability of the corrective measure to achieve GWPS within the Uppermost Aquifer at the compliance boundaries.

1.2.2 Reliability

The reliability of the corrective measure is a description of its ability to function as designed until the GWPS are achieved in the Uppermost Aquifer at the compliance boundaries. Evaluation of the reliability included considering:

1. Type and degree of long-term management required, including monitoring, operation, and maintenance.

2. Long-term reliability of the engineering and institutional controls associated with the corrective measure.
3. Potential need for replacement of the corrective measure.

1.2.3 Ease of Implementation

The ease or difficulty of implementing a given corrective measure was evaluated by considering:

1. Degree of difficulty associated with constructing the corrective measure.
2. Expected operational reliability of the corrective measure.
3. Need to coordinate with and obtain necessary approvals and permits.
4. Availability of necessary equipment and specialists.
5. Available capacity and location of needed treatment, storage, and disposal services.

1.2.4 Potential Impacts of the Remedy

Potential impacts associated with a given corrective measure included consideration of impacts on the distribution and/or transport of contaminants, safety impacts (the short-term risks that might be posed to the community or the environment during implementation), cross-media impacts (increased traffic, noise, fugitive dust), and control of potential exposure of humans and environmental receptors to remaining wastes.

1.2.5 Time Required to Begin, Implement, and Complete the Remedy

Evaluating the time required to begin the remedy focused on the site-specific conditions that could require additional or extended timeframes to characterize, design, and/or field test a corrective measure to verify its applicability and effectiveness. The length of time that would be required to begin and implement the remedy was considered to be the total time to: 1) verify applicability and effectiveness; and 2) to complete construction of the corrective measure.

The time required to complete the remedy considered the total time after the corrective measure was implemented until GWPS would be achieved in the Uppermost Aquifer at the compliance boundaries.

1.2.6 Institutional, Environmental or Public Health Requirements

Institutional, environmental and public health requirements considered state, local, and site-specific permitting or other requirements that could substantially affect construction or implementation of a corrective measure.

2. SITE HISTORY AND CHARACTERIZATION

2.1 Site Description and History

The BEC is owned and operated by DMG, and is located in southwest Illinois in Randolph and St. Clair Counties. The Randolph County portion of the BEC is located within Sections 2, 3, 4, 9, 10, 11, 14, 15, and 16 of Township 4 South and Range 7 West. The St. Clair County portion of the property is located within Sections 33, 34, and 35 of Township 3 South and Range 7 West. The Baldwin Fly Ash Pond System is approximately one-half mile west-northwest of the Village of Baldwin (Figure 1).

The BEC is a coal-fired electrical generating plant that began operation of its first unit in 1970; two additional generating units were put into service in 1973 and 1975. The plant initially burned bituminous coal from Illinois and switched to subbituminous coal in 1999. Total plant generating capacity is approximately 1,892 megawatts.

The BEC property is bordered on the west by the Kaskaskia River; on the east by Baldwin Road, farmland, and strip mining areas; on the southeast by the village of Baldwin; on the south by the Illinois Central Gulf railroad tracks, scattered residences, and State Route 154; and on the north by farmland. The St. Clair/Randolph County Line crosses east-west at approximately the midpoint of the Baldwin Power Plant Cooling Lake. Figure 1 shows the location of the plant; Figure 2 is a site plan showing the location of the Fly Ash Pond System and groundwater monitoring system established in accordance with the requirements of 40 C.F.R. § 257.91.

The Fly Ash Pond System at the BEC is a CCR Multi-Unit consisting of three unlined SIs: the East Fly Ash Pond, Old East Fly Ash Pond, and West Fly Ash Pond, with a combined surface area of approximately 232 acres. The Fly Ash Pond System discharged to the Bottom Ash Pond, which discharged to the Secondary Pond, and in turn to the Tertiary Pond, which ultimately flows towards a tributary of the Kaskaskia River, south of the Cooling Pond intake structure. The elevation of the top of ash is lower than the surrounding berms, which provide full ash containment. The Fly Ash Pond System is estimated to contain about 10,000,000 cubic yards (CY) of CCR.

2.2 Geology and Hydrogeology

Geologic units present at the Fly Ash Pond System include fill, ash generated at BEC, and unlithified glacial deposits overlying Mississippian and Pennsylvanian bedrock. Outside of the fill material, groundwater in the unlithified deposits from the water table to the top of bedrock is monitored per Illinois EPA’s request and is referred to as the Upper Groundwater Unit. This unit includes the Cahokia Alluvium, Peoria Loess, Equality Formation, and Vandalia Till Member, as described below. The Bedrock Unit beneath the unlithified deposits constitutes the geologic formation nearest the natural ground surface that is an aquifer. Thus, per 40 C.F.R. § 257.53, the Bedrock Unit comprises the Uppermost Aquifer and is monitored in accordance with 40 C.F.R. § 257.90. Details of Site geology are also provided in cross-sections AA’ through EE’ (Appendix A).

The five principal types of unlithified materials (Upper Groundwater Unit) present above the Bedrock Unit (Uppermost Aquifer), in the vicinity of the Fly Ash Pond System, consist of the following, in descending order:

- UNLITHIFIED DEPOSITS (UPPER GROUNDWATER UNIT)
  - Fill, predominantly coal ash - (fly ash, bottom ash, and slag). Fill is within the Fly Ash Pond System, but also includes constructed berms around the ponds and constructed railroad embankment to the south.
  - Cahokia Formation - (alluvial clay, sandy clay, and clayey sand). The Cahokia Formation is the uppermost unlithified unit between the ash ponds and the Kaskaskia River, and along the south side of the western third of the Fly Ash Pond System. The Cahokia, an alluvial deposit of the Kaskaskia River and its tributaries, consists predominantly of clay with some clayey sand and sandy clay intervals.
  - Peoria Loess - (silt and silty clay). The Peoria Loess occurs in topographically higher areas and bedrock upland areas and is typically underlain by the Vandalia Till Member of the Glasford Formation. It was categorized as silt and silty clay and ranges from 2 to 23 ft. in thickness.
  - Equality Formation - (clay and sandy clay with occasional sand seams and lenses). The Equality Formation is present as the lowermost unlithified geologic layer along the southwestern portion of the Fly Ash Pond System, where it lies between the Cahokia and bedrock. It is present as the uppermost unlithified layer at the south-central portion of the Fly Ash Pond System where the Cahokia pinches out. It is also the present as the middle or uppermost unlithified layer in the central portion of the Fly Ash Pond System, where it is either the uppermost unit above the Vandalia Till Member or lies between the Vandalia Till Member and either the Peoria Loess or CCR and fill material. The Equality was deposited in a slackwater lake formed as a result of back flooding of the Kaskaskia River during flooding events of the Mississippi River. The Equality ranged in thickness from 8 to 20 ft.
  - Vandalia Till Member - (clay and sandy clay diamictons with intermittent and discontinuous sand lenses). The Vandalia Till Member of the Glasford Formation is the lowermost and oldest unlithified geologic material in the vicinity of the Fly Ash Pond System. The Vandalia Till is a diamicton and occurs beneath the Equality in the central portion of the Site as the Cahokia pinches out and as the topographic and bedrock uplands are approached. At the higher topographic elevations (*i.e.*, bedrock uplands) to the east and southeast of the ash ponds, the Vandalia Till is the principal unlithified geologic material, but may be mantled in some areas by 4 to 6 ft of the Peoria Loess. The Vandalia Till also exhibits some intermittent and discontinuous sand lenses. The lowermost portion of the Vandalia Till may become shaley within a few feet of the top of bedrock.
- BEDROCK UNIT (UPPERMOST AQUIFER)
  - Bedrock Unit (Uppermost Aquifer). - The Bedrock Unit is the Uppermost Aquifer beneath the Fly Ash Pond System. The Bedrock Unit consists of Pennsylvanian and Mississippian bedrock, mainly limestone and shale. The shallow bedrock transitions from Mississippian-age limestone and shale beneath the western portion of the Site, to Pennsylvanian-age limestone and shale toward the east (Willman, 1967). The change from Mississippian bedrock to Pennsylvanian bedrock occurs beneath the central portion of the ash ponds. The shallow bedrock is composed of interbedded and undifferentiated limestone and shale. Bedrock topography slopes generally to the west and southwest across the Fly Ash Pond System. A bedrock low is present at the southwest corner of the Site and extends

northeastward. The topographic relief of the bedrock (change in bedrock elevation beneath the site) is approximately 45 ft.

The Uppermost Aquifer is the shallow Pennsylvanian and Mississippian-aged bedrock that immediately underlies the unlithified deposits. Within the boundaries of the Site, only thin and intermittent sand lenses are present within predominantly clay deposits, thus, the unlithified materials do not represent a continuous aquifer unit. The shallow bedrock yields water through interconnected secondary porosity features (e.g. cracks, fractures, crevices, joints, bedding planes and other secondary openings). The shallow bedrock is the only water-bearing unit that is continuous across the Site. Groundwater in the Pennsylvanian and Mississippian-aged bedrock mainly occurs under semi-confined to confined conditions with the overlying unlithified unit behaving as the upper confining unit to the Uppermost Aquifer.

Groundwater flow in the unlithified glacial materials, and in the bedrock, is to the west and southwest, and ultimately flows towards the Kaskaskia River or its tributaries, which border the BEC to the west and south. The Kaskaskia River in the vicinity of the Fly Ash Pond System is a gaining stream. Groundwater flow maps completed between 2015 and 2020 are included as Appendix B. The horizontal migration of CCR constituents in groundwater is limited by the low permeability of both the unlithified deposits, and the Uppermost Aquifer.

Field measurements indicated that the horizontal hydraulic conductivity for the Upper Groundwater Unit ranged from $3.5x10^{-7}$ to $6.8x10^{-4}$ cm/s, with a geometric mean of $3.2x10^{-5}$ cm/s. Laboratory testing of vertical hydraulic conductivity measurements from the units that comprise the Upper Groundwater Unit have a geometric mean value of $8.6x10^{-7}$. Based on field testing, the geometric mean horizontal hydraulic conductivity for the Uppermost Aquifer (Bedrock Unit) was $5.0x10^{-6}$ cm/s (NRT, 2014 and Appendix C).

A hydraulic conductivity of 5×10^{-6} cm/s and a median effective porosity of 30% were used to calculate bedrock groundwater velocities based on data referenced in Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, 2014). Groundwater flow velocity in the vicinity of the neighboring bottom ash pond was approximately 0.0017 and 0.0009 feet per day (ft/day) as groundwater flowed from east to west across the site on March 19, 2019 and September 24, 2019, respectively. Less than 0.0008 ft/day change in groundwater velocity was observed when comparing March 19, 2019 and September 24, 2019 (Appendix C).

Recent vertical gradients determined at the site between the unlithified deposits and the bedrock Uppermost Aquifer at nested well pairs MW-150/MW-350, MW-155/MW-355, OW-156/MW-356, and MW-252/MW-352 on March 19, 2019 and September 24, 2019 are downward, with the exception of gradients at nested well pair OW-156/MW-356 (Appendix C).

2.3 Groundwater Quality and Plume Delineation

Water quality in the Uppermost Aquifer (i.e., Pennsylvanian and Mississippian-aged bedrock) decreases with increasing depth as water becomes increasingly mineralized due to naturally occurring conditions. Further, the ability of the unit to store and transmit water is dependent on the density of bedrock features that contribute to secondary porosities and whether those features are interconnected enough to yield water. Therefore, the lower limit of the uppermost aquifer is the depth at which either the groundwater is mineralized to a point that it is no longer a useable water source or the secondary porosities do not yield a sufficient volume of groundwater to produce a useable water supply.

Detection monitoring in the Uppermost Aquifer, per 40 C.F.R. § 257.90, was initiated in November 2015; statistically significant increases (SSIs) of Appendix III parameters over background concentrations were detected in October 2017. Alternate source evaluations were inconclusive for one or more of the SSIs. Therefore, in accordance with 40 C.F.R. § 257.94(e)(2), an Assessment Monitoring Program was established on April 9, 2018 (Table 1). Assessment Monitoring results identified statistically significant levels (SSLs) of the Appendix IV parameter lithium over the GWPS based on background concentrations of 0.0693 milligrams per Liter (mg/L). SSLs for lithium were identified in downgradient monitoring wells MW-375 and MW-391 (Figure 2).

In accordance with the Statistical Analysis Plan for BEC (NRT, 2017), SSLs are based on the median of the three most recent sampling event concentrations compared to the GWPS. The highest median concentrations associated with the lithium SSLs at MW-375 and MW-391 are 0.0742 milligrams per liter (mg/L) and 0.129 mg/L, respectively (Table 2). Plume delineation well (MW-350) was added to the monitoring well network at the property line down gradient of MW-391 and sampling was initiated in June of 2019. In 2020, the background groundwater protection standard (GWPS) calculation was updated to the date range of 11/1/2017 to 3/26/20 to account for changing conditions at background wells MW-304 and MW-306 (Table 2 and Figure 3). No other parameters have been identified as having SSLs for the Fly Ash Pond System.

Lithium is present in background wells in excess of the health-based screening level of 0.04 mg/L; therefore, the GWPS is based on background concentrations (Table 2 and Figure 4). Exceedances of the GWPS in the Uppermost Aquifer are limited to the area close to the BEC's south and southwest property boundary. SSLs at MW-391 are defined by MW-375 to the south, MW-350 to the west, the secondary and tertiary ponds to the northwest, and MW-366 to the northeast (Figure 3). Due to the low permeability of the bedrock Uppermost Aquifer, MW-391 did not have a sufficient quantity of groundwater to facilitate sample collection during the March, June, August, and September 2016 sampling events, as well as those in July and November 2017. Lithium concentrations in MW-391 were initially below background concentrations. As the well equilibrated with the low permeability bedrock and water levels stabilized, lithium concentrations also stabilized near current levels (Figure 4). Mann-Kendall analysis of the last six lithium concentrations observed in MW-391 indicate there is no statistically significant trend in concentrations (Appendix D) confirming the relative stability of lithium concentrations.

2.4 Source Control: IEPA-Approved Closure in Place (Soil Cover System) and MNA

Construction of source control measures is complete and included pumping to remove surface water, dewatering the CCR, relocating and/or reshaping the existing CCR to achieve acceptable grades for closure, and constructing an earthen cover system. The earthen cover system complies with applicable design requirements of the CCR Rule, including establishment of a vegetative cover to minimize long-term erosion. The new cover system will significantly minimize water infiltration into the closed CCR unit (the primary source of CCR constituents in groundwater) and improve surface water drainage off the cover system, thus reducing generation of potentially impacted water, and ultimately reducing the extent of lithium impacts in the Uppermost Aquifer.

Natural attenuation processes will constitute a “finishing step” after effective source control. Ongoing groundwater monitoring will document the attenuation and long-term effectiveness of the source control. The IEPA-Approved source control measures include, but are not limited to, the following primary components:

- Pumping to remove surface water.
- Dewatering the CCR to allow cover system construction.
- Relocating and/or reshaping the existing CCR to achieve acceptable grades for closure. Plant-generated CCR may be placed in the Baldwin Fly Ash Pond System as beneficial reuse.
- Constructing an earthen cover system that complies with the CCR Rule, including establishment of a vegetative cover to minimize long-term erosion. The soil cover system consists of a minimum 18-inch infiltration layer of compacted earthen material, with a permeability less than 1 x 10^{-5} cm/sec, which is less than the permeability of the subsoils present below the CCR to allow water in the pore space of the CCR to drain into the foundation soils and not accumulate in the closed impoundment.
- Constructing a stormwater management system to convey runoff from the final cover system into a system of interior collection channels for routing through two new stormwater detention ponds and ultimately discharging through the existing Secondary Pond and Tertiary Pond prior to discharge through the BEC's existing NPDES permitted Outfall.
- An operational sewage lagoon with a geomembrane liner is located in the northernmost end of the Baldwin Fly Ash Pond System. The sewage lagoon was constructed on top of CCR, in the northeast corner of the Baldwin Fly Ash Pond System; and, will remain open and operational after the closure of the Baldwin Fly Ash Pond System. The area surrounding this sewage lagoon will be closed in place with a final cover system, in compliance with the CCR Rule, and the final cover system will tie into the lagoon perimeter berm.
- Monitoring attenuation processes in groundwater of the Upper Groundwater Unit and the Uppermost Aquifer, to demonstrate that the extent of groundwater impact is decreasing in size and concentration following closure. In accordance with the IEPA-approved Groundwater Monitoring Plan (NRT, 2016), if a statistically significant increasing trend is observed to continue over a period of two or more years, and a subsequent hydrogeologic site investigation demonstrates that such exceedances are due to a release from the Baldwin Fly Ash Pond System, and corrective actions are necessary and appropriate to mitigate the release, a corrective action plan will be proposed as a modification to the Post-Closure Care Plan.
- Ongoing inspection and maintenance of the cover system and stormwater and property management, per the approved Post-Closure Care Plan.

3. DESCRIPTION OF CORRECTIVE MEASURES

3.1 Objectives of the Corrective Measures

The following performance standards, per 40 C.F.R. § 257.97, must be met by the selected corrective measures:

- Be protective of human health and the environment
- Attain the groundwater protection standards per 40 C.F.R. § 257.95(h)
- Provide source control to reduce or eliminate, to the maximum extent feasible, further releases of Appendix IV constituents
- Remove from the environment as much of the contaminated material as feasible
- Comply with waste management standards, per 40 C.F.R. § 257.98(d)

3.2 Potential Groundwater Corrective Measures

Site-specific considerations regarding the Fly Ash Pond System provided in Section 2 were used to evaluate potential groundwater corrective measures. Each of the corrective measures evaluated may be capable of satisfying the performance standards listed above to varying degrees of effectiveness. The corrective measure review process yields a set of applicable corrective measures that can be used to supplement the source control activities described in Section 2. The corrective measures may be used independently or may be combined into specific remedial alternatives to leverage the advantages of multiple corrective measures to attain GWPS in the Uppermost Aquifer.

The following potential corrective measures are commonly used to mitigate groundwater impacts and were considered as a part of the CMA process:

- Monitored Natural Attenuation (MNA)
- Groundwater Extraction
- Groundwater Cutoff Wall
- Permeable Reactive Barrier
- In-Situ Chemical Treatment

3.2.1 Monitored Natural Attenuation

Both federal and state regulators have long recognized that MNA can be an acceptable component of a remedial action when it can achieve remedial action objectives in a reasonable timeframe. In 1999, the USEPA published a final policy directive (USEPA, 1999) for use of MNA for groundwater remediation and described the process as follows:

- The reliance on natural attenuation processes (within the context of a carefully controlled and monitored site cleanup approach) to achieve site-specific remediation objectives within a time frame that is reasonable compared to that offered by other more active methods. The ‘natural attenuation processes’ that are at work in such a remediation approach include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater. These in-situ processes include biodegradation; dispersion; dilution; sorption; volatilization; radioactive decay; and chemical or biological stabilization, transformation, or destruction of contaminants.

The USEPA has stated that source control (like the completed IEPA-approved earthen cover system) is the most effective means of ensuring the timely attainment of remediation objectives (USEPA, 1999). Natural attenuation processes may be appropriate as a "finishing step" after effective source control implementation, if there are no risks to receptors and/or the contaminant plume is not expanding. Thus, MNA would be used in conjunction with source control measures described in Section 2.

The 1999 USEPA MNA document was focused on organic compounds in groundwater. However, in a 2015 companion document, the USEPA addressed the use of MNA for inorganic compounds in groundwater. The USEPA noted that the use of MNA to address inorganic contaminants: (1) is not intended to constitute a treatment process for inorganic contaminants; (2) when appropriately implemented, can help to restore an aquifer to beneficial uses by immobilizing contaminants onto aquifer solids and providing the primary means for attenuation of contaminants in groundwater; and (3) is not intended to be a "do nothing" response (USEPA, 2015). Rather, documenting the applicability of MNA for groundwater remediation should be thoroughly and adequately supported with site-specific characterization data and analysis in accordance with the USEPA's tiered approach to MNA (USEPA 1999, 2007, and 2015):

1. Demonstrate that the area of groundwater impacts is not expanding.
2. Determine the mechanisms and rates of attenuation.
3. Determine that the capacity of the aquifer is sufficient to attenuate the mass of constituents in groundwater and that the immobilized constituents are stable and will not remobilize.
4. Design a performance monitoring program based on the mechanisms of attenuation and establish contingency remedies (tailored to site-specific conditions) should MNA not perform adequately.

Both physical and chemical attenuation processes can contribute to the reduction in mass, toxicity, mobility, volume, or concentration of contaminants in groundwater. Physical attenuation processes applicable to CCR include dilution, dispersion and flushing. Chemical attenuation processes applicable to CCR include precipitation and coprecipitation (*i.e.*, incorporation into sulfide minerals), sorption (*i.e.*, to iron, manganese, aluminum, or other metal oxides or oxyhydroxides, or to sulfide minerals or organic matter), and ion exchange.

All inorganic compounds are subject to physical attenuation processes. Physical mechanisms may be the primary natural attenuation processes acting upon CCR constituents, such as boron, chloride and lithium, that are relatively mobile (poorly chemically attenuated). The performance of MNA as a groundwater remedy varies based on site-specific conditions. Additional data collection and analysis may be required to support the USEPA's tiered approach to MNA (USEPA, 2015) and obtain regulatory approval.

3.2.2 Groundwater Extraction

Groundwater extraction is one of the most widely used groundwater corrective measures and has a long history of performance. This corrective measure includes installation of one or more groundwater pumping wells or trenches to control and extract impacted groundwater.

Groundwater extraction captures and contains impacted groundwater and can limit plume expansion and/or off-site migration. Construction of a groundwater extraction system typically includes, but is not limited to, the following primary components:

- Designing and constructing a groundwater extraction system consisting of one or more extraction wells and operating at a rate to allow capture of CCR impacted groundwater within the Uppermost Aquifer.
- Management of extracted groundwater, which may include modification to the existing NPDES permit, including treatment prior to discharge, if necessary.
- Ongoing inspection and maintenance of the groundwater extraction system.

Remediation of inorganics by groundwater extraction can be effective, but systems do not always perform as expected. A combination of factors, including geologic heterogeneities, difficulty in flushing low permeability zones, and rates of contaminant desorption from aquifer solids can limit effectiveness. Groundwater extraction systems require ongoing operation and maintenance to ensure optimal performance and the extracted groundwater must be managed, either by ex-situ treatment or disposal.

3.2.3 Groundwater Cutoff Wall

Since the late 1970s and early 1980s, vertical cutoff walls have been used to control and/or isolate impacted groundwater. Low-permeability cutoff walls can be used to prevent horizontal off-site migration of potentially impacted groundwater. Cutoff walls act as barriers to transport of impacted groundwater and can isolate soils that have been impacted by CCR to prevent contact with unimpacted groundwater. Cutoff walls are often used in conjunction with an interior pumping system to establish a reverse gradient within the cutoff wall. The reverse gradient imparted by the pumping system maintains an inward flow through the wall, keeping it from acting as a groundwater dam and controlling potential end-around or breakout flow of contaminated groundwater.

A commonly used cutoff wall construction technology is the slurry trench method, which consists of excavating a trench and backfilling it with a soil-bentonite mixture, often created with the soils excavated from the trench. The trench is temporarily supported with bentonite slurry that is pumped into the trench as it is excavated (D’Appolonia & Ryan, 1979). Excavation for cutoff walls is conducted with conventional hydraulic excavators, hydraulic excavators equipped with specialized booms to extend their reach (*i.e.*, long-stick excavators), or chisels and clamshells, depending upon the depth of the trench and the material to be excavated. Constructing the cutoff wall such that it intersects a low-permeability material at its base, referred to as “keying”, can greatly increase its effectiveness, depending on the objectives of the barrier.

Cutoff walls could be used in combination with groundwater extraction or as part of a permeable reactive barrier system (as the “funnel” in a funnel-and-gate system; Section 3.2.4). The strength of the bedrock and the required cutoff wall design depth are not known; verifying whether a cutoff wall could be constructed in the bedrock Uppermost Aquifer would be necessary.

3.2.4 Permeable Reactive Barrier

Chemical treatment via a Permeable Reactive Barrier (PRB) is defined as an emplacement of reactive materials in the subsurface designed to intercept a contaminant plume, provide a flow path through the reactive media, and transform or otherwise render the contaminant(s) into environmentally acceptable forms to attain remediation concentration goals downgradient of the barrier (EPRI, 2006).

As groundwater passes through the PRB under natural gradients, dissolved constituents in the groundwater react with the media and are transformed or immobilized. A variety of media have been used or proposed for use in PRBs. Zero-valent iron has been shown to effectively immobilize some CCR constituents, including arsenic, chromium, cobalt, molybdenum, selenium, and sulfate. Zero-valent iron has not been proven effective for boron, antimony, or lithium (EPRI, 2006).

System configurations include continuous PRBs, in which the reactive media extends across the entire path of the contaminant plume; and funnel-and-gate systems, where low-permeability barriers are installed to control groundwater flow through a permeable gate containing the reactive media. Continuous PRBs intersect the entire contaminant plume and do not materially impact the groundwater flow system. Design may or may not include keying the PRB into a low-permeability unit at depth. Funnel-and-gate systems utilize a system of barriers to groundwater flow (funnels) to direct the contaminant plume through the reactive gate. The barriers, typically some form of cutoff wall, are keyed into a low-permeability unit at depth to prevent short circuiting of the plume. Funnel-and-gate design must consider the residence time to allow chemical reactions to occur. Directing the contaminant plume through the reactive gate can significantly increase the flow velocity, thus reducing residence time.

Design of PRB systems requires rigorous site investigation to characterize the site hydrogeology and to delineate the contaminant plume. A thorough understanding of the geochemical and redox characteristics of the plume is critical to assess the feasibility of the process and select appropriate reactive media. Laboratory studies, including batch studies and column studies using samples of site groundwater, are needed to determine the effectiveness of the selected reactive media at the site (EPRI, 2006). The main considerations in selecting reactive media are as follows (EPRI, 2006):

- Reactivity - The media should be of adequate reactivity to immobilize a contaminant within the residence time of the design.
- Hydraulic performance - The media should provide adequate flow through the barrier, meaning a greater particle size than the surrounding aquifer materials. Alternatively, gravel beds have been emplaced in front of barriers to direct flow through the barrier.
- Stability - The media should remain reactive for an amount of time that makes its use economically advantageous over other technologies.
- Environmentally compatible by-products - Any by-products of media reaction should be environmentally acceptable. For example, iron released by zero-valent iron corrosion should not occur at levels exceeding regulatory acceptance levels.
- Availability and price: The media should be easy to obtain in large quantities at a price that does not negate the economic feasibility of using a PRB.

3.2.5 In-Situ Chemical Treatment

In-situ chemical treatment for inorganics are being tested and applied with increasing frequency (Evanko and Dzombak, 1997). In-situ chemical treatment includes the targeted injection of reactive media into the subsurface to mitigate groundwater impacts. Inorganic contaminants are typically remediated through immobilization by reduction or oxidation followed by precipitation or adsorption (EPRI, 2006). Chemical reactants that have been applied or are in development for application in treating inorganic contaminants include ferrous sulfate, nanoscale zero-valent iron, organo-phosphorus nutrient mixture (PrecipiPHOS™) and sodium dithionite (EPRI, 2006). Zero-valent iron has been shown to effectively immobilize some CCR constituents, including arsenic, chromium, cobalt, molybdenum, selenium, and sulfate. However, the CCR constituent detected in the Uppermost Aquifer, lithium, has not been proven to be amenable to transformation or immobilization using reactive media.

In-situ chemical treatment design considerations include the following (EPRI, 2006):

- Source location and dimensions
- Source contaminant mass
- The ability to comingle the contaminants and reactants in the subsurface
- Competing subsurface reactions (that consume added reactants)
- Hydrologic characteristics of the source and subsurface vicinity
- Delivery options for the cleanup procedure(s)
- Capture of any contaminants mobilized by the procedures
- Long-term stability of any immobilized contaminants

4. EVALUATION OF POTENTIAL CORRECTIVE MEASURES

4.1 Evaluation Criteria

The potential groundwater corrective measures described in the previous section were evaluated relative to the criteria presented in Section 1.2 and reiterated below:

- Performance
- Reliability
- Ease of implementation
- Potential impacts of appropriate potential remedies (safety impacts, cross-media impacts, and control of exposure to any residual contamination)
- Time required to begin and complete the remedy
- Institutional requirements that may substantially affect implementation of the remedy(s) (permitting, environmental or public health requirements)

These factors are presented in Table 3 to allow a qualitative evaluation of the ability of each potential corrective measure to address SSLs for lithium in the Uppermost Aquifer. The goal is to understand which potential corrective measures could be used, either independently or in combination, to attain the GWPS, as discussed in the following sections.

Discussion of potential groundwater corrective measures is provided below with content pertaining to each evaluation criteria provided above highlighted in **bold** text.

4.2 Potential Groundwater Corrective Measure Evaluation

As presented in the previous section, the following groundwater corrective measures are potentially viable to address SSLs for lithium in the Uppermost Aquifer:

- MNA
- Groundwater Extraction
- Groundwater Cutoff Wall
- Permeable Reactive Barrier
- In-Situ Chemical Treatment

These potential corrective measures are discussed below relative to their ability to effectively address the SSLs for lithium in the Uppermost Aquifer.

4.2.1 Monitored Natural Attenuation

MNA is an in-situ remedial technology which relies on source control and natural processes occurring in aquifers to attenuated dissolved constituents and thereby reduce their concentrations in groundwater. MNA is most effective at sites where the source is controlled, the contaminant plume is stable or shrinking, contaminant concentrations are low, and potential receptors are not exposed to concentrations greater than health-based values. The **performance** of MNA as a groundwater remedy can vary based on site-specific conditions; these conditions should be evaluated in accordance with USEPA's tiered approach to MNA (USEPA 1999, 2007, and 2015).

The results of an in-progress independent evaluation regarding the potential feasibility of MNA as a groundwater remedy are provided as Attachment D. This evaluation considered whether site-specific conditions appear favorable for **implementation** of MNA. As part of this evaluation, the likely ability of MNA, in combination with source control, to meet the criteria provided in 40 C.F.R. § 257.96(c) was completed; these results are also summarized in Table 3. As discussed in the independent evaluation in Attachment D, MNA performance is likely to achieve the 40 C.F.R. § 257.97 performance criteria based on the conclusions of the evaluation. Additional efforts will be completed to gather information to complete the tiered evaluation in accordance with USEPA guidance which will support the selection of MNA, in combination with source control, as a groundwater remedy. The MNA evaluation is currently underway at the Miami Fort Pond System and will be completed in 2021.

4.2.2 Groundwater Extraction

Groundwater extraction is a widely accepted groundwater corrective measure with a long track record of performance and reliability. It is routinely approved by the IEPA. The **performance** of a groundwater extraction system is dependent on site-specific hydrogeologic conditions and would require additional data collection (aquifer testing) and possibly groundwater fate and transport modeling to support the design and regulatory approval. Groundwater extraction systems are proven **reliable** when properly designed and maintained. The low-permeability and heterogeneous lithology of the bedrock Uppermost Aquifer could present difficulties for designing an effective system. The Uppermost Aquifer bedrock has a mean horizontal hydraulic conductivity of $5.0x10^{-6}$ cm/s and groundwater flow velocity was recently estimated in the upper aquifer at approximately 0.0017 (ft/day). For a corrective measure using groundwater extraction to effectively control off-site flow or to remove potentially contaminated groundwater, horizontal and vertical capture zone(s) must be created using pumping wells. However, the low permeability Uppermost Aquifer would restrict the ability to pump at rates high enough to establish the required capture zone(s) or require a high density of wells. Cutoff walls (Section 4.2.3) could also be used in conjunction with a pumping system to control groundwater movement. Source control measures (Section 2) will reduce the mass loading to the Uppermost Aquifer, thus reducing the total contaminant mass that would need to be captured to attain GWPS.

Implementation of a groundwater extraction system presents design challenges due to the low permeability and heterogeneous lithology of the Uppermost Aquifer. Details of the bedrock bedding planes, fracture distribution and density, as well as the contaminant distribution within the fracture system, would be needed to effectively design the extraction system. Extracted groundwater would need to be managed, which may include modification to the existing NPDES permit and treatment prior to discharge, if necessary. Trenches would likely not be feasible due to the depth and lithified character of the Uppermost Aquifer.

There could be some **impacts** associated with constructing and operating a groundwater extraction system, including some limited exposure to extracted groundwater. Additional data collection and analyses would be required to design an extraction system. Construction could be completed within 1 year. **Time of implementation** is approximately 3 to 4 years, including characterization, design, permitting and construction. **Timeframes to achieve GWPS** are dependent on site-specific conditions, which require detailed technical analysis. Groundwater extraction requires **approval by the IEPA** to be implemented.

4.2.3 Groundwater Cutoff Wall

Groundwater cutoff walls are a widely accepted corrective measure used to control and/or isolate impacted groundwater and are routinely approved by the IEPA. Cutoff walls have a long history of **reliable performance** as hydraulic barriers provided they are properly designed and constructed. Construction of a cutoff wall extending into the Uppermost Aquifer would be difficult, if it is technical feasible, because the aquifer is in bedrock. **Implementation** of a groundwater cutoff wall presents design challenges due to the lithified nature of the Uppermost Aquifer. Cutoff walls are generally constructed in unconsolidated soil deposits and keyed into low permeability materials such as bedrock. Additional site investigation would be required to verify the feasibility of a cutoff wall in the bedrock Uppermost Aquifer.

Cutoff walls are designed to act as hydraulic barriers, as a result, cutoff walls inherently alter the existing groundwater flow system. Changes to the existing groundwater flow system may need to be controlled to maximize the effectiveness of the remedy, for example, groundwater extraction may be required to control build-up of hydraulic head upgradient and around the cutoff walls. The effectiveness and **performance** of a cutoff wall as a hydraulic barrier also relies on the contrast between the hydraulic conductivity of the aquifer and the cutoff wall. The most effective barriers have hydraulic conductivity values that are several orders of magnitude lower than the aquifer that it is in contact with. A cutoff wall designed with hydraulic conductivity of 1x10-7 cm/sec would be less than two orders of magnitude lower than the aquifer with a mean conductivity of 5x10-6 cm/sec, which may adversely affect **reliability** as groundwater may migrate through the barrier under certain conditions.

There could be some **impacts** associated with constructing and operating a groundwater cutoff wall in bedrock, including changes to the groundwater flow system that have to be considered for effective groundwater corrective action. Additional data collection and analyses would be required to design a cutoff wall. Construction could be completed within 2 to 3 years. **Time of implementation** is approximately 5 to 8 years, including characterization, design, permitting and construction. To attain GWPS, cutoff walls require a separate groundwater corrective measure to operate in concert with the hydraulic barriers. Cutoff walls are commonly coupled with MNA and/or groundwater extraction as groundwater corrective measures. The **time to attain GWPS** is dependent on the selected groundwater corrective measure or measures that are coupled with the cutoff walls. Cutoff walls require **approval by the IEPA** to be implemented.

The Uppermost Aquifer is a bedrock unit consisting mainly of limestone and shale overlain by tens of feet of unlithified, fine grained soil deposits. Constructing an effective cutoff wall, with sufficient contrast between the hydraulic conductivity of the aquifer and the cutoff wall would be difficult and may not be possible; and, groundwater treatment requires a separate groundwater corrective measure. Therefore, groundwater cutoff wall was not retained as a viable corrective measure to address SSLs of lithium in the Uppermost Aquifer.

4.2.4 Permeable Reactive Barrier

PRB application as a groundwater corrective measure for lithium is not well established and more research is needed (EPRI, 2006), therefore, **performance and reliability** are unknown.

Implementation of PRBs may have design challenges associated with both groundwater hydraulics and plume configuration. The Uppermost Aquifer is a bedrock unit consisting mainly of limestone and shale overlain by tens of feet of unlithified, fine-grained soil deposits. Constructing an effective PRB system, including emplacement of reactive media, within the bedrock of the Uppermost Aquifer would be difficult, and may not be possible.

Funnel-and-gate PRBs inherently alters the existing groundwater flow system. These changes to the existing groundwater flow system may need to be controlled to reduce potential **impacts** of the remedy. Construction of PRBs could be completed within 2 to 3 years, if possible. **Time of implementation** is approximately 6 to 9 years, including characterization, design, permitting and construction. **Timeframes to achieve GWPS** are dependent on site-specific conditions, including reactivity, which is unproven, and maintenance (replacement or rejuvenation requirements) which require detailed technical analysis. PRBs and potentially associated groundwater cutoff walls (funnel-and-gate system) require **approval by the IEPA** to be implemented.

The Uppermost Aquifer is located in bedrock and the CCR constituent detected in the Uppermost Aquifer, lithium, has not been proven to be amenable to transformation or immobilization using reactive media. Therefore, PRB was not retained as a viable corrective measure to address SSLs of lithium in the Uppermost Aquifer.

4.2.5 In-Situ Chemical Treatment

In-situ chemical treatment of lithium is not well established and more research is needed (EPRI, 2006); therefore, **performance and reliability** are unknown.

Implementation of in-situ chemical treatment may have chemical delivery challenges due to the low permeability and heterogeneous lithology of the Uppermost Aquifer. Details of the bedrock bedding planes, fracture distribution and density, as well as the contaminant distribution within the fracture system, would be needed to effectively design an injection system.

Injections of reactive media will alter the geochemistry of the flow system and could be completed within 2 to 3 years, if feasible. **Time of implementation** is approximately 8 to 13 years, including characterization, design, permitting and injections. Chemical treatment alters groundwater geochemical conditions, which may result in potential **impacts** associated with implementation of the remedy. **Timeframes to achieve GWPS** are dependent on site-specific conditions, including reactivity and maintenance (replacement or rejuvenation requirements) which require detailed technical analysis. Since in-situ chemical treatment alters groundwater geochemistry implementation of the remedy **may require Underground Injection Control approval (UIC)**.

The Uppermost Aquifer is located in bedrock and the CCR constituent detected in the Uppermost Aquifer, lithium, has not been proven to be amenable to transformation or immobilization using reactive media. Therefore, in-situ chemical treatment was not retained as a viable corrective measure to address SSLs of lithium in the Uppermost Aquifer.

5. REMEDY SELECTION PROCESS

5.1 Retained Corrective Measures

This CMA was prepared to address the requirements of 40 C.F.R. § 257.96. The following potentially viable corrective measures were identified based upon site-specific conditions:

- MNA
- Groundwater Extraction

Per 40 C.F.R. § 257.97, a remedy must be selected to address the SSLs in the Uppermost Aquifer, based on the results of the CMA. The remedy should be selected as soon as feasible and must meet the following standards:

- Be protective of human health and the environment
- Attain the groundwater protection standard as specified pursuant to § 257.95(h)
- Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in Appendix IV to this part into the environment
- Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems
- Comply with standards for management of wastes as specified in § 257.98(d)

Source control measures completed will significantly minimize water infiltration into the closed CCR unit and allow surface water to drain off the cover system, thus reducing the generation of potentially impacted water and reducing the extent of groundwater impacts by natural attenuation, both in the unlithified deposits above bedrock and in the bedrock Uppermost Aquifer.

Based on the analysis completed to date (Attachment D), MNA combined with source control appears to be a promising groundwater remedy at the Baldwin FAP when evaluated against the requirements in 40 C.F.R. § 257.96(c). Further investigation will be completed in 2021 to collect sufficient evidence to support the tiered MNA evaluation, which will include a better understanding of site hydrogeology and conditions after closure to develop multiple lines of evidence in accordance with USEPA guidance.

Additional aquifer testing and capture zone evaluation is also required to facilitate design of a groundwater extraction system, if necessary.

The Post-Closure Care Plan includes on-going groundwater monitoring to demonstrate that the extent of groundwater impact is decreasing in size and concentration in the Uppermost Aquifer following closure. In accordance with the IEPA-approved Groundwater Monitoring Plan (NRT, 2016), if a statistically significant increasing trend is observed to continue over a period of two or more years, and a subsequent hydrogeologic site investigation demonstrates that such exceedances are due to a release from the Baldwin Fly Ash Pond System, and corrective actions are necessary and appropriate to mitigate the release, a corrective action plan will be proposed as a modification to the Post-Closure Care Plan. The corrective action plan may incorporate one or more of the corrective measures identified in this CMA to address impacts from CCR constituents in the Uppermost Aquifer.

5.2 Future Actions

Source control by IEPA-Approved closure in place was completed November 17, 2020. MNA will be implemented as part of the approved Closure Plan, including monitoring of the Uppermost Aquifer. Further investigation will be completed in 2021 to collect sufficient evidence to support the tiered MNA evaluation.

Semiannual reports per § 257.97 will continue to be prepared to describe the progress in selecting and designing the remedy that addresses SSLs for lithium in the Uppermost Aquifer. A final report describing the selected remedy and how it meets the standards listed above will also be prepared, per § 257.97.

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TABLES

Table 1 - Assessment Monitoring Program Summary, Baldwin Fly Ash Pond System

Sampling Dates	Analytical Data Receipt Date	Parameters Collected	SSL(s) Appendix IV	SSL(s) Determination Date	ASD Completion Date	CMA Completion / Status
September 25-26, 2018	November 6, 2018	Appendix III	--	--	--	--
		Appendix IV Detected[1]	Lithium (MW-375, MW-391)	January 7, 2019	NA	September 5, 2019 (completed CMA)
March 19-20, 2019	April 30, 2019	Appendix III	--	--	--	--
		Appendix IV	Lithium (MW-375, MW-391)	July 29, 2019	NA	ongoing
June 25, 2019 (delineation)[2]	July 10, 2019	Lithium	NA	NA	NA	NA
September 24-25, 2019	October 24, 2019	Appendix III	--	--	--	--
		Appendix IV Detected[1]	Lithium (MW-375, MW-391)	January 22, 2020	NA	Feasibility study phase of CMA; Public meeting held December 2, 2019
March 24-26, 2020	April 15, 2020	Appendix III	--	--	--	March 5, 2020 (Semiannual remedy selection progress report)
		Appendix IV	Lithium (MW-391)	July 30, 2020	NA	September 5, 2020 (Semiannual remedy selection progress report)
September 15-17, 2020	October 16, 2020	Appendix III	--	--	--	--
		Appendix IV Detected[1]	TBD	TBD	TBD	TBD

[O:KLT 11/23/20, C: RAB 11/24/2020]

Notes:

-- = SSL evaluation does not apply to Appendix III parameters
ASD = Alternate Source Demonstration
CMA = Corrective Measures Assessment
NA = Not Applicable
SSL = Statistically Significant Level
TBD = To Be Determined
1. Groundwater sample analysis was limited to Appendix IV parameters detected in previous events in accordance with 40 C.F.R. Part 257.95(d)(1).
2. June 25, 2019 sample was collected as part of a delineation event and the analytical result was not statistically evaluated for an SSL. Individual monitoring well exceedance of the GWPS is presented on Table 2

Table 2 - Groundwater Concentrations Delineating The Lithium Plume, Baldwin Fly Ash Pond System

Monitoring Well ID	Parameter:	Lithium (mg/L)								Parameter:	Lithium (mg/L)			
	Date:	9/25-26/2018		3/19-20/2019		6/25/2019		9/24-25/2019		Date:	3/24-26/2020		9/15-17/2020	
	GWPS	Result	Comparison Value[1]	Result	Comparison Value[1]	Result	Comparison Value[1]	Result	Comparison Value[1]	GWPS[2]	Result	Comparison Value[1]	Result	Comparison Value[1]
MW-304	0.0693	0.0958	0.0958	0.0833	0.0833	NS	NS	0.0836	0.0836	**0.0958**	0.0782	0.0782	0.0910	0.0910
MW-306	0.0693	0.0132	0.0132	0.0143	0.0143	NS	NS	0.0133	0.0133	**0.0958**	0.0132	0.0132	0.0143	0.0143
MW-350[3]	0.0693	--	--	--	--	0.0788	**0.0788**	--	--	**0.0958**	0.0787	0.0787	0.0964	TBD
MW-366	0.0693	0.0171	0.0171	0.0101	0.0115	NS	NS	0.0177	0.0150	**0.0958**	0.0094	0.0124	0.0121	TBD
MW-375	0.0693	0.0707	0.0666	0.0744	0.0687	NS	NS	0.0831	**0.0742**	**0.0958**	0.0772	0.0746	0.0916	TBD
MW-377	0.0693	0.0584	0.0573	0.0603	0.0597	NS	NS	0.0671	0.0578	**0.0958**	0.0637	0.0596	0.0690	TBD
MW-383	0.0693	0.0354	0.0350	0.0387	0.0373	NS	NS	0.0421	0.0387	**0.0958**	0.0369	0.0392	0.0444	TBD
MW-384	0.0693	0.0392	0.0428	0.0433	0.0449	NS	NS	0.0451	0.0425	**0.0958**	0.0426	0.0437	0.0522	TBD
MW-390	0.0693	0.0146	0.0219	0.0153	0.0145	NS	NS	0.0249	0.0183	**0.0958**	0.0161	0.0188	0.0174	TBD
MW-391	0.0693	0.135	**0.0996**	0.128	**0.126**	NS	NS	0.124	**0.129**	**0.0958**	0.127	**0.126**	0.129	TBD

[O: RAB 11/23/2020, C:KLT 11/23/20, U: RAB 11/25/2020. C:KLT 11/25/20. C:BGH 11/27/20]

Notes:

Bold red highlighted concentration indicates exceedance of GWPS for parameter indicated

-- = No sample; monitoring well not part of CCR program during sampling event
GWPS = Groundwater Protection Standard
mg/L = milligrams per liter
NS = Not Sampled
TBD = To Be Determined
1. Comparison Values are presented on plume maps.
2. Background GWPS calculation was updated to the date range of 11/1/2017-3/26/2020 to account for changing conditions in background wells MW-304 and MW-306. The GWPS was then applied to the sampling event of March 2020.
3. MW-350 was added to the monitoring network during 1st quarter 2020.

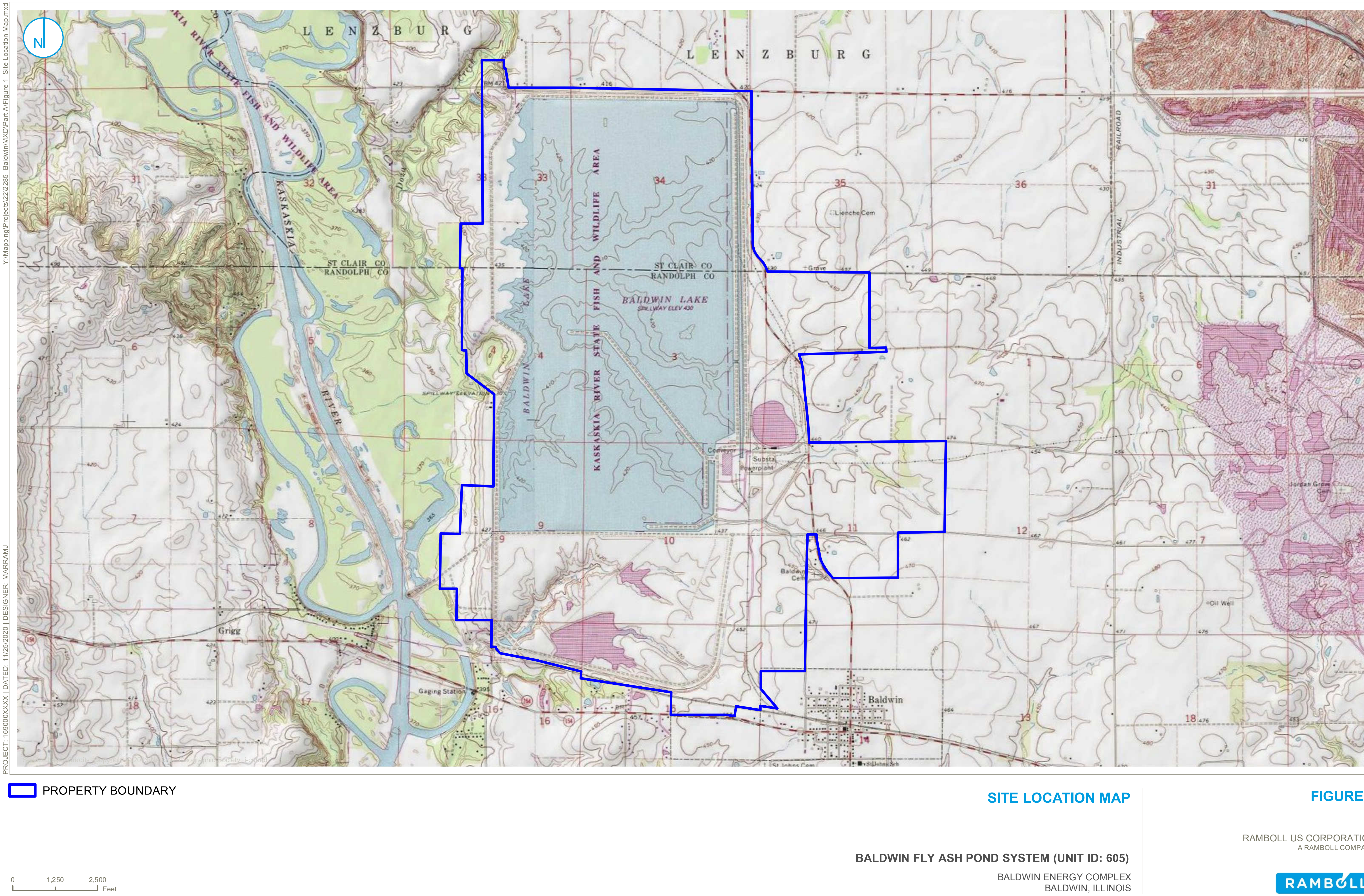
TABLE 3. CORRECTIVE MEASURES ASSESSMENT MATRIX
CORRECTIVE MEASURES ASSESSMENT
BALDWIN ENERGY COMPLEX
BALDWIN FLY ASH POND SYSTEM
BALDWIN, IL
11/30/2020

Evaluation Factors	Performance	Reliability	Ease of Implementation	**Potential Impacts of Remedy** (safety impacts, cross-media impacts, control of exposure to any residual contamination)	Time Required to Begin and Implement Remedy[1]	Time to Attain Groundwater Protection Standards	**Institutional Requirements** (state/local permit requirements, environmental/public health requirements that affect implementation of remedy)
MNA	Performs best paired with source control, completed at the site in 2020. Performance appears likely to be good given existing information including the stable trend for lithium prior to completion of source control	Planned additional testing will evaluate if hydrogeology is favorable for lithium dilution/dispersion	Easy - completion of tiered evaluation and long-term monitoring required, neither of which require extensive specialized equipment or contractors	None identified.	1 year	Dependent on site-specific conditions including source decay rate. Attainment of GWPS will be limited by the low permeability bedrock Uppermost Aquifer. Hence timeframes for MNA and other measures may be similar.	No institutional requirements are anticipated.
Groundwater Extraction	Widely accepted, routinely approved; variable performance based on site-specific conditions. May be limited by low permeability bedrock Uppermost Aquifer.	Reliable if properly designed, constructed, and maintained.	Design challenges due to hydraulic conditions of bedrock aquifer and plume configuration. Extracted groundwater would require management.	Alters groundwater flow system. Potential for some limited exposure to extracted groundwater.	3 to 4 years.	Dependent on site-specific conditions. Attainment of GWPS will be limited by the low permeability bedrock Uppermost Aquifer	Extracted groundwater will require management and approval from IEPA.
Groundwater Cutoff Wall	Widely accepted, routinely approved, good performance if properly designed and constructed. May not be feasible for the bedrock Uppermost Aquifer.	Reliable if properly designed and constructed (if feasible).	Widely used, established technology. May not be feasible in bedrock Uppermost Aquifer.	Alters groundwater flow system.	5 to 8 years.	Needs to be combined with other corrective measures. Time required to attain GWPS dependent on corrective measures.	Requires IEPA approval processes.
Permeable Reactive Barrier	In-Situ treatment not well established for lithium, therefore performance is unknown.	Variable reliability based on site-specific groundwater hydraulics and geochemical conditions. May not be feasible in bedrock Uppermost Aquifer. Unkown reliability for lithium.	Design challenges associated with groundwater hydraulics. May not be feasible in bedrock Uppermost Aquifer.	Alters groundwater flow system.	6 to 8 years.	Application as a groundwater corrective measure for lithium is not well established. As a passive system, GWPS attainment will be limited by low permeability bedrock Uppermost Aquifer	Requires IEPA approval processes.
In-Situ Chemical Treatment	In-Situ treatment not well established for lithium, therefore performance is unknown.	Variable reliability based on site-specific physical and geochemical conditions. May not be feasible in bedrock Uppermost Aquifer. Unkown reliability for lithium.	Design challenges associated with groundwater hydraulics. May not be feasible in bedrock Uppermost Aquifer.	Alters groundwater geochemistry.	7 to 8 years.	Application as a groundwater corrective measure for lithium is not well established. GWPS attainment will be limited by low permeability bedrock Uppermost Aquifer	May require Underground Injection Control approval.

Notes: [1] Time required to begin and implement remedy includes design, permitting and construction.

RAMBOLL

FIGURES



Y:\Mapping\Projects\22\2285_Baldwin\MXD\Part A\Figure 1_Site Location Map.mxd

PROJECT: 169000XXXX | DATED: 11/25/2020 | DESIGNER: MARRAMJ

SITE LOCATION MAP

FIGURE 1

BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)

BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

DOWNGRADIENT MONITORING WELL
UPGRADIENT MONITORING WELL
CCR MONITORED MULTI-UNIT, SUBJECT SITE
CCR MONITORED UNIT
NON-CCR UNIT

0 400 800 Feet

SITE AND WELL LOCATION MAP
POND SYSTEM

BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

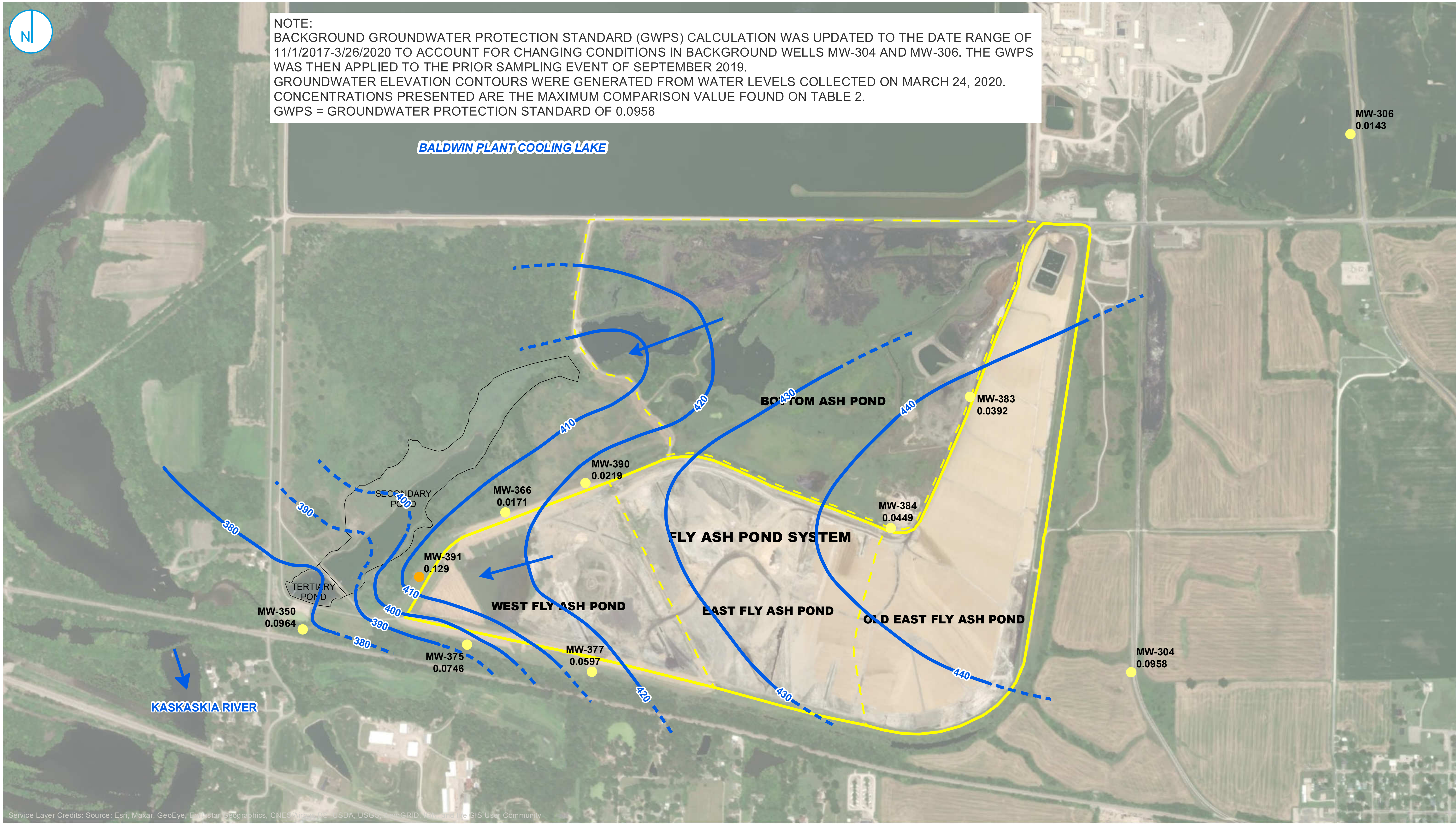
FIGURE 2

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

Y:\Mapping\Projects\22\2285_Baldwin\MXD\Part A\Figure 1_Baldwin_Site and Well Location Map.mxd

PROJECT: 169000XXXX | DATED: 11/25/2020 | DESIGNER: MARRAMJ



LITHIUM, TOTAL (mg/L)
- DETECTED
- DETECTED, >GWPS
- CCR MONITORED MULTI-UNIT, SUBJECT SITE
- CCR MONITORED UNIT
- NON-CCR UNIT

0 400 800 Feet

- GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION

TOTAL LITHIUM PLUME MAP

FIGURE 3

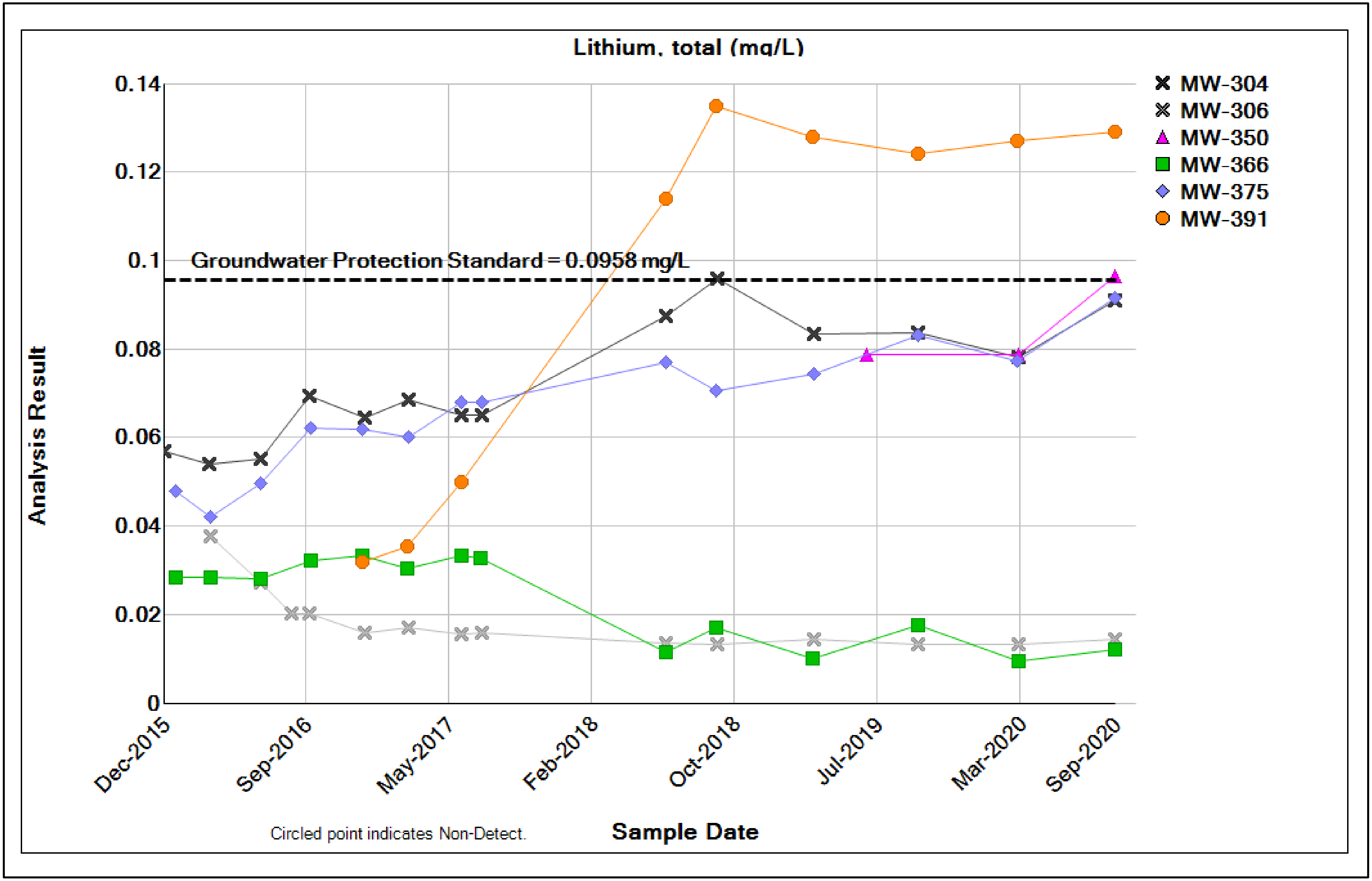
RAMBOLL US CORPORATION
A RAMBOLL COMPANY

BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

RAMBOLL

PROJECT: 169000XXXX | DATED: 11/30/2020 | DESIGNER: MARRAMJ

Y:\Mapping\Projects\22\2285_Baldwin\MXD\Part A\Figure 2_Baldwin_Lithium.mxd



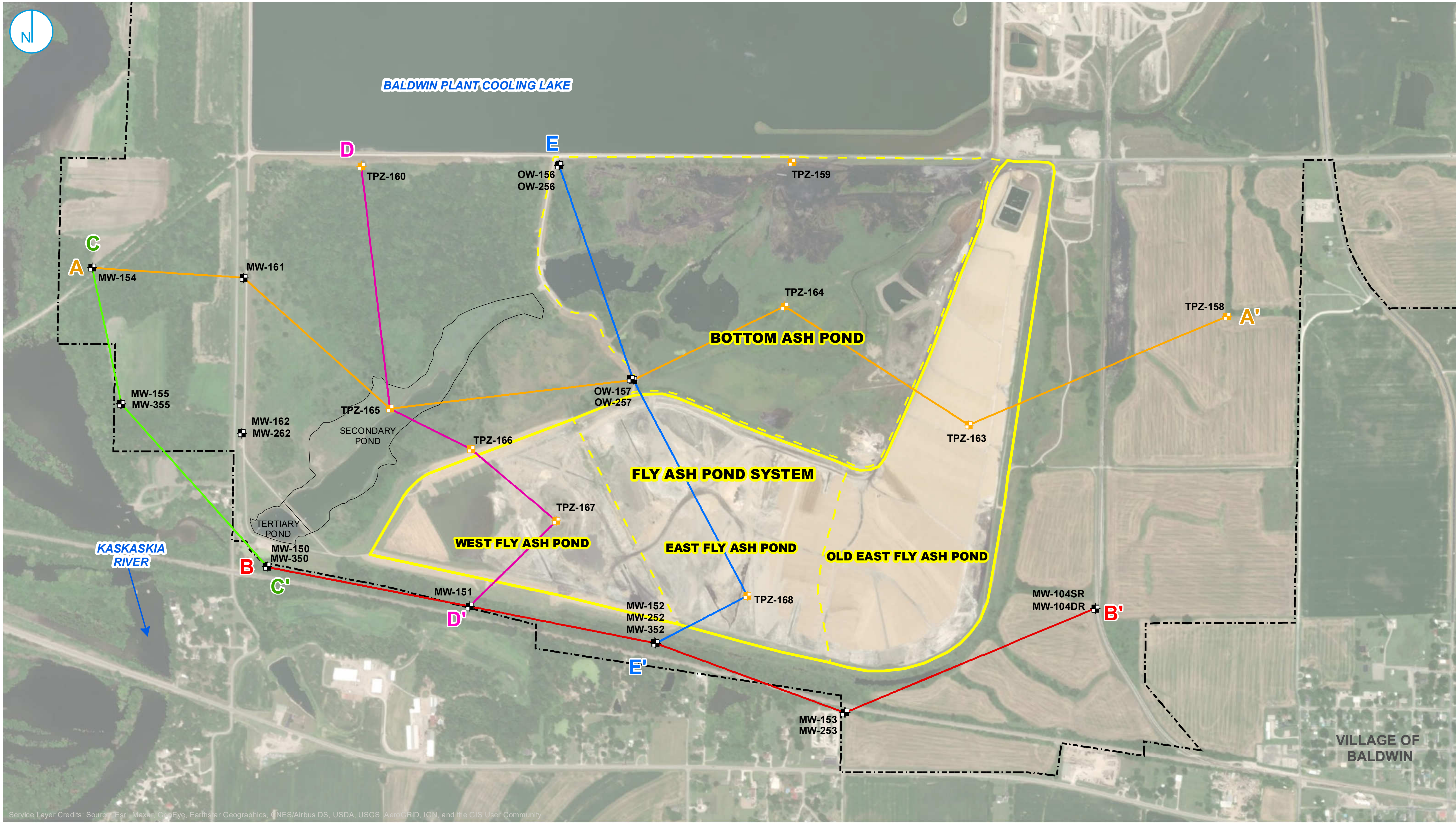
LITHIUM - TIMESERIES

FIGURE 4

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

BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

APPENDIX A
GEOLOGIC CROSS-SECTIONS



Y:\Mapping\Projects\22\2285_Baldwin\MXD\Part A\Figure 4_Cross Section Location Map.mxd

PROJECT: 169000XXXX | DATED: 11/25/2020 | DESIGNER: MARRAMJ

MONITORING WELL
PIEZOMETER
RIVER FLOW DIRECTION

CROSS SECTION TRANSECTS
A to A'
B to B'
C to C'
D to D'
E to E'

CCR MONITORED MULTI-UNIT
CCR MONITORED UNIT
NON-CCR UNIT
PROPERTY BOUNDARY

0 400 800 Feet

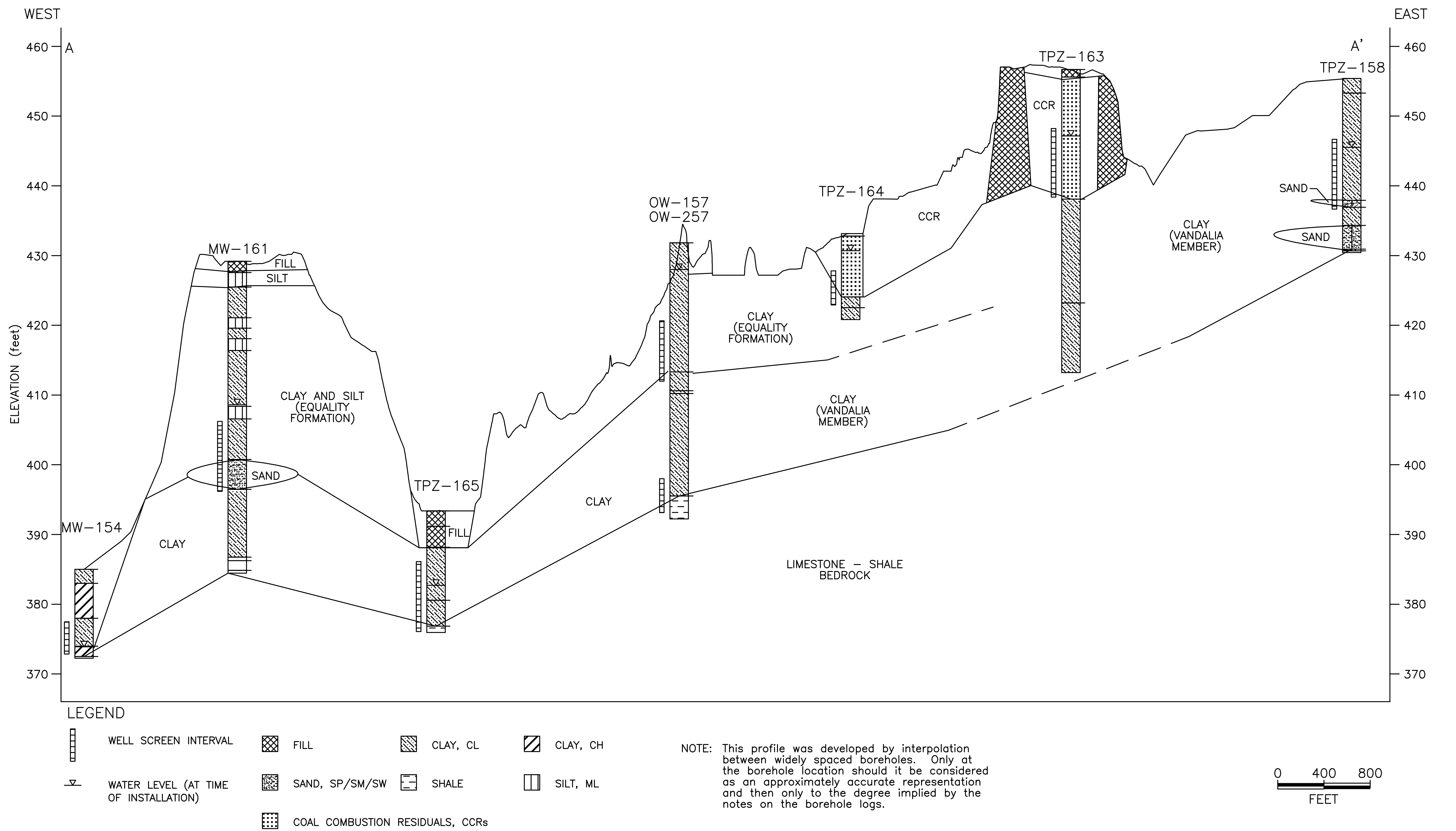
CROSS SECTION LOCATION MAP

FIGURE A1

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

RAMBOLL

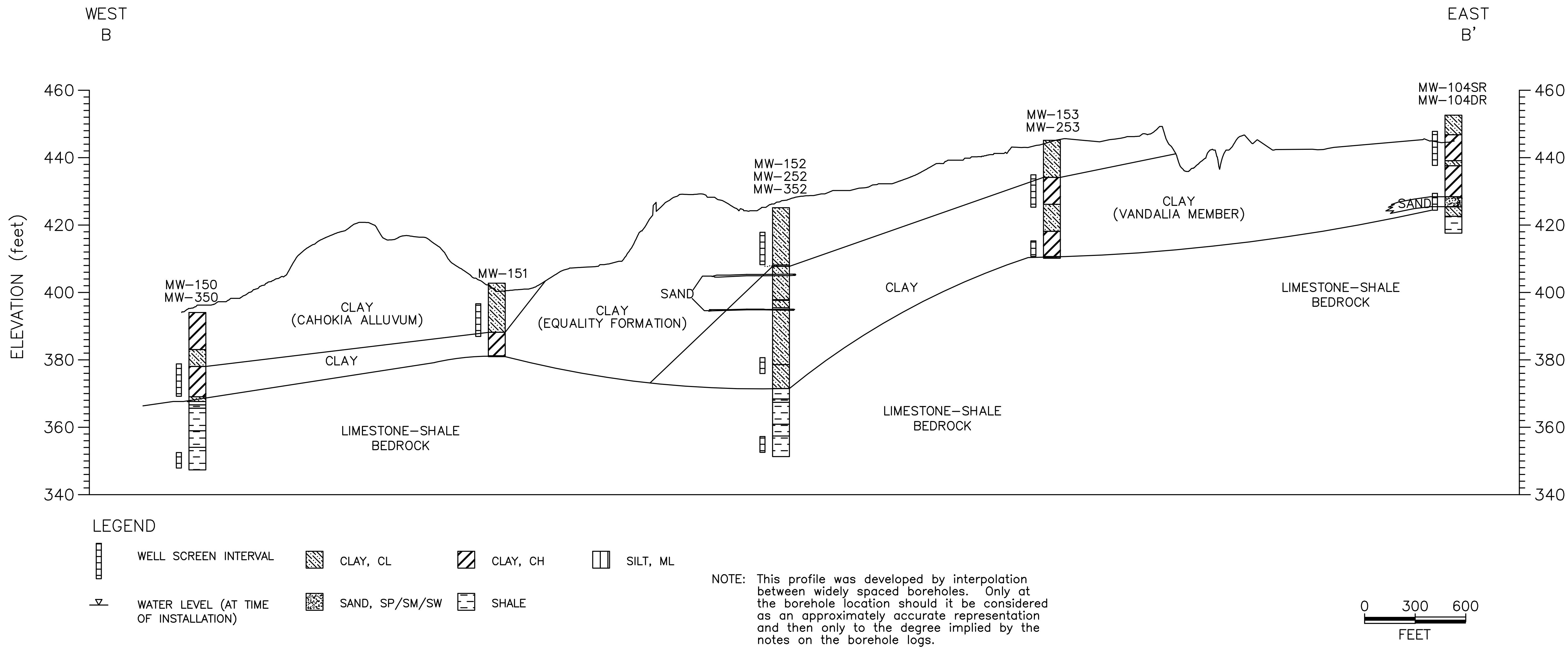


GEOLOGIC CROSS SECTION A-A'

BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

FIGURE A2

RAMBOLL US CORPORATION
A RAMBOLL COMPANY



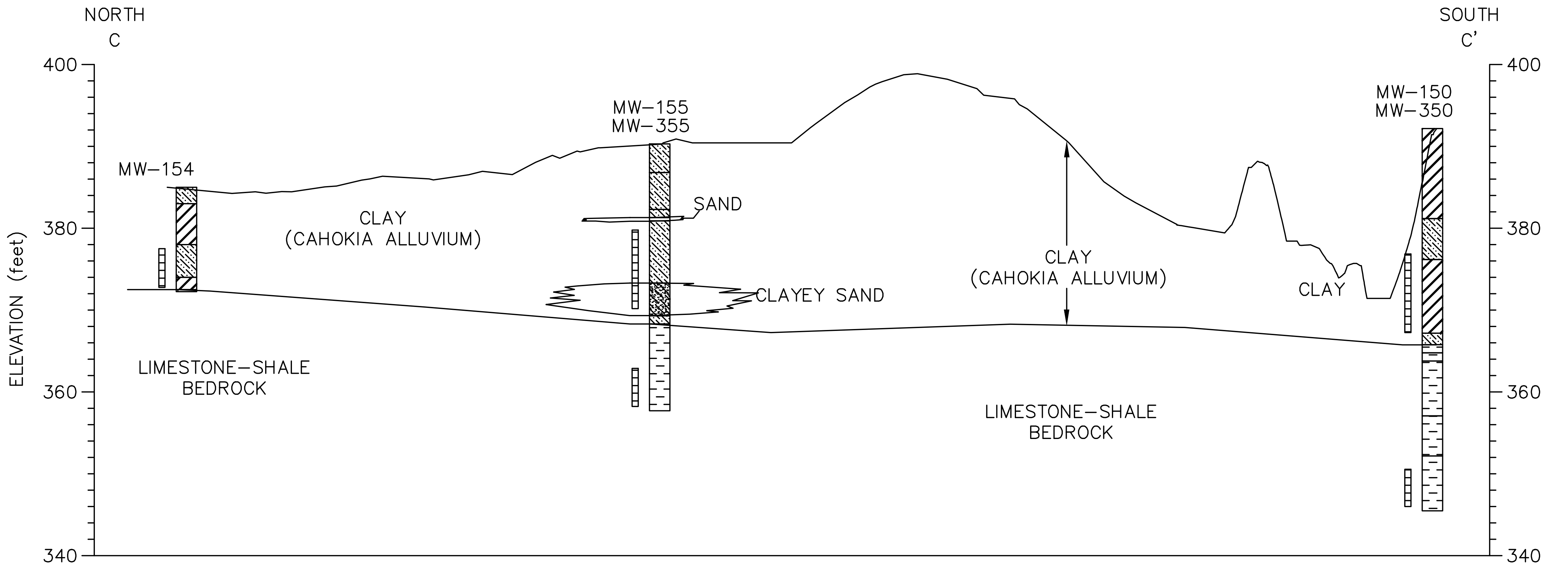
NOTE: This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.

GEOLOGIC CROSS SECTION B-B'

FIGURE A3

BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

RAMBOLL US CORPORATION
A RAMBOLL COMPANY



LEGEND

WELL SCREEN INTERVAL

WATER LEVEL (AT TIME OF INSTALLATION)

CLAY, CL

SAND, SP/SM/SW

CLAY, CH

SHALE

NOTE: This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.

0 150 300

FEET

\\server27-01\Y Drive\Mapping\Projects\7\74914\300\Figure 5C_Cross Section C-C.dwg

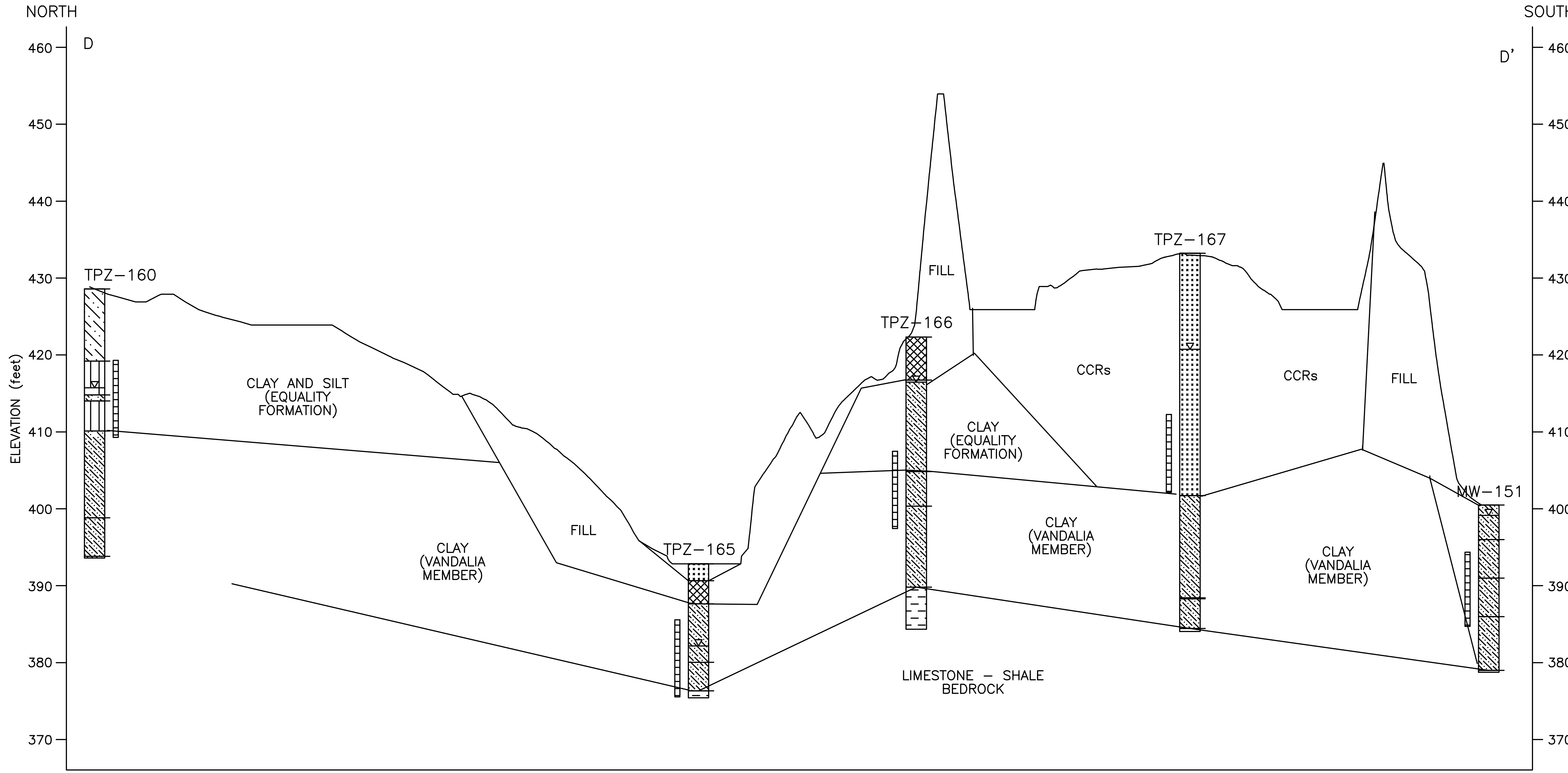
PROJECT: 74914 DATED: 7/13/2020 1:38 PM DESIGNER: ENGELHSA

GEOLOGIC CROSS SECTION C-C'

BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

FIGURE A4

RAMBOLL US CORPORATION
A RAMBOLL COMPANY



LEGEND

WELL SCREEN INTERVAL

WATER LEVEL (AT TIME OF INSTALLATION)

FILL

SAND, SP/SM/SW

COAL COMBUSTION RESIDUALS, CCRs

CLAY, CL

SHALE

SILT, ML

NOTE: This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.

0 200 400
FEET

\\server27-01\Y Drive\Mapping\Projects\7\74914\300\Figure 5D_Cross Section D-D.dwg

PROJECT: 74914 DATED: 7/13/2020 1:36 PM DESIGNER: ENGELHSA

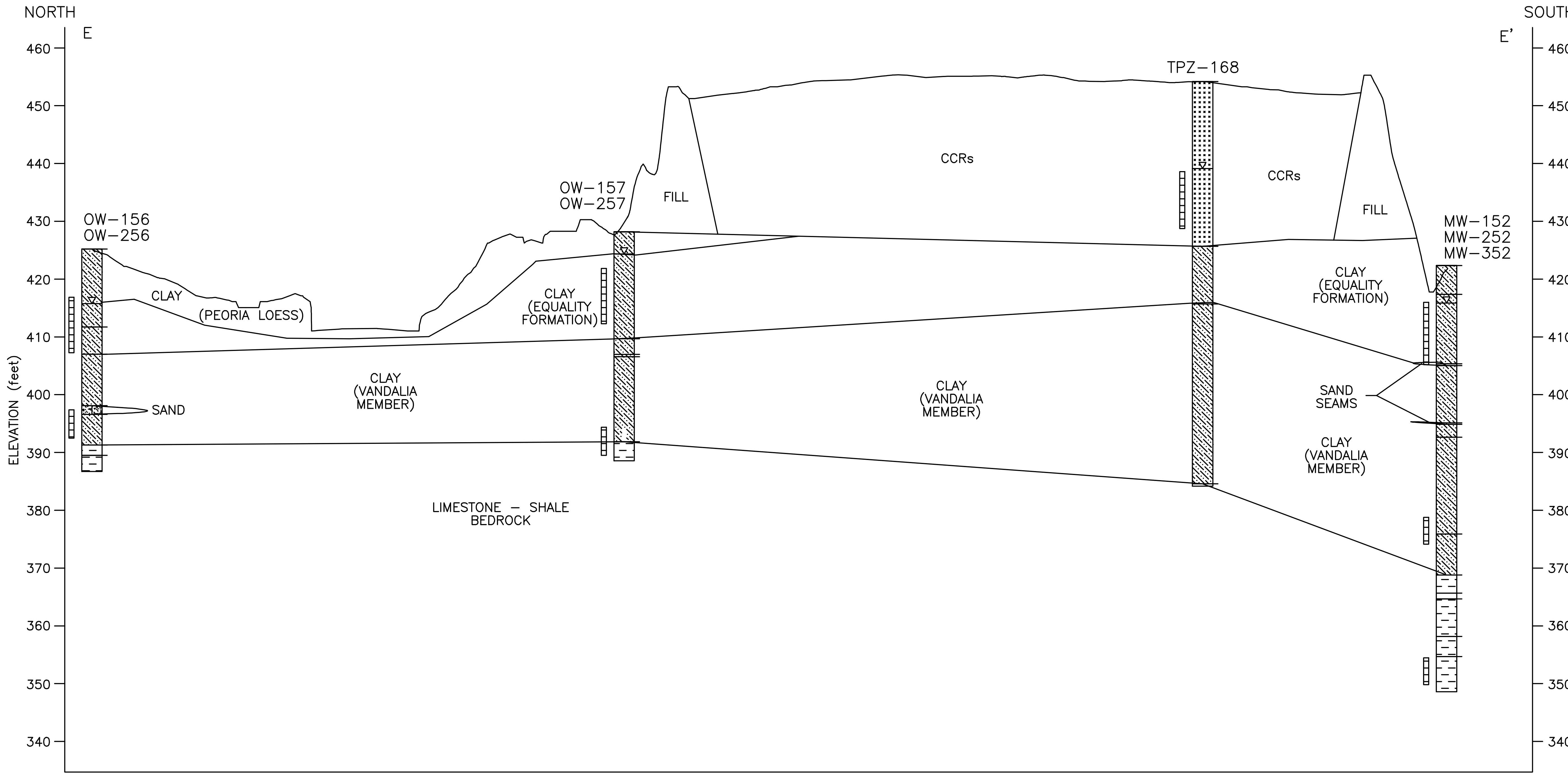
GEOLOGIC CROSS SECTION D-D'

BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

FIGURE A5

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

\\server27-011\Y Drive\Mapping\Projects\71\74914\300\Figure 5E_Cross Section E-E.dwg
PROJECT: 74914 DATED: 7/13/2020 1:31 PM DESIGNER: ENGELHSA



LEGEND

- WELL SCREEN INTERVAL
- WATER LEVEL (AT TIME OF INSTALLATION)
- CLAY, CL
- SAND, SP/SM/SW
- COAL COMBUSTION RESIDUALS, CCRs
- SHALE

NOTE: This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.

0 200 400
FEET

GEOLOGIC CROSS SECTION E-E'

BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

FIGURE A6

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

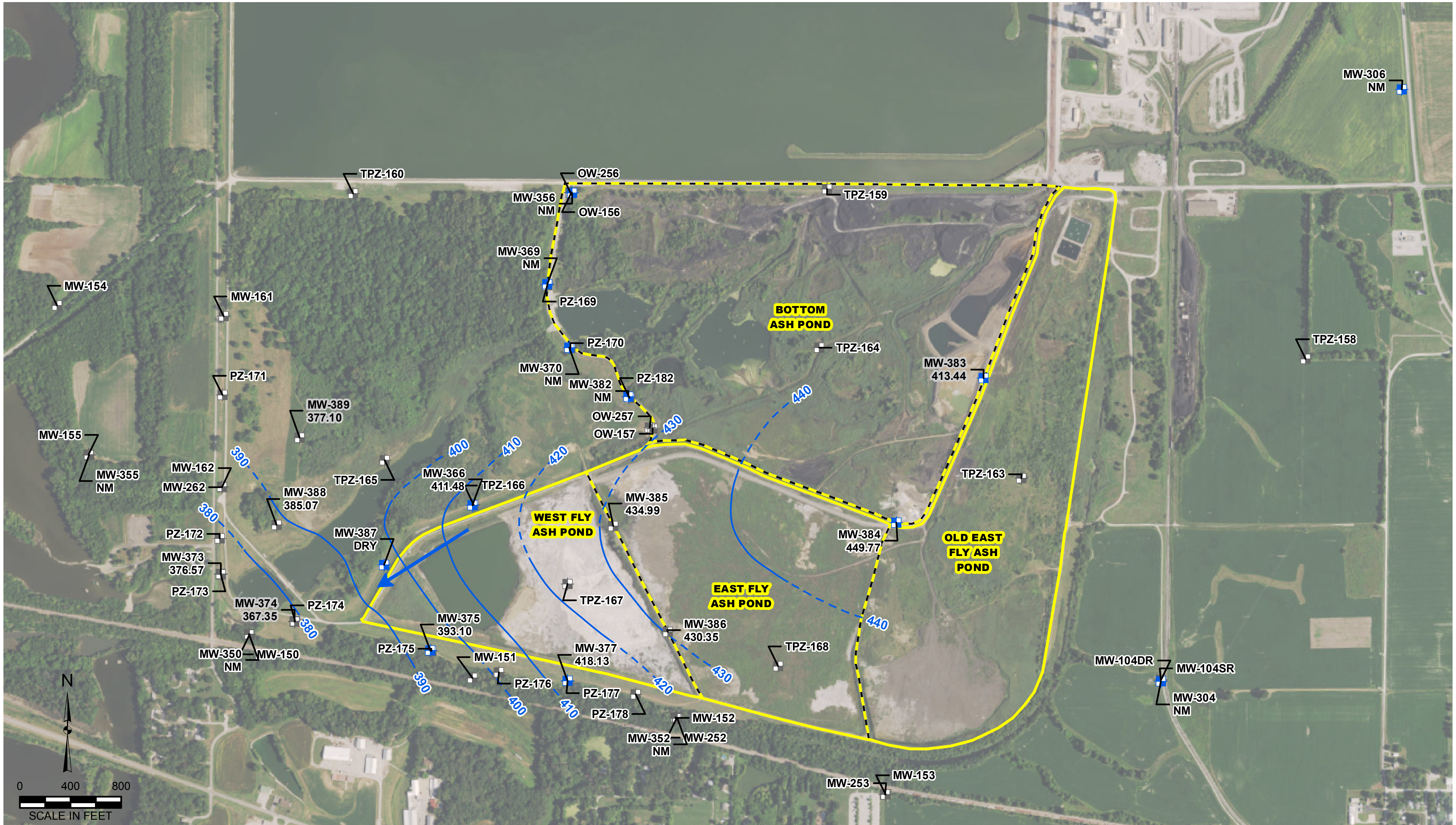
APPENDIX B
GROUNDWATER ELEVATION CONTOUR MAPS, 2015-2020

OPERATING RECORD
REVISION 1

TITLE 40 CFR PART 257 SECTION 257.91

GROUNDWATER ELEVATION CONTOUR MAPS
MONITORING PERIOD 2015 - QUARTER 1, 2020

LOCATION: BALDWIN ENERGY COMPLEX
LEGAL ENTITY: DYNEGY MIDWEST GENERATION, LLC
UNIT IDENTIFICATION NUMBER: 605
UNIT NAME: BALDWIN FLY ASH POND SYSTEM



CCR RULE MONITORING WELL LOCATION
NON-CCR RULE MONITORING WELL LOCATION
GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD 88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
CCR UNIT
CCR MONITORED MULTI-UNIT

NOTES:
-GROUNDWATER ELEVATIONS WITH GRAY OUTLINE WERE NOT USED FOR CONTOURING BECAUSE WATER LEVELS DID NOT RECOVER TO STATIC LEVELS AT TIME OF MEASUREMENT FOLLOWING INSTALLATION AND DEVELOPMENT.

-MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.

DRAWN BY/DATE: SDS 1/24/17
REVIEWED BY/DATE: TBN 1/25/17
APPROVED BY/DATE: JJW 2/8/17

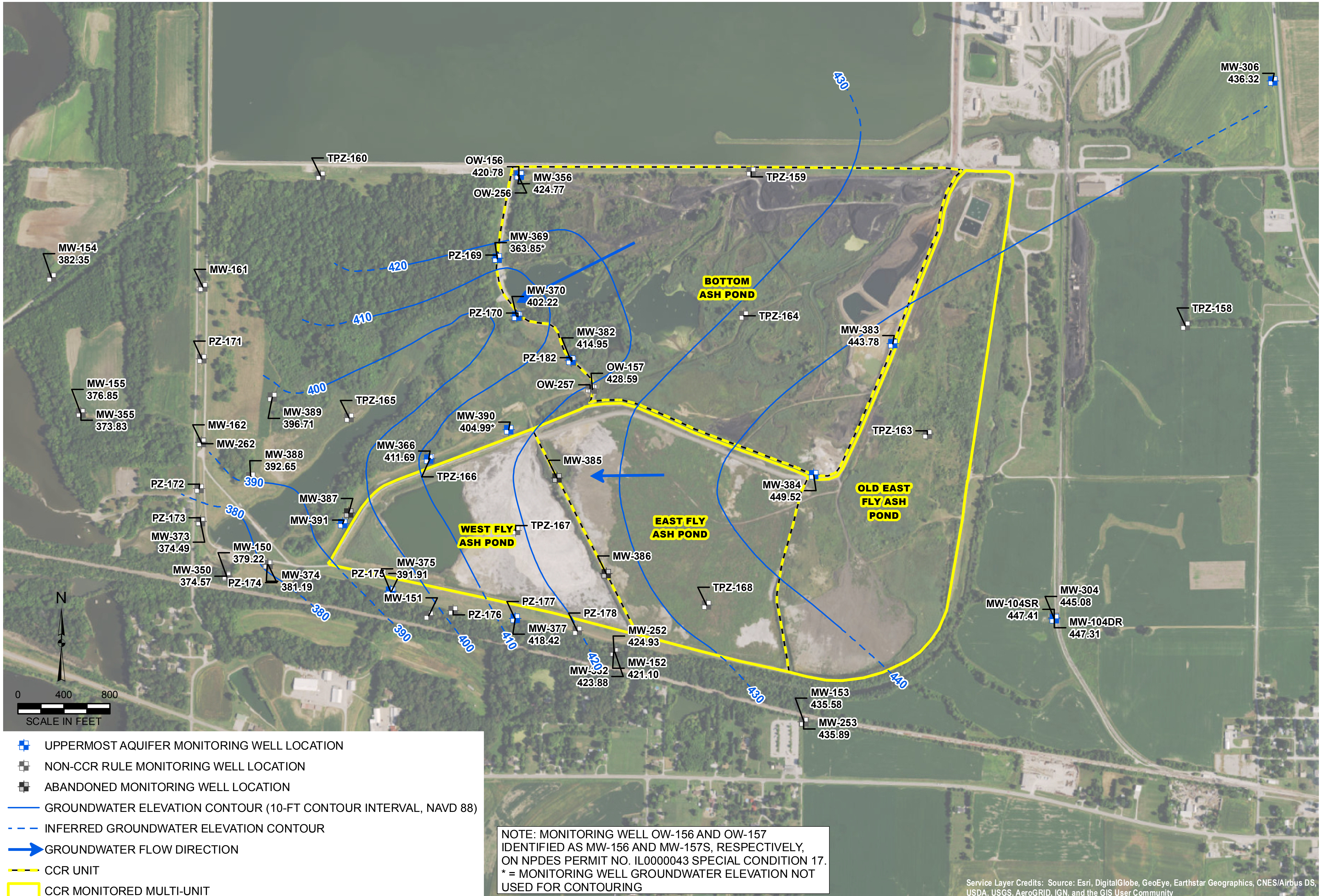
BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 1: JANUARY 19, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



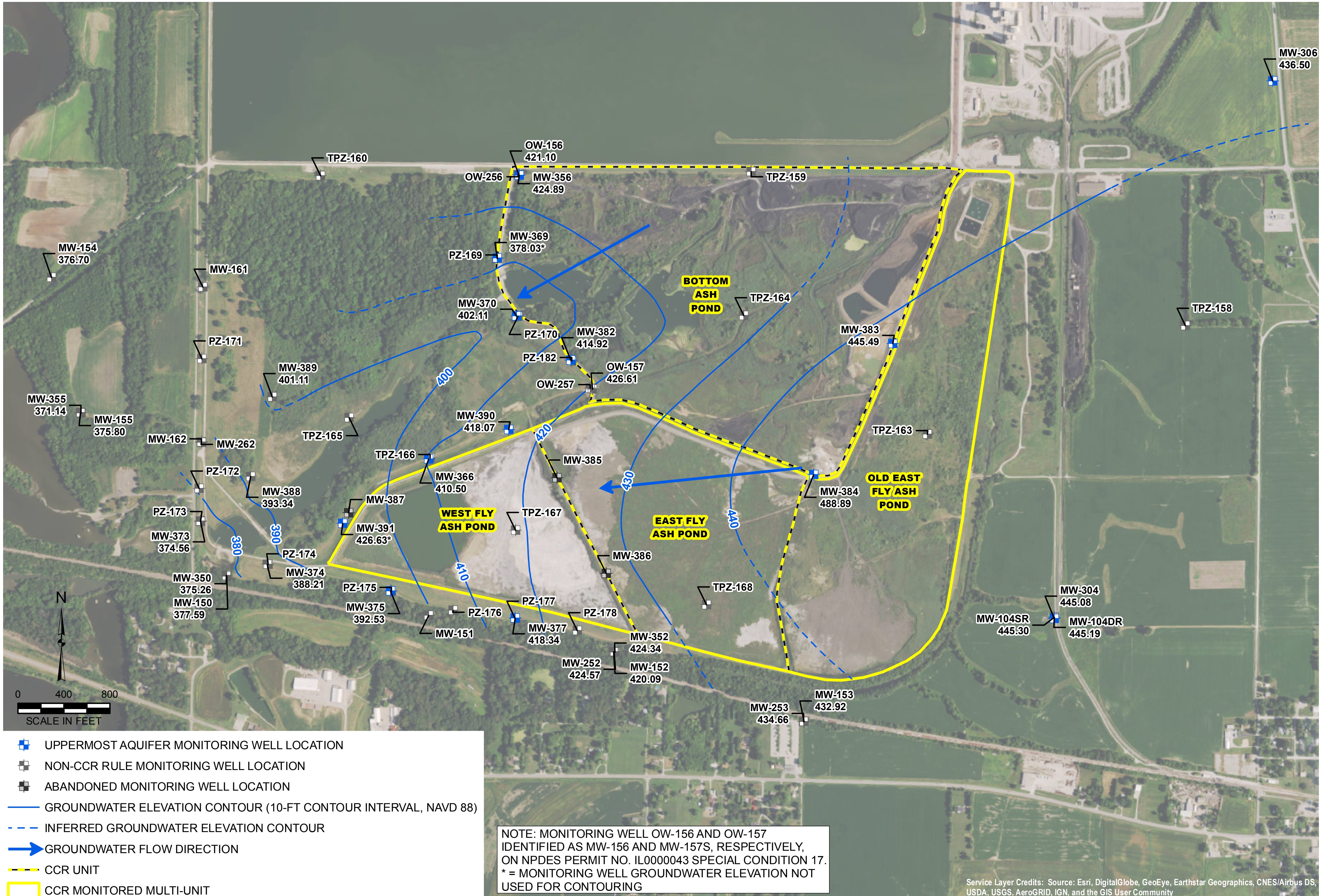
UPPERMOST AQUIFER MONITORING WELL LOCATION
NON-CCR RULE MONITORING WELL LOCATION
ABANDONED MONITORING WELL LOCATION
GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD 88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
CCR UNIT
CCR MONITORED MULTI-UNIT

NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.
* = MONITORING WELL GROUNDWATER ELEVATION NOT USED FOR CONTOURING

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



UPPERMOST AQUIFER MONITORING WELL LOCATION
NON-CCR RULE MONITORING WELL LOCATION
ABANDONED MONITORING WELL LOCATION
GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD 88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
CCR UNIT
CCR MONITORED MULTI-UNIT

NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.
* = MONITORING WELL GROUNDWATER ELEVATION NOT USED FOR CONTOURING

DRAWN BY/DATE: SDS 1/24/17
REVIEWED BY/DATE: TBN 1/25/17
APPROVED BY/DATE: JJW 2/8/17

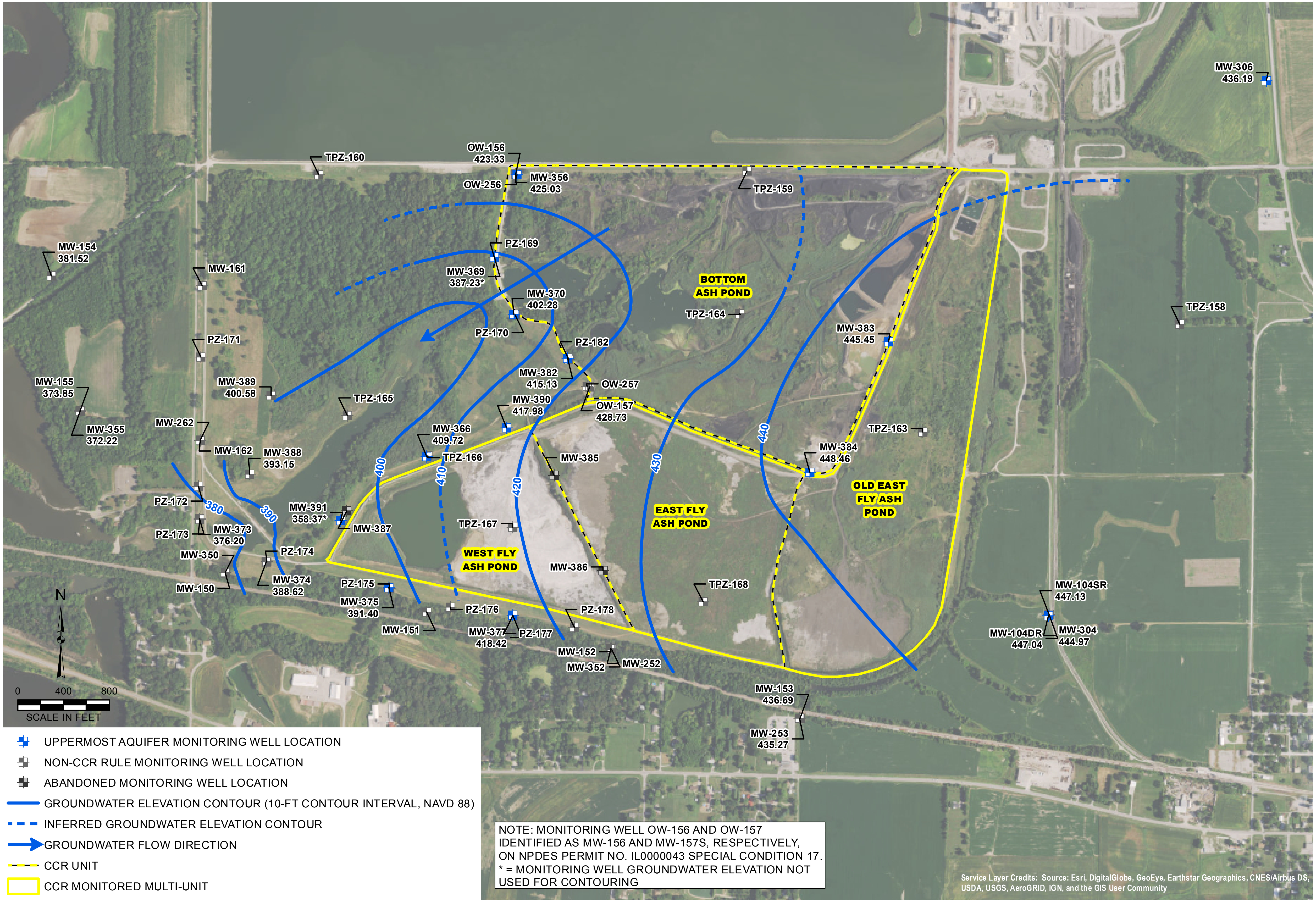
BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605) UPPERMOST AQUIFER UNIT GROUNDWATER ELEVATION CONTOUR MAP ROUND 3: JUNE 21, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



DRAWN BY/DATE: SDS 1/25/17
REVIEWED BY/DATE: TBN 1/26/17
APPROVED BY/DATE: JJW 2/8/17

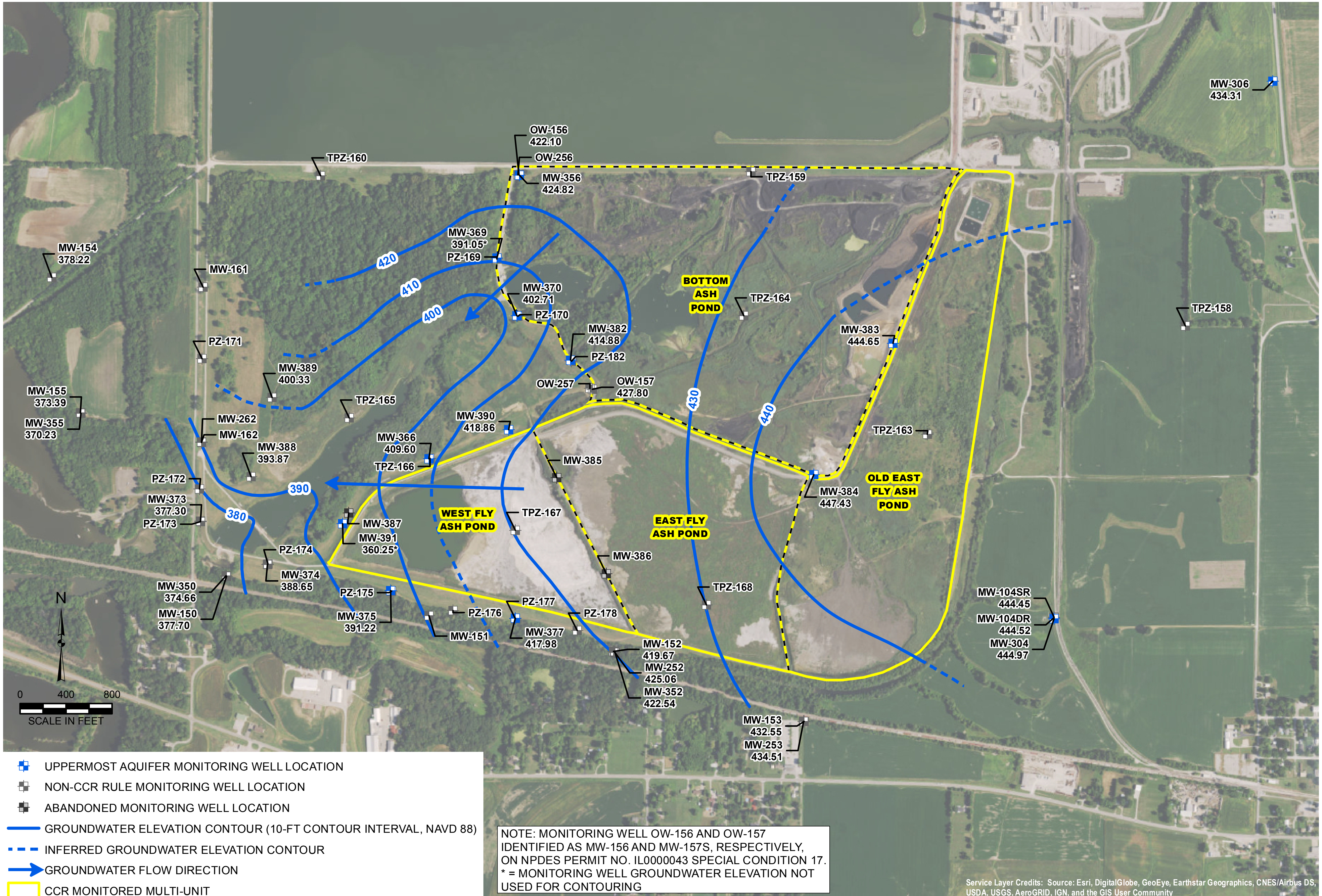
BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)
UPPERMOST AQUIFER UNIT GROUNDWATER ELEVATION CONTOUR MAP
ROUND 4: SEPTEMBER 19, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



DRAWN BY/DATE: SDS 3/6/17
REVIEWED BY/DATE: TBN 3/6/17
APPROVED BY/DATE: JJW 8/30/17

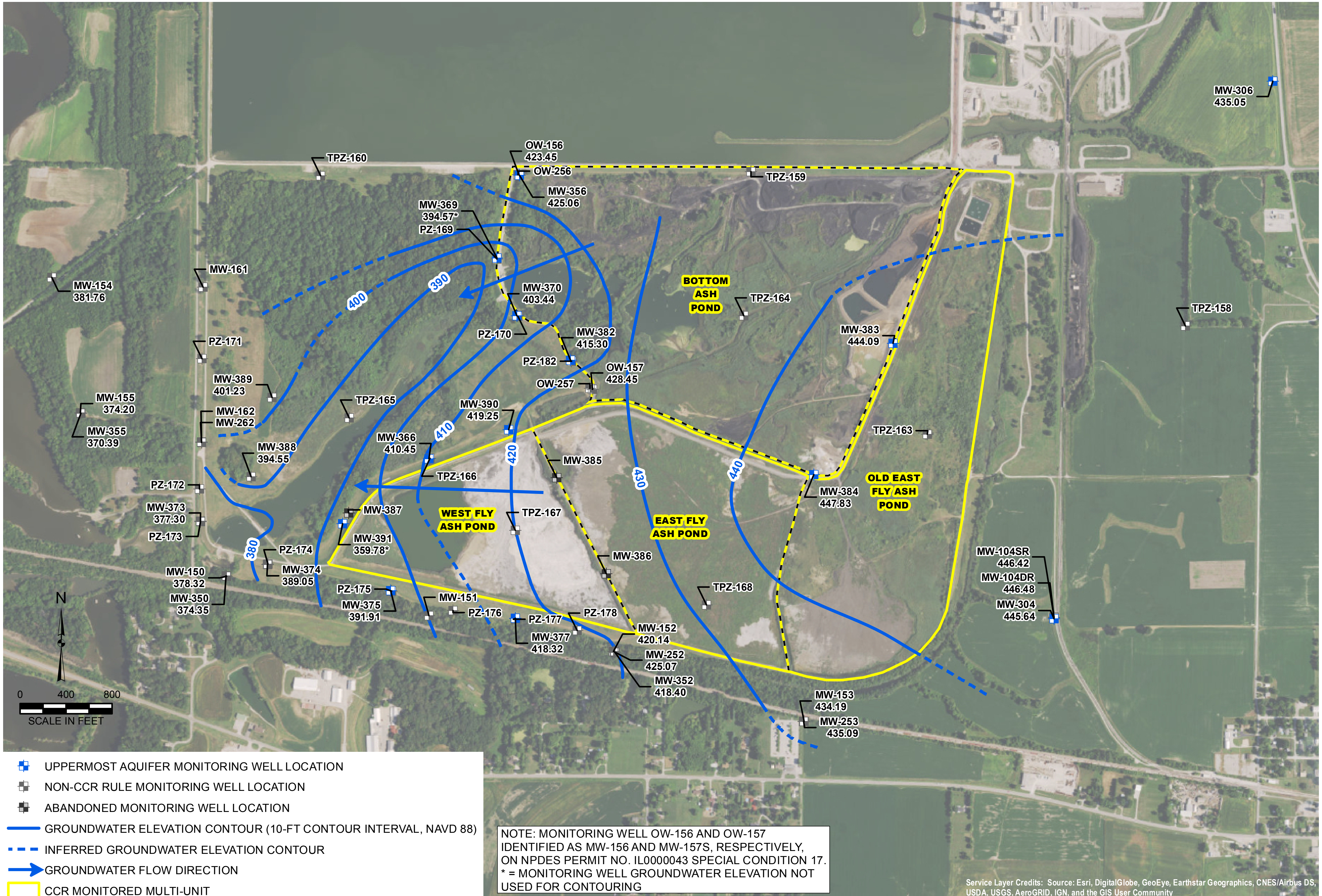
BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND BALDWIN FLY ASH POND SYSTEM (UNIT IT: 605) UPPERMOST AQUIFER UNIT GROUNDWATER ELEVATION CONTOUR MAP ROUND 5: DECEMBER 21, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



DRAWN BY/DATE: SDS 4/14/17
REVIEWED BY/DATE: TBN 4/14/17
APPROVED BY/DATE: JJW 8/30/17

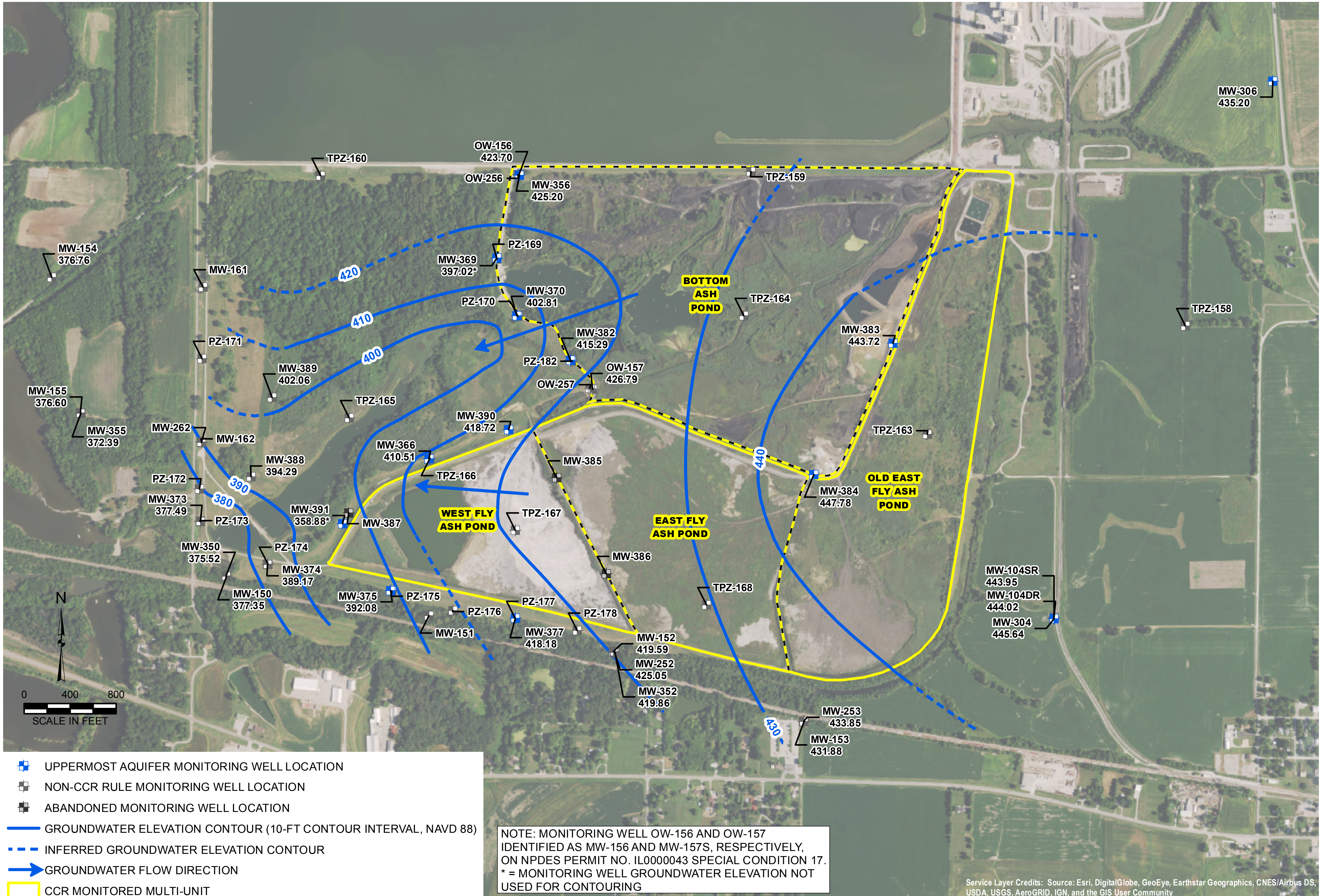
BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)
UPPERMOST AQUIFER UNIT GROUNDWATER ELEVATION CONTOUR MAP
ROUND 6: MARCH 14, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



UPPERMOST AQUIFER MONITORING WELL LOCATION
NON-CCR RULE MONITORING WELL LOCATION
ABANDONED MONITORING WELL LOCATION
GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD 88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
CCR MONITORED MULTI-UNIT

NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.
* = MONITORING WELL GROUNDWATER ELEVATION NOT USED FOR CONTOURING

DRAWN BY/DATE: SDS 7/12/17
REVIEWED BY/DATE: TBN 7/12/17
APPROVED BY/DATE: JJW 8/30/17

BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND BALDWIN FLY ASH POND SYSTEM (UNIT IT: 605) UPPERMOST AQUIFER UNIT GROUNDWATER ELEVATION CONTOUR MAP ROUND 7: JUNE 19, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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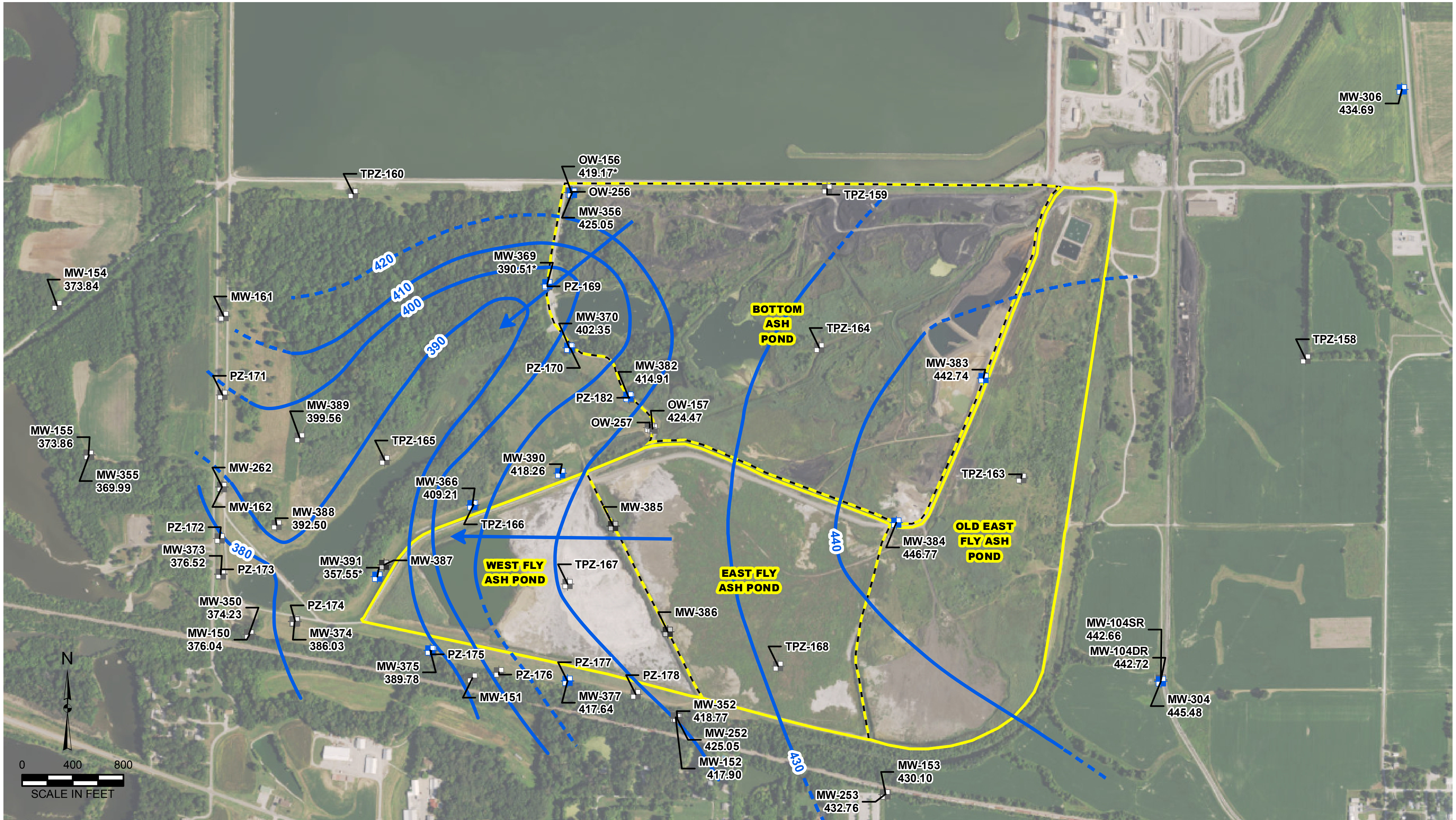
BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605) UPPERMOST AQUIFER UNIT GROUNDWATER ELEVATION CONTOUR MAP ROUND 8: JULY 25, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

DRAWN BY/DATE: SDS 8/10/17
REVIEWED BY/DATE: TBN 8/10/17
APPROVED BY/DATE: JJW 8/30/17



- UPPERMOST AQUIFER MONITORING WELL LOCATION
- NON-CCR RULE MONITORING WELL LOCATION
- ABANDONED MONITORING WELL LOCATION
- GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD 88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- CCR MONITORED MULTI-UNIT

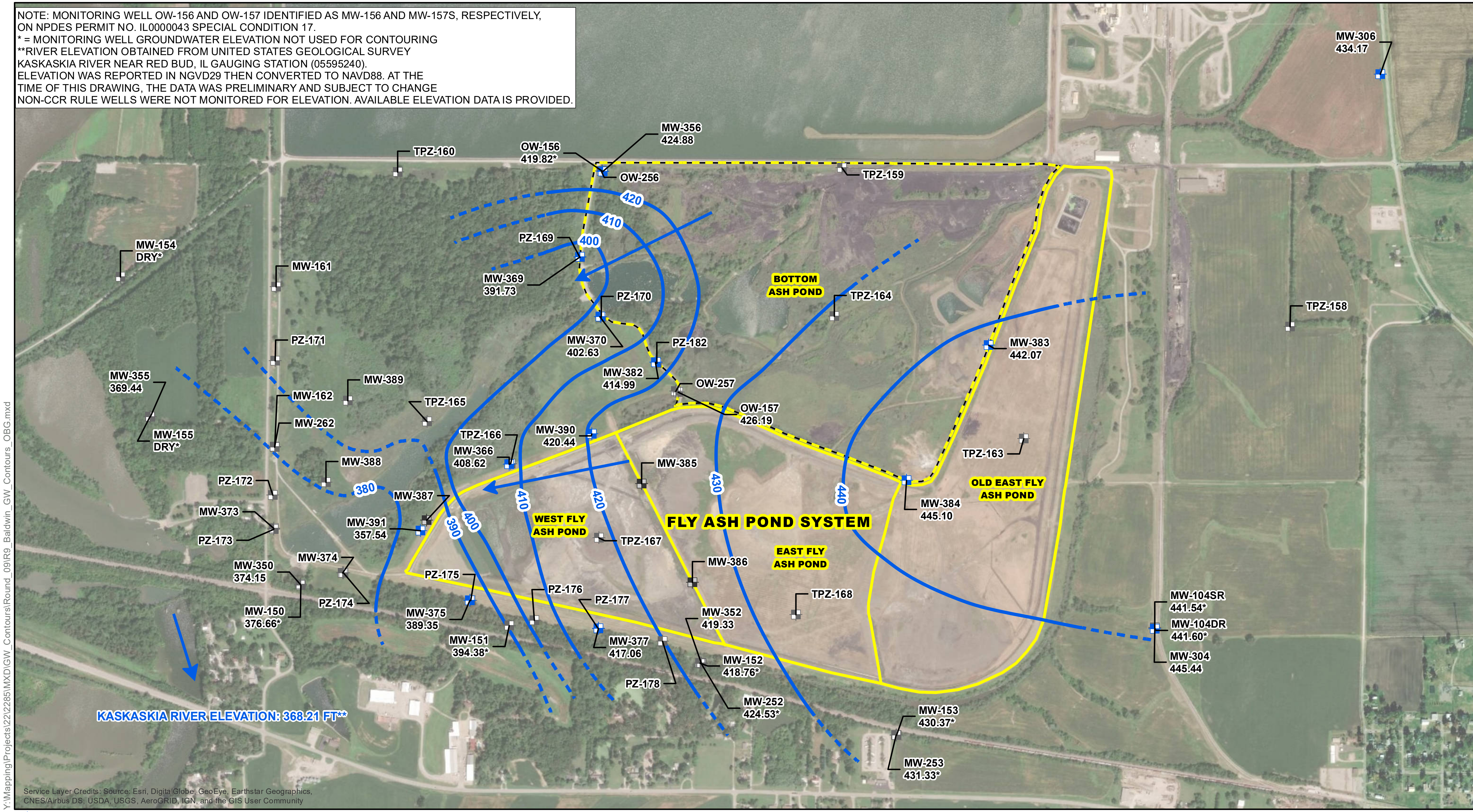
NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.
* = MONITORING WELL GROUNDWATER ELEVATION NOT USED FOR CONTOURING

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

Y:\Mapping\Projects\22\2285\MXD\GW_Contours\Round_08\R8_Baldwin_GW_Contours.mxd Author: stolzsd; Date/Time: 9/1/2017, 4:35:46 PM



CCR RULE MONITORING WELL LOCATION
NON-CCR RULE MONITORING WELL LOCATION
ABANDONED MONITORING WELL LOCATION
GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
CCR MONITORED MULTI-UNIT
CCR MONITORED UNIT

CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

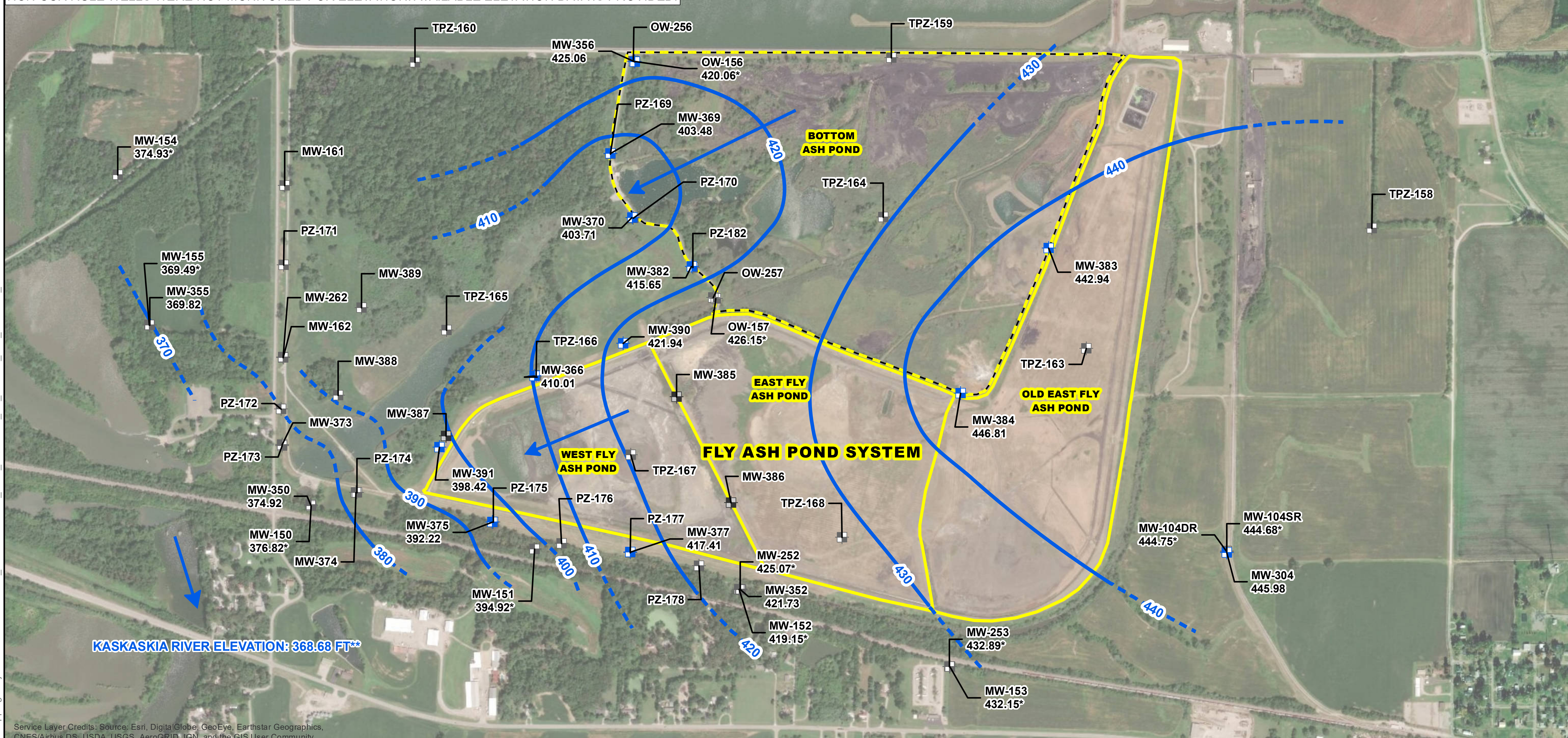
N

0 200 400 800
Feet

BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND
BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)
GROUNDWATER ELEVATION CONTOUR MAP
NOVEMBER 27, 2017

O'BRIEN & GERE ENGINEERS, INC.

NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.
* = MONITORING WELL GROUNDWATER ELEVATION NOT USED FOR CONTOURING
**RIVER ELEVATION OBTAINED FROM U.S. ARMY CORPS OF ENGINEERS KASKASKIA RIVER NEAR RED BUD, IL GAUGING STATION (05595240). ELEVATION WAS REPORTED IN NGVD29 THEN CONVERTED TO NAVD88.
AT THE TIME OF THIS DRAWING, THE DATA WAS PRELIMINARY AND SUBJECT TO CHANGE.
NON-CCR RULE WELLS WERE NOT MONITORED FOR ELEVATION. AVAILABLE ELEVATION DATA IS PROVIDED.



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CCR RULE MONITORING WELL LOCATION
NON-CCR RULE MONITORING WELL LOCATION
ABANDONED MONITORING WELL LOCATION
GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
CCR MONITORED MULTI-UNIT
CCR MONITORED UNIT

CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

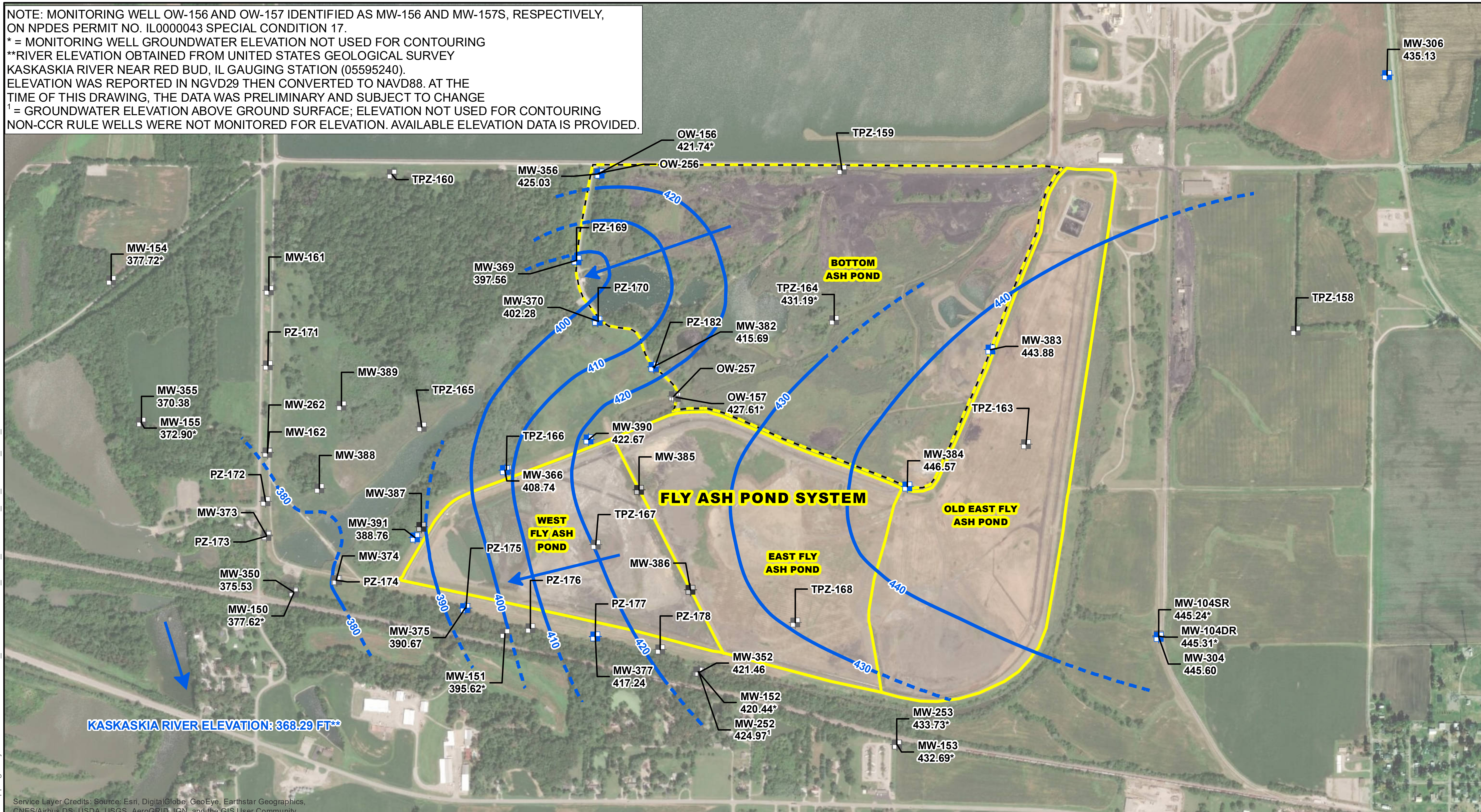
N

0 200 400 800
Feet

BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND
BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)
GROUNDWATER ELEVATION CONTOUR MAP
JUNE 25, 2018

O'BRIEN & GERE ENGINEERS, INC.

NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.
* = MONITORING WELL GROUNDWATER ELEVATION NOT USED FOR CONTOURING
**RIVER ELEVATION OBTAINED FROM UNITED STATES GEOLOGICAL SURVEY KASKASKIA RIVER NEAR RED BUD, IL GAUGING STATION (05595240). ELEVATION WAS REPORTED IN NGVD29 THEN CONVERTED TO NAVD88. AT THE TIME OF THIS DRAWING, THE DATA WAS PRELIMINARY AND SUBJECT TO CHANGE
1 = GROUNDWATER ELEVATION ABOVE GROUND SURFACE; ELEVATION NOT USED FOR CONTOURING
NON-CCR RULE WELLS WERE NOT MONITORED FOR ELEVATION. AVAILABLE ELEVATION DATA IS PROVIDED.



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- CCR RULE MONITORING WELL LOCATION
- NON-CCR RULE MONITORING WELL LOCATION
- ABANDONED MONITORING WELL LOCATION
- GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- CCR MONITORED MULTI-UNIT
- CCR MONITORED UNIT

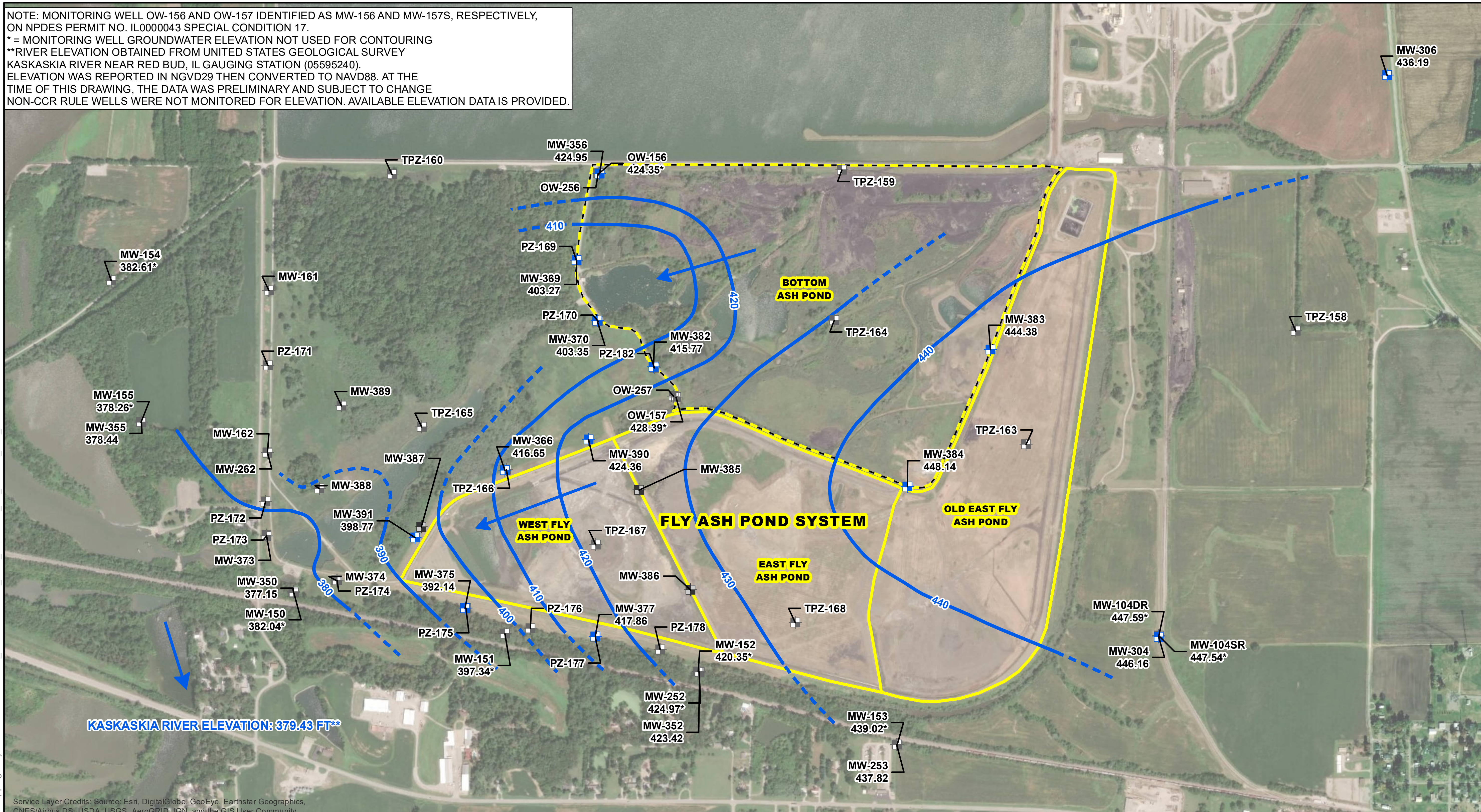
CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

N

0 200 400 800
Feet

BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND
BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)
GROUNDWATER ELEVATION CONTOUR MAP
SEPTEMBER 25, 2018

O'BRIEN & GERE ENGINEERS, INC.



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- CCR RULE MONITORING WELL LOCATION
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- CCR MONITORED MULTI-UNIT
- CCR MONITORED UNIT

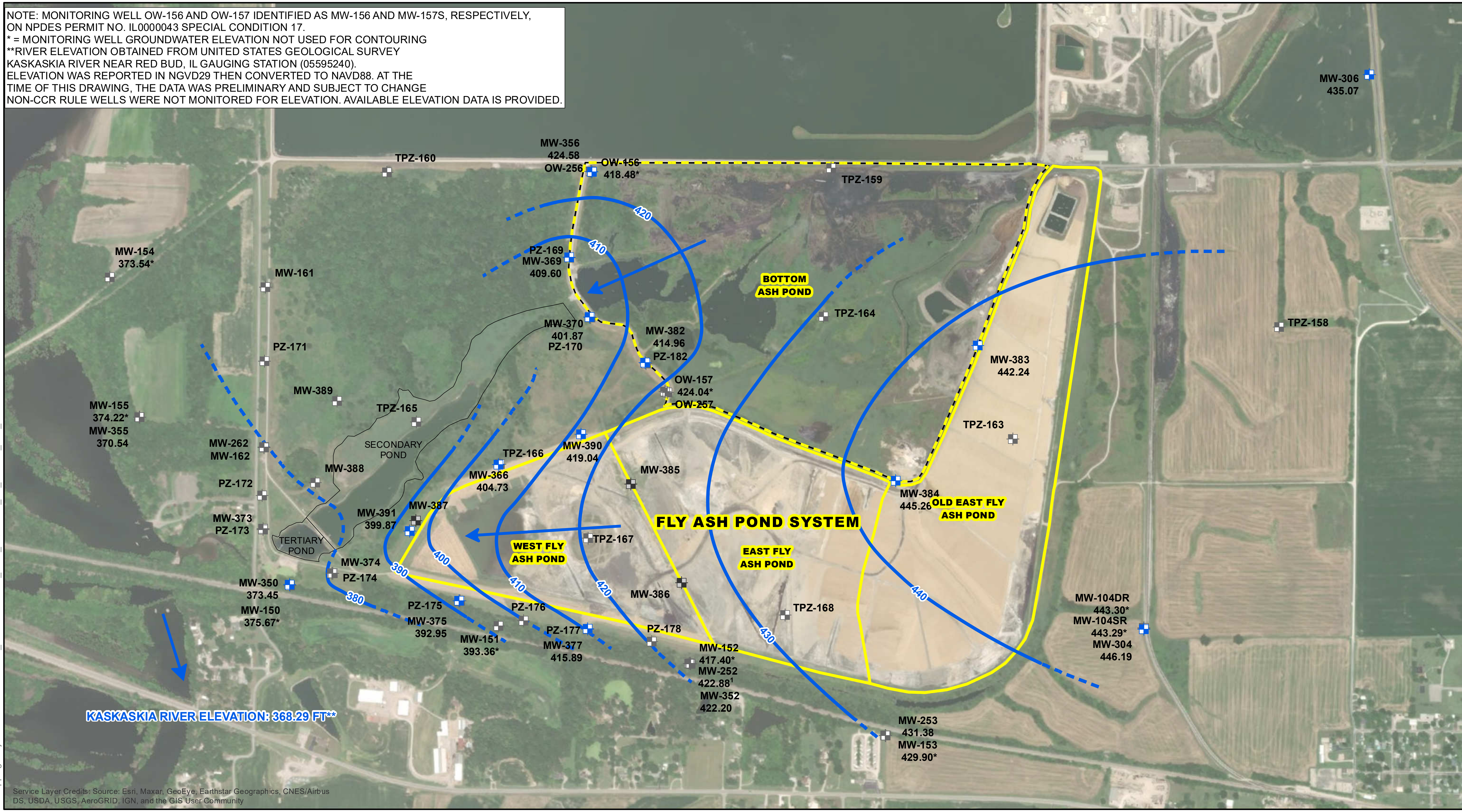
CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

N

0 200 400 800
Feet

BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND
BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)
GROUNDWATER ELEVATION CONTOUR MAP
MARCH 19, 2019

O'BRIEN & GERE ENGINEERS, INC.



- CCR RULE MONITORING WELL LOCATION
- NON-CCR RULE MONITORING WELL LOCATION
- ABANDONED MONITORING WELL LOCATION
- GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- NON-CCR UNIT
- CCR MONITORED MULTI-UNIT
- CCR MONITORED UNIT

CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

N

0 200 400 800
Feet

BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND
BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)
GROUNDWATER ELEVATION CONTOUR MAP
SEPTEMBER 24, 2019

O'BRIEN & GERE ENGINEERS, INC.

Y:\Mapping\Projects\22\2285\MXD\GW_Contours\Round_2020_1Q\R2020_1Q_Baldwin_GW_Contours.mxd

NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.
* = MONITORING WELL GROUNDWATER ELEVATION NOT USED FOR CONTOURING
**RIVER ELEVATION OBTAINED FROM UNITED STATES GEOLOGICAL SURVEY KASKASKIA RIVER NEAR RED BUD, IL GAUGING STATION (05595240). ELEVATION WAS REPORTED IN NGVD29 THEN CONVERTED TO NAVD88. AT THE TIME OF THIS DRAWING, THE DATA WAS PRELIMINARY AND SUBJECT TO CHANGE
NON-CCR RULE WELLS WERE NOT MONITORED FOR ELEVATION. AVAILABLE ELEVATION DATA IS PROVIDED.
1 = WATER LEVEL ABOVE GROUND SURFACE, MONITORING WELL GROUNDWATER ELEVATION NOT USED FOR CONTOURING

CCR RULE MONITORING WELL
NON-CCR RULE MONITORING WELL
ABANDONED MONITORING WELL
GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
CCR MONITORED MULTI-UNIT
CCR MONITORED UNIT
NON-CCR UNIT

0 400 800 Feet

PROJECT: 169000XXXX | DATED: 8/14/2020 | DESIGNER: STOLZSD

BALDWIN BOTTOM ASH POND (UNIT ID: 601) AND BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605) GROUNDWATER ELEVATION CONTOUR MAP
MARCH 24, 2020

CCR RULE GROUNDWATER MONITORING
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

APPENDIX C
VERTICAL AND HORIZONTAL GRADIENTS

TABLE C1
SUMMARY OF HORIZONTAL AND VERTICAL PERMEABILITY TEST RESULTS
BALDWIN ASH POND SYSTEM (UNIT ID: 605)
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

Horizontal Hydraulic Conductivity: Field Test Results					
Monitoring Well Number	**Depth Interval Tested (feet)**	**Analysis Method**	**Lithologic Layer**	**Primary Lithologies within Screened Well Interval**	**Horizontal Hydraulic Conductivity (cm/s)**
Hydrogeologic Unit 2: Unlithified Deposits					
MW-104DR	23.2 - 28.2	Bouwer-Rice	Vandalia Till Member	Sand (fine-medium), Sandy Clay, and Silty Clay	6.8E-04
MW-151	6.1 - 15.8	Bouwer-Rice	Cahokia Formation	Sandy Clay, Silty Clay and Clay	1.1E-05
MW-152	7.5 - 16.7	Bouwer-Rice	Equality Formation	Clay	7.0E-05
OW-156	7.9 - 17.2	Bouwer-Rice	Equality Formation	Clay and Silty Clay	4.3E-05
OW-157	7.8 - 17.1	Bouwer-Rice	Equality Formation	Clay and Silty Clay	1.3E-04
MW-161	23.3 - 32.8	Bouwer-Rice	Equality Formation	Silty Clay, Sand with Silt	8.1E-05
TPZ-166	15.3 - 24.7	Bouwer-Rice	Vandalia Till Member	Silty Clay	1.9E-05
MW-252	44.4 - 49.0	Bouwer-Rice	Vandalia Till Member	Clay	1.9E-06
MW-253	29.9 - 34.5	Bouwer-Rice	Vandalia Till Member	Clay, shaley	3.5E-07
OW-256	28.0 - 32.5	Bouwer-Rice	Vandalia Till Member	Silty Clay, Sand (fine-medium)	2.2E-04
OW-257	34.0 - 38.5	Bouwer-Rice / KGS Model	Vandalia Till Member	Silty Clay	3.3E-06
MW-262	42.1 - 46.6	Bouwer-Rice	Vandalia Till Member	Sand with Silt, Sand, Silty Clay	6.0E-04
				Geometric Mean Hydraulic Conductivity	**3.2E-05**
Hydrogeologic Unit 3: Upper Bedrock					
MW-350	41.6 - 46.2	Bouwer-Rice	Mississippian Bedrock	Limestone, massive, hard to very hard; RQD = 96% (Excellent)	2.1E-06
MW-352	67.9 - 72.5	Bouwer-Rice	Pennsylvanian or Mississippian Bedrock	Limestone, medium hard to hard; RQD = 57% (Fair)	1.7E-06
MW-355	27.4 - 32.0	Bouwer-Rice	Mississippian Bedrock	Limestone, medium soft, fossiliferous; RQD = 57% (Fair)	3.5E-05
				Geometric Mean Hydraulic Conductivity	**5.0E-06**

Vertical Hydraulic Conductivity: Laboratory Test Results					
Monitoring Well Number	**Depth Interval Tested (feet)**	**Analysis Method**	**Lithologic Layer**	**Primary Lithologies within Screened Well Interval**	**Horizontal Hydraulic Conductivity (cm/s)**
Hydrogeologic Unit 1: Fill Unit					
TPZ-163	1.5 - 3.5	Geotechnology (2013)	Ash Pond System: Fly Ash / Bottom Ash	Ash (USCS classification: Silty Sand, fine grained)	2.5E-04
TPZ-164	3.0 - 5.0	Geotechnology (2013)	Ash Pond System: Bottom Ash	Ash (USCS classification: Sandy Silt, fine grained sand)	6.5E-04
TPZ-167	29.0 - 30.0	Geotechnology (2013)	Ash Pond System: Fly Ash	Ash (USCS classification: Silt)	9.7E-06
TPZ-168	3.0 - 5.0	Geotechnology (2013)	Ash Pond System: Fly Ash	Ash (USCS classification: Sandy Silt, fine-medium grained sand)	4.2E-04
				Geometric Mean Hydraulic Conductivity	**1.6E-04**
Hydrogeologic Unit 2: Unlithified Deposits					
MW-154	8.0 - 9.2	Shively Geotechnical (2010)	Cahokia Formation	Sandy Clay with gravel	7.8E-06
MW-350	18.0 - 20.0	Shively Geotechnical (2010)	Cahokia Formation	Clay	3.4E-07
TPZ-164	10.0 - 12.0	Geotechnology (2013)	Equality Formation	Clay	1.3E-06
MW-252	44.0 - 46.0	Shively Geotechnical (2010)	Vandalia Member	Clay	6.3E-09
MW-262	33.5 - 35.5	Geotechnology (2013)	Vandalia Member	Clay	9.9E-09
TPZ-163	28.0 - 30.0	Geotechnology (2013)	Vandalia Member	Clay, trace fine sand	4.2E-04
TPZ-165	8.0 - 10.0	Geotechnology (2013)	Vandalia Member	Clay, trace sand	5.3E-06
TPZ-167	32.0 - 34.0	Geotechnology (2013)	Vandalia Member	Clay with sand	6.2E-07
				Geometric Mean Hydraulic Conductivity	**8.6E-07**

Notes:
cm/s = centimeters per second

Reference:
Bouwer-Rice = Bouwer and Rice Analytical Method for Unconfined Aquifers, 1976. (note: also used for Confined Aquifers)
KGS Model = KGS overdamped slug test analysis model (Hyder et al., 1994)
Shively Geotechnical (2010): see Appendix D of NRT, June 11, 2014. Groundwater Quality Assessment and Phase II Hydrogeologic Investigation, Baldwin Ash Pond System
Geotechnology (2013): see Appendix D of NRT, June 11, 2014. Groundwater Quality Assessment and Phase II Hydrogeologic Investigation, Baldwin Ash Pond System
Data source was the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014)

TABLE C2

GROUNDWATER HORIZONTAL HYDRAULIC GRADIENTS AND FLOW VELOCITIES

BALDWIN ASH POND SYSTEM (UNIT ID: 605)

BALDWIN ENERGY COMPLEX

BALDWIN, ILLINOIS

March 19, 2019					
Area	**Approximate Flow Direction**	**Average Hydraulic Conductivity (cm/s)**	**Horizontal Hydraulic Gradient**	**Effective Porosity**	**Velocity (ft/day)**
Baldwin Bottom Ash Pond - West	W	5E-06	0.04	0.30	0.0017
Baldwin Fly Ash Pond System - West	SW	5E-06	0.02	0.30	0.0008
September 24, 2019					
Area	**Approximate Flow Direction**	**Average Hydraulic Conductivity (cm/s)**	**Horizontal Hydraulic Gradient**	**Effective Porosity**	**Velocity (ft/day)**
Baldwin Bottom Ash Pond - West	SW	5E-06	0.02	0.30	0.0009
Baldwin Fly Ash Pond System - West	W	5E-06	0.01	0.30	0.0007

Note:

cm/s = centimeters per second

ft/day = feet per day

SW = southwest

W = west

1) cm/s x 2,835 = ft/day

2) Source of hydraulic conductivity values was the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014)

TABLE C3
VERTICAL HYDRAULIC GRADIENTS
BALDWIN ASH POND SYSTEM (UNIT ID: 605)
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

Monitoring Wells for Gradient Calculations across Screened Hydrogeologic Units		Screen Midpoint Elevations (feet)		Groundwater Level Measurements (Elevation in Feet)			
				3/19/2019		9/24/2019	
Shallow	**Deep**	**Shallow**	**Deep**	**Shallow**	**Deep**	**Shallow**	**Deep**
MW-104SR	MW-104DR	442.83	428.47	447.54	447.59	443.29	443.30
MW-153	MW-253	427.60	410.53	439.02	437.82	429.90	431.38
MW-152	MW-252	410.29	375.56	420.35	424.97	417.40	422.88
MW-252	MW-352	375.56	352.15	424.97	423.42	422.88	422.20
MW-150	MW-350	374.00	350.21	382.04	377.15	375.67	373.45
MW-155	MW-355	375.50	361.11	378.26	378.44	374.22	370.54
OW-156	OW-356	412.60	364.20	424.35	424.95	418.48	424.58

Monitoring Wells for Gradient Calculations Across Screened Hydrogeologic Units		Monitored Geologic Unit**		Hydrogeologic Unit***		Vertical Groundwater Gradient Between Designated Units (feet/foot)		Average Groundwater Gradient (feet/foot)
Shallow	**Deep**	**Shallow**	**Deep**	**Shallow**	**Deep**	**3/19/2019**	**9/24/2019**	
MW-104SR	MW-104DR	Vandalia	Vandalia	2	2	**-0.003**	**-0.001**	**-0.002**
MW-153	MW-253	Vandalia	Vandalia	2	2	0.070	**-0.087**	**-0.008**
MW-152	MW-252	Equality	Vandalia	2	2	**-0.133**	**-0.158**	**-0.145**
MW-252	MW-352	Vandalia	Bedrock	2	3	0.066	0.029	0.048
MW-150	MW-350	Cahokia	Bedrock	2	3	0.206	0.093	0.149
MW-155	MW-355	Cahokia	Bedrock	2	3	**-0.013**	0.281	0.134
OW-156	OW-356	Equality	Bedrock	2	3	**-0.012**	**-0.126**	**-0.069**

Notes:

-0.02 Vertical gradient is upwards between the screened well intervals and formations indicated.
0.04 Vertical gradient is downwards between the screened well intervals and formations indicated.
* Water level in shallow well was below top of screen. Midpoint elevation calculated based on water level elevation and bottom of screen.
- - No data collected on date, water level not static, or incorrectly measured/transcribed.
- - - Deep wells OW-256 and OW-257 not constructed until August 2014.
Data source was the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014)

APPENDIX D
TECHNICAL MEMORANDUM – BALDWIN FLY ASH POND MONITORED NATURAL ATTENUATION (MNA) EVALUATION

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Columbus, Ohio 43221
PH 614.468.0415
FAX 614.468.0416
www.geosyntec.com

TECHNICAL MEMORANDUM

Date: November 30, 2020

To: Brian Voelker - Vistra

Copies to: Stu Cravens and Phil Morris - Vistra

From: Allison Kreinberg, Bob Glazier, and Nathan Higgerson - Geosyntec Consultants

Subject: Baldwin Fly Ash Pond Monitored Natural Attenuation (MNA) Evaluation Update

Geosyntec is evaluating the feasibility of monitored natural attenuation (MNA), in combination with coal combustion residual (CCR) unit source control measures, as a groundwater remedy for statistically significant levels (SSLs) of lithium above the groundwater protection standard (GWPS) at the Baldwin Fly Ash Pond (FAP) unit. As discussed in Section 2.3 of the Corrective Measures Assessment (CMA), an SSL of lithium was identified at downgradient monitoring well MW-391. The tiered evaluation is being completed in accordance with USEPA guidance[1,2] to assess whether MNA, in combination with source control, is likely to be the viable remedy based on site conditions. The findings of the study completed to-date and the additional data collection required to develop multiple lines of evidence to support the evaluation of MNA in accordance with USEPA guidance are summarized below.

MNA EVALUATION

The selection of MNA, with source control, as a remedy for groundwater constituents will be based on a multiple lines of evidence approach, as outlined in the USEPA guidance. The multiple lines of evidence approach for the Baldwin FAP will be based upon (i) source control to mitigate further loading of lithium mass to groundwater; (ii) delineation of the nature and extent of lithium impacts in groundwater; and (iii); a successful evaluation of favorable site conditions that result in the attenuation of lithium in groundwater leading to stable or declining trends of lithium in groundwater following source control implementation.

[1] USEPA. 2007. Monitored Natural Attenuation of Inorganic Contaminants in Ground Water, Volume I – Technical Basis for Assessment. EPA/600/R-07/139. October.
[2] USEPA. 2015. Use of Monitored Natural Attenuation for Inorganic Contaminants in Groundwater at Superfund Sites. Directive No. 9283.1-36. August.

KEY CONDITIONS

The status of key conditions which will support the selection of MNA, in combination with source control, as a groundwater remedy is summarized below. These conditions were assessed as Tier 1 of the evaluation.

Site Geology and Hydrogeology

As noted in Section 2.2 of the CMA, the uppermost aquifer beneath the FAP is the Bedrock Unit, which consists of Pennsylvanian and Mississippian bedrock, mainly limestone and shale. The Bedrock Unit is overlain by unlithified alluvial and glacial deposits of clay, silty clay, silt, sandy clay, and clayey sand with occasional intermittent and discontinuous sand lenses. Groundwater flow in the unlithified glacial materials, and in the bedrock, is to the west and southwest, and ultimately flows towards the Kaskaskia River or its tributaries, which border the Baldwin Energy Complex to the west and south, as shown in the potentiometric map provided in Appendix A.

Source Control

Illinois Environmental Protection Agency (IEPA) approved the closure and post-closure plan on August 16, 2016, which consisted of dewatering the unit and constructing an earthen cover system with a permeability less than 1 x 10^{-5} centimeters per second (cm/sec). A stormwater management system will convey runoff from the final cover system into a system of interior collection channels before routing to stormwater detention ponds. Closure construction activities at the FAP associated with the approved closure plan were completed in November 2020. These closure measures act as improved source control and are designed to prevent future releases onsite.

Delineation of Groundwater Exceedances

As discussed in Section 2.3 of the CMA, the lithium SSL at MW-391 appears to be delineated via downgradient well MW-350. Lateral delineation is provided by wells MW-366, MW-375 and the secondary and tertiary surface water features. The potentiometric map provided as Figure 3 of the CMA and provided herein as Attachment A illustrates these results. On-going review of groundwater hydrology under all site conditions, including post-closure, is being conducted to further evaluate the completeness of delineation.

Lithium Attenuation

Lithium is a conservative constituent which is not readily attenuated by precipitation or adsorption processes. Instead, the primary attenuation mechanism is likely dilution and dispersion during groundwater transport downgradient. USEPA guidance notes that “Dilution and dispersion generally are not appropriate as primary MNA mechanisms because they reduce concentrations through dispersal of contaminant mass rather than destruction or immobilization of contaminant mass. Dilution and dispersion may be appropriate as a “polishing step” for distal portions of a plume when an active remedy is being used at a site, source control is complete, and appropriate land use and groundwater use controls are in place." Source control is in place via the closure efforts completed in November 2020.

As described in Section 2.3 of the CMA, MW-391 did not have sufficient groundwater to permit sampling during monitoring events in 2016 and 2017. After groundwater elevations stabilized, the lithium concentration also stabilized (as shown in the time series graph provided in Figure 1), with no statistically significant trend identified for the recent monitoring events at MW-391 (Appendix B). Additional monitoring is required to evaluate lithium concentrations post-closure. Given the current and anticipated future land use, there is likely limited risk of lithium exposure to the public.

These findings adequately meet the requirements of Tier 1 of the MNA evaluation in accordance with USEPA guidance. However, additional efforts are planned for 2021 to sufficiently develop all lines of evidence and complete a full tiered evaluation.

ADDITIONAL EVALUATION

As part of the tiered evaluation, additional efforts will be completed in 2021 to support the existing findings that MNA, in combination with source control, may be an appropriate groundwater remedy at the FAP. For each tier of the remaining evaluation, the following scope of work is planned to collect sufficient additional information:

- Tier 2 (Demonstration the attenuation mechanism and rate): Groundwater hydrogeology will be reviewed to assess if dilution and dispersion will sufficiently reduce downgradient concentrations below the regulatory criteria, including after completion of closure activities. Evaluation of the decay of source flux to groundwater, including additional sampling and possible additional modeling, may be required. Evaluation of lithium attenuation mechanism and rate is not necessary because, in addition to source control, only dilution and dispersion are being considered and attenuation of lithium by reaction with aquifer solids is not likely to be occurring.

- Tier 3 (Demonstration that the aquifer capacity is sufficient for attenuation): Additional modeling of groundwater hydrogeology may be required depending on the results of the Tier 2 analysis.

- Tier 4 (Long-Term Monitoring): Based on the results of the Tier 2 and Tier 3 evaluations, a performance monitoring plan will be developed to evaluate the efficacy of MNA at the site. The performance monitoring plan will also include potential supplemental remedies, if needed. These other potential remedies will be evaluated in parallel with the tiered evaluation in accordance with 40 C.F.R. § 257.97 in the performance monitoring plan.

EVALUATION CRITERIA

MNA was evaluated to assess whether it will likely meet the criteria outlined in 40 C.F.R. § 257.96(c) as a potential corrective action. This evaluation is summarized below and in Table 3 of the CMA.

MNA Performance

MNA performance is best when paired with source control measures, which were completed at the site in November 2020. For lithium, the stable concentrations at MW-391 combined with source control suggest that MNA performance at the FAP is likely to achieve the performance criteria outlined in 40 C.F.R. § 257.97. Completion of the tiered evaluation and assessment of lithium concentrations under closure conditions are required to fully assess MNA performance relative to the performance criteria.

Reliability of MNA

The reliability of MNA is dependent on site-specific conditions. A review of site hydrogeology under post-closure conditions to confirm downgradient delineation is required. Additional evaluation may be required to understand the site-specific dilution and dispersion capacity and rate, both of which will provide more information on the reliability of MNA.

Ease of implementation of MNA

MNA is relatively easy to implement compared to other potential corrective actions which require construction, earthwork, or engineering design. Additional efforts required to implement MNA include completion of the tiered investigation and implementation of the performance monitoring plan. These efforts do not require specialized equipment or contractors.

Potential impacts (including safety impacts, cross-media impacts, and control of exposure to any residual contamination)

Potential impacts are not anticipated with MNA. MNA relies on processes that are naturally occurring in the aquifer; therefore, cross-media impacts are unlikely. Large scale handling of impacted materials (such as during groundwater extraction) is not required, reducing the potential for exposure to residuals during implementation.

Time required to begin and complete MNA

USEPA guidance states that "natural attenuation should achieve site-specific objections within a time frame that is reasonable compared to that offered by more active methods"[3]. When considering a reasonable time frame, USEPA recommends consideration of factors such as

[3] USEPA. 1999. Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites. OSWER Directive 9200.4-17P. April.

contaminant properties, exposure risk, classification of the protected resource, and potential for plume stability. As discussed above, source control is complete and lithium concentrations at MW-391 already exhibit stable behavior.

Additional information is required to complete the tiered MNA evaluation and develop a performance monitoring plan. This evaluation can be completed within one year. The time required to attain the groundwater protection standard at MW-391 can be estimated once additional information is developed regarding the attenuation rate and continued stability or decline in concentrations after source control implementation was completed in November of 2020. Because the time to completion will depend on the source decay rate, it is anticipated that MNA would have a similar cleanup time as other potential corrective actions, such as groundwater extraction. It is anticipated that the timeframe is reasonable within the guidance provided by USEPA.

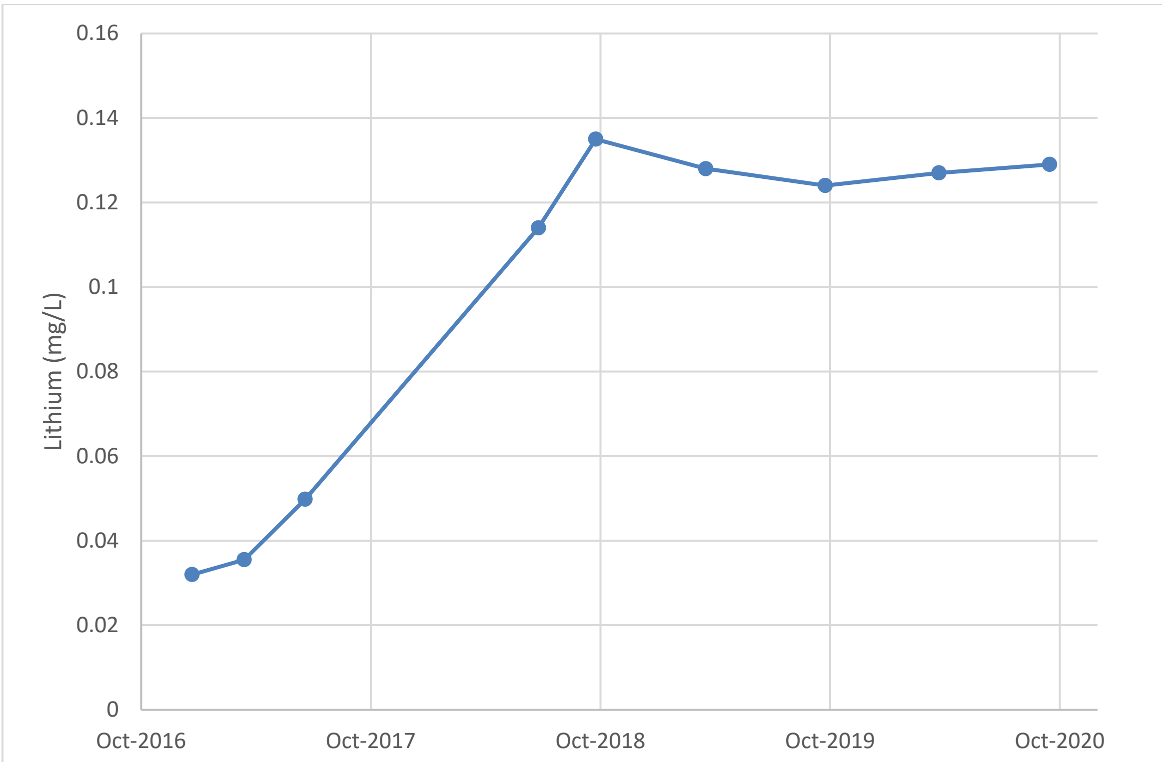
Institutional requirements, such as state or local permit requirements, that may substantially affect implementation of MNA

No institutional requirements are anticipated which would substantially affect implementation of MNA.

CONCLUSIONS

Based on the analysis completed to date, MNA combined with source control appears to be a promising groundwater remedy at the Baldwin FAP when evaluated against the requirements in 40 C.F.R. § 257.96(c). Further investigation will be completed in 2021 to collect sufficient evidence to support the tiered MNA evaluation, which will include a better understanding of site hydrogeology and conditions after closure to develop multiple lines of evidence in accordance with USEPA guidance.

FIGURES



Notes: Lithium values are shown as milligrams per liter (mg/L).

MW-391 Lithium Time Series Graph

Baldwin

Baldwin, Illinois

Geosyntec consultants

Columbus, OH

2020/11/27

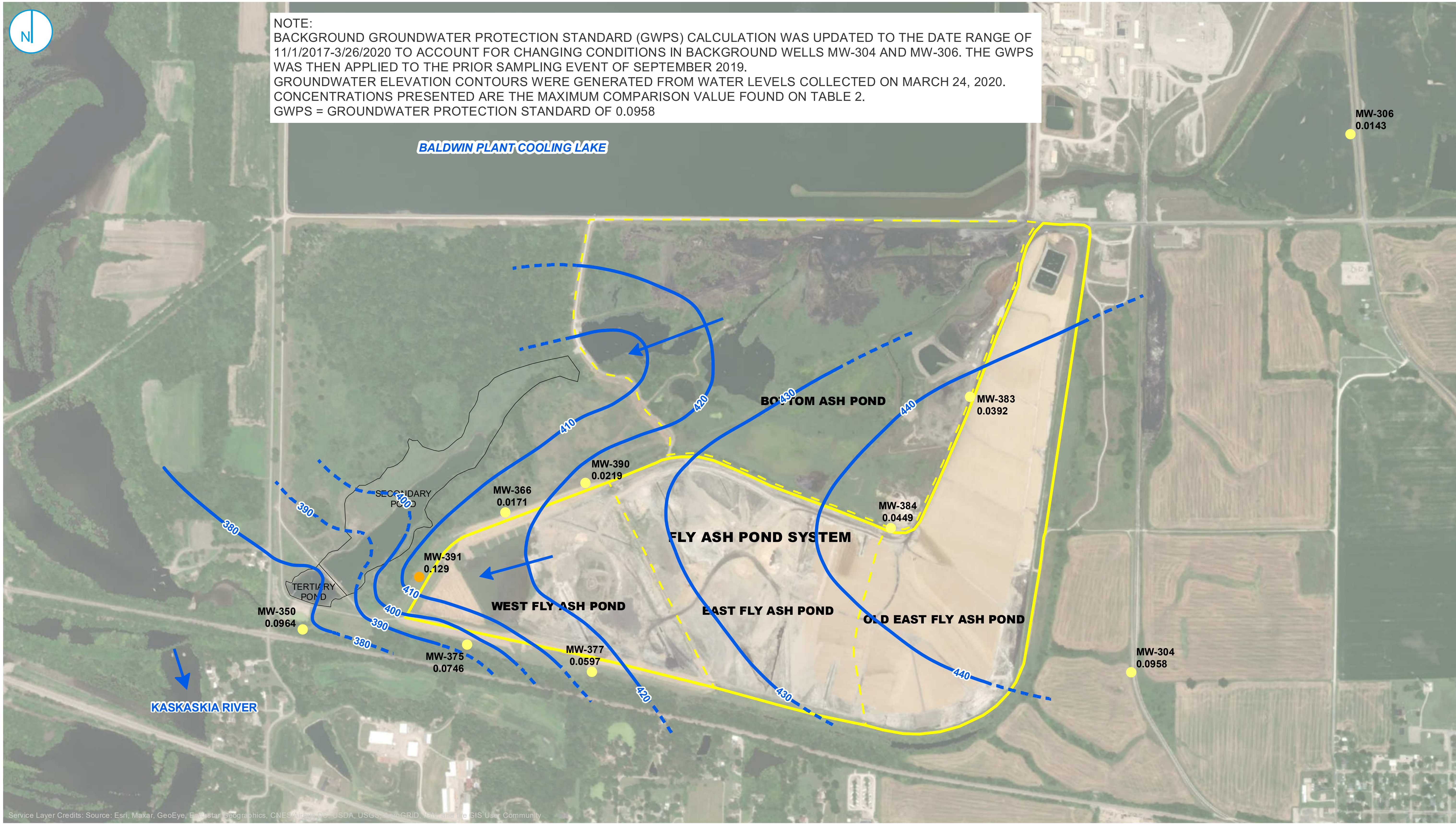
Figure 1

internal info: path, date revised, author

APPENDIX A

Lithium Plume Map

NOTE:
BACKGROUND GROUNDWATER PROTECTION STANDARD (GWPS) CALCULATION WAS UPDATED TO THE DATE RANGE OF 11/1/2017-3/26/2020 TO ACCOUNT FOR CHANGING CONDITIONS IN BACKGROUND WELLS MW-304 AND MW-306. THE GWPS WAS THEN APPLIED TO THE PRIOR SAMPLING EVENT OF SEPTEMBER 2019.
GROUNDWATER ELEVATION CONTOURS WERE GENERATED FROM WATER LEVELS COLLECTED ON MARCH 24, 2020.
CONCENTRATIONS PRESENTED ARE THE MAXIMUM COMPARISON VALUE FOUND ON TABLE 2.
GWPS = GROUNDWATER PROTECTION STANDARD OF 0.0958



Y:\Mapping\Projects\22\2285_Baldwin\MXD\Part A\Figure 2_Baldwin_Lithium.mxd

PROJECT: 169000XXXX | DATED: 11/30/2020 | DESIGNER: MARRAMJ

LITHIUM, TOTAL (mg/L)
- DETECTED
- DETECTED, >GWPS
- CCR MONITORED MULTI-UNIT, SUBJECT SITE
- CCR MONITORED UNIT
- NON-CCR UNIT

0 400 800 Feet

- GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION

TOTAL LITHIUM PLUME MAP

BALDWIN FLY ASH POND SYSTEM (UNIT ID: 605)
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

FIGURE 3

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

APPENDIX B

Mann-Kendall Analysis - Lithium Concentrations at

MW-391

Mann-Kendall Trend Test Analysis

User Selected Options	Only includes data from 6/26/2018 onward
Date/Time of Computation	ProUCL 5.111/27/2020 9:36:22
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.99
Level of Significance	0.01

MW-391 Lithium (recent data)

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	6
Number Values Reported (n)	6
Minimum	0.114
Maximum	0.135
Mean	0.126
Geometric Mean	0.126
Median	0.128
Standard Deviation	0.00697
Coefficient of Variation	0.0552

Mann-Kendall Test

M-K Test Value (S)	3
Tabulated p-value	0.36
Standard Deviation of S	5.323
Standardized Value of S	0.376
Approximate p-value	0.354

Insufficient evidence to identify a significant trend at the specified level of significance.

ATTACHMENT 8 – REMEDY SELECTION PROGRESS REPORTS (FLY ASH POND SYSTEM)

RAMBOLL

ENVIRONMENT
& HEALTH

March 5, 2020

SEMIANNUAL REMEDY SELECTION PROGRESS REPORT
BALDWIN FLY ASH POND SYSTEM

In accordance with Title 40 Code of Federal Regulations (C.F.R.) § 257.97(a), the owner or operator of a coal combustion residuals (CCR) unit must prepare a semiannual report describing the progress in selecting and designing a remedy for statistically significant levels (SSLs) of constituents listed in Appendix IV of 40 C.F.R. Part 257 over the groundwater protection standards established in accordance with 40 C.F.R. § 257.95(h).

This report is for the Fly Ash Pond System at the Baldwin Energy Complex.

As stated in the notification dated February 6, 2019, an SSL for total lithium was identified at the Fly Ash Pond System during assessment monitoring completed in accordance with 40 C.F.R. § 257.95.

A Corrective Measures Assessment (CMA) was completed for the Fly Ash Pond System on September 5, 2019 as required by 40 C.F.R. § 257.96. The CMA indicated the source control measure consists of closure in place with a final cover system of earthen material. Closure is underway in accordance with the Closure and Post Closure Care Plan approved by the Illinois Environmental Protection Agency in August of 2016, and scheduled to be completed by November 2020. Post-closure groundwater monitoring will also be completed to assess natural attenuation of CCR constituents in groundwater and demonstrate that the extent of groundwater impact is decreasing in size and concentration following closure.

A public meeting was held on December 2, 2019 at the Red Bud High School Gymnasium in Red Bud, Illinois to discuss the results of the of the CMA in accordance with 40 C.F.R. § 257.96(e).

Selection of the groundwater remedy is currently in the monitored natural attenuation (MNA) feasibility study phase.

ENVIRONMENT
& HEALTH

September 5, 2020

SEMIANNUAL REMEDY SELECTION PROGRESS REPORT
BALDWIN FLY ASH POND SYSTEM

In accordance with Title 40 Code of Federal Regulations (C.F.R.) § 257.97(a), the owner or operator of a coal combustion residuals (CCR) unit must prepare a semiannual report describing the progress in selecting and designing a remedy for statistically significant levels (SSLs) of constituents listed in Appendix IV of 40 C.F.R. Part 257 over the groundwater protection standards established in accordance with 40 C.F.R. § 257.95(h).

This report is for activities occurring between March 5, 2020 and September 5, 2020 at the Fly Ash Pond System at the Baldwin Energy Complex.

As stated in the March 5, 2020 Semiannual Remedy Selection Progress Report, A Corrective Measures Assessment (CMA) was completed for the Fly Ash Pond System on September 5, 2019 as required by 40 C.F.R. § 257.96. The CMA indicated the source control measure consists of closure in place with a final cover system of earthen material. Closure construction is nearing completion in accordance with the Closure and Post Closure Care Plan approved by the Illinois Environmental Protection Agency in August of 2016, and scheduled to be completed in September 2020.

As stated in the notification dated August 13, 2020, an SSL for total lithium was identified at the Fly Ash Pond System during assessment monitoring completed in accordance with 40 C.F.R. § 257.95.

Selection of the groundwater remedy continues to be in the monitored natural attenuation (MNA) feasibility study phase. Activities completed since March 5, 2020 include review of existing groundwater and source water data, identification and collection of additional groundwater and source water samples, and identification of additional data collection needs to support development of a geochemical conceptual site model. These activities are necessary to understand the natural attenuation mechanisms occurring at the site and to evaluate the natural attenuation of lithium to meet applicable groundwater protection standards.

ATTACHMENT 9 – STRUCTURAL STABILITY ASSESSMENT

AECOM

Submitted to
Dynegy Midwest Generation, LLC
1500 Eastport Drive
Collinsville, IL 62234

Submitted by
AECOM
1001 Highlands Plaza Drive West
Suite 300
St. Louis, MO 63110

October 2016

CCR Rule Report: Initial Structural Stability Assessment

For

Bottom Ash Pond

At Baldwin Energy Complex

1 Introduction

This Coal Combustion Residual (CCR) Rule Report documents that the Bottom Ash Pond at the Dynegy Midwest Generation, LLC Baldwin Energy Complex meets the structural stability assessment requirements specified in 40 Code of Federal Regulations (CFR) §257.73(d). The Bottom Ash Pond is located near Baldwin, Illinois in Randolph County, approximately 0.9 miles southwest of the Baldwin Energy Complex. The Bottom Ash Pond serves as the primary wet impoundment for sluiced bottom ash and other non-CCR wastewaters produced at the Baldwin Energy Complex.

The Bottom Ash Pond is an existing CCR surface impoundment as defined by 40 CFR §257.53. The CCR Rule requires that an initial structural stability assessment for an existing CCR surface impoundment be completed by October 17, 2016. In general, the initial structural stability assessment must document that the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices.

The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial structural stability assessment was conducted in accordance with the requirements of 40 CFR § 257.73(d). The owner or operator must prepare a periodic structural stability assessment every five years.

2 Initial Structural Stability Assessment

40 CFR §257.73(d)(1)
The owner or operator of the CCR unit must conduct initial and periodic structural stability assessments and document whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein. The assessment must, at a minimum, document whether the CCR unit has been designed, constructed, operated, and maintained with [the standards in (d)(1)(i)-(vii)].

An initial structural stability assessment has been performed to document that the design, construction, operation and maintenance of the Bottom Ash Pond is consistent with recognized and generally accepted good engineering practices and meets the standards in 257.73(d)(1)(i)-(vii). The results of the structural stability assessment are discussed in the following sections. Based on the assessment and its results, the design, construction, operation, and maintenance of the Bottom Ash Pond were found to be consistent with recognized and generally accepted good engineering practices.

2.1 Foundations and Abutments (§257.73(d)(1)(i))

CCR unit designed, constructed, operated, and maintained with stable foundations and abutments.

The stability of the foundations was evaluated using soil data from field investigations and reviewing design drawings, operational and maintenance procedures, and conditions observed in the field by AECOM. Additionally, slope stability analyses were performed to evaluate slip surfaces passing through the foundations.

The foundation consists of soft to stiff clay, which indicates stable foundations. Soil conditions at the abutments were found to be similar to the foundation for the remainder of the Bottom Ash Pond. Slope stability analyses exceed the criteria listed in §257.73(e)(1) for slip surfaces passing through the foundation. The slope stability analyses are discussed in the *CCR Rule Report: Initial Safety Factor Assessment for Bottom Ash Pond at Baldwin Energy Complex* (October 2016). A review of operational and maintenance procedures as well as current and past performance of the dikes has determined appropriate processes are in place for continued operational performance. Based on the conditions observed by AECOM, the Bottom Ash Pond was designed and constructed with stable foundations and abutments. Operational and maintenance procedures are in place to address any issues related to the stability of the foundations and abutments. Therefore, the Bottom Ash Pond meets the requirements in §257.73(d)(1)(i).

2.2 Slope Protection (§257.73(d)(1)(ii))

CCR unit designed, constructed, operated, and maintained with adequate slope protection to protect against surface erosion, wave action and adverse effects of sudden drawdown.

The adequacy of slope protection was evaluated by reviewing design drawings, operational and maintenance procedures, and conditions observed in the field by AECOM.

Based on this evaluation, adequate slope protection was designed and constructed at the Bottom Ash Pond. No evidence of significant areas of erosion or wave action were observed. The interior slopes are covered with riprap erosion protection in some areas and vegetation in other areas. The exterior slopes are covered in vegetation. Operational and maintenance procedures to repair the vegetation and riprap as needed are appropriate to protect against surface erosion and wave action. Intentional or unintentional sudden drawdown of the pool in the Bottom Ash Pond is not expected to occur due to the characteristics of the spillway structures. Because sudden drawdown conditions are not expected to occur, slope protection to protect against the adverse effects of sudden drawdown is not required. Therefore, the Bottom Ash Pond meets the requirements in §257.73(d)(1)(ii).

2.3 Dike Compaction (§257.73(d)(1)(iii))

CCR unit designed, constructed, operated, and maintained with dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit.

The density of the dike materials was evaluated using soil data from field investigations and reviewing design drawings, operational and maintenance procedures, and conditions observed in the field by AECOM. Additionally, slope stability analyses were performed to evaluate slip surfaces passing through the dike over the range of expected loading conditions as defined within §257.73(e)(1).

Based on this evaluation, the dike consists of soft to very stiff material that is stiff on average, which is indicative of mechanically compacted dikes. Slope stability analyses, which are discussed in the *CCR Rule Report: Initial Safety Factor Assessment for Bottom Ash Pond at Baldwin Energy Complex* (October 2016), exceed the criteria listed in §257.73(e)(1) for slip surfaces passing through the dike. Thus, the original design and construction of the Bottom Ash Pond included sufficient dike compaction. Operational and maintenance procedures are in place to identify and mitigate deficiencies in order to maintain sufficient compaction of the dikes to withstand the range of loading conditions. Therefore, the Bottom Ash Pond meets the requirements in §257.73(d)(1)(iii).

2.4 Vegetated Slopes (§257.73(d)(1)(iv))[1]

CCR unit designed, constructed, operated, and maintained with vegetated slopes of dikes and surrounding areas, except for slopes which have an alternate form or forms of slope protection.

The adequacy of slope vegetation was evaluated by reviewing design drawings, operational and maintenance procedures, and conditions observed in the field by AECOM.

Based on this evaluation, the vegetation on the exterior and interior slopes is adequate as no substantial bare or overgrown areas were observed. Riprap slope protection is present in some areas on the interior slopes and is used as an alternate form of slope protection, which is adequate as significant areas of erosion or bare soil within or around the riprap were not observed. Therefore, the original design and construction of the Bottom Ash Pond included adequate vegetation of the dikes and surrounding areas. Adequate operational and maintenance procedures are in place to regularly manage vegetation growth, including mowing and seeding any bare areas, as evidenced by the conditions observed by AECOM. Therefore, the Bottom Ash Pond meets the requirements in §257.73(d)(1)(iv).

[1] As modified by court order issued June 14, 2016, Utility Solid Waste Activities Group v. EPA, D.C. Cir. No. 15-1219 (order granting remand and vacatur of specific regulatory provisions).

2.5 Spillways (§257.73(d)(1)(v))

CCR unit designed, constructed, operated, and maintained with a single spillway or a combination of spillways configured as specified in [paragraph (A) and (B)]:

(A) All spillways must be either:

(1) of non-erodible construction and designed to carry sustained flows; or

(2) earth- or grass-lined and designed to carry short-term, infrequent flows at non-erosive velocities where sustained flows are not expected.

(B) The combined capacity of all spillways must adequately manage flow during and following the peak discharge from a:

(1) Probable maximum flood (PMF) for a high hazard potential CCR surface impoundment; or

(2) 1000-year flood for a significant hazard potential CCR surface impoundment; or

(3) 100-year flood for a low hazard potential CCR surface impoundment.

The spillways were evaluated using design drawings, operational and maintenance procedures, and conditions observed in the field by AECOM. Additionally, hydrologic and hydraulic analyses were completed to evaluate the capacity of the spillways relative to inflow estimated for the 1,000-year flood event for the significant hazard potential Bottom Ash Pond. The hazard potential classification assessment was performed by Stantec in 2016 in accordance with §257.73(a)(2).

Three separate spillways are present: a high-density polyethylene (HDPE) pipe conduit and riser, a riprap-lined emergency spillway, and a pumping station with HDPE discharge pipes. All of the spillways are constructed with non-erodible materials that are designed to carry sustained flows. The capacity of the spillways, was evaluated using hydrologic and hydraulic analysis performed per §257.82(a). The analysis found that the spillways can adequately manage flow during peak discharge resulting from the 1,000-year storm event without uncontrolled overtopping of the embankments. The hydrologic and hydraulic analyses are discussed in the *CCR Rule Report: Initial Inflow Design Flood Control System Plan for Bottom Ash Pond at Baldwin Energy Complex* (October 2016). Operational and maintenance procedures are in place to repair any issues with the spillways and remove debris or other obstructions from the spillways, as evidenced by the conditions observed by AECOM. As a result, these procedures are appropriate for maintaining the spillway. Therefore, the Bottom Ash Pond meets the requirements in §257.73(d)(1)(v).

2.6 Stability and Structural Integrity of Hydraulic Structures (§257.73(d)(1)(vi))

CCR unit designed, constructed, operated, and maintained with hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure.

The stability and structural integrity of the hydraulic structure penetrating the dike of the Bottom Ash Pond, the 30-inch HDPE pipe conduit spillway, was evaluated using design drawings, operational and maintenance procedures, closed-circuit televisions (CCTV) pipe inspections, and conditions observed in the field by AECOM. No other hydraulic structures are known to pass through the dike of or underlie the base of the Bottom Ash Pond.

The CCTV inspection of the HDPE outflow pipe found the pipe to be free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris that may negatively affect the operation of the hydraulic structure. Operational and maintenance procedures are in place to remove debris or other obstructions from the hydraulic structure, and address any deficiencies, as evidenced by conditions observed by AECOM. As a result, these procedures are appropriate for maintaining the spillway. Therefore, the Bottom Ash Pond meets the requirements in §257.73(d)(1)(vi).

2.7 Downstream Slope Inundation/Stability (§257.73(d)(1)(vii))

CCR unit designed, constructed, operated, and maintained with, for CCR units with downstream slopes which can be inundated by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body.

The structural stability of the downstream slopes of the Bottom Ash Pond was evaluated using hydraulic and hydrologic analyses, as discussed in the *CCR Rule Report: Initial Inflow Design Flood Control System Plan for Bottom Ash Pond at Baldwin Energy Complex* (October, 2016). This analysis, which considered a 100-year flood condition in the downstream Kaskaskia River, found that the peak water surface elevation of the downstream non-CCR Secondary Pond is 0.6 feet below the elevation of the Bottom Ash Pond embankment toe during 1,000-year Inflow Design Flood conditions. During normal conditions, the pool in the Secondary Pond is approximately 1,000 lateral feet beyond the toe of the Bottom Ash Pond embankment.

Based on this evaluation, the requirements in §257.73(d)(1)(vii) are not applicable to the Bottom Ash Pond, as inundation of the downstream slopes is not expected to occur.

3 Certification Statement

CCR Unit: Dynegy Midwest Generation, LLC; Baldwin Energy Complex; Bottom Ash Pond

I, Victor A. Modeer, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this CCR Rule Report, and the underlying data in the operating record, has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the initial structural stability assessment dated October 13, 2016 was conducted in accordance with the requirements of 40 CFR § 257.73(d).

VICTOR A MODEER JR.
Printed Name

10/13/16
Date

VICTOR ALBERT MODEER JR.
062-043112
REGISTERED PROFESSIONAL ENGINEER OF ILLINOIS
11/30/17

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ATTACHMENT 10 – SAFETY FACTOR ASSESSMENT

Submitted to
Dynegy Midwest Generation, LLC
1500 Eastport Drive
Collinsville, IL 62234

Submitted by
AECOM
1001 Highlands Plaza Drive West
Suite 300
St. Louis, MO 63110

October 2016

CCR Rule Report: Initial Safety Factor Assessment

For

Bottom Ash Pond

At Baldwin Energy Complex

1 Introduction

This Coal Combustion Residual (CCR) Rule Report documents that the Bottom Ash Pond at the Dynegy Midwest Generation, LLC Baldwin Energy Complex meets the safety factor assessment requirements specified in 40 Code of Federal Regulations (CFR) §257.73(e). The Bottom Ash Pond is located near Baldwin, Illinois in Randolph County, approximately 0.9 miles southwest of the Baldwin Energy Complex. The Bottom Ash Pond serves as the primary wet impoundment for sluiced bottom ash and other non-CCR wastewaters produced at the Baldwin Energy Complex.

The Bottom Ash Pond is an existing CCR surface impoundment as defined by 40 CFR §257.53. The CCR Rule requires that the initial safety factor assessment for an existing CCR surface impoundment be completed by October 17, 2016.

The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial safety factor assessment meets the requirements of 40 CFR § 257.73(e). The owner or operator must prepare a safety factor assessment every five years.

2 Initial Safety Factor Assessment

40 CFR §257.73(e)(1)
The owner or operator must conduct initial and periodic safety factor assessments for each CCR unit and document whether the calculated factors of safety for each CCR unit achieve the minimum safety factors specified in (e)(1)(i) through (iv) of this section for the critical cross section of the embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments must be supported by appropriate engineering calculations.

(i) The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.
(ii) The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.
(iii) The calculated seismic factor of safety must equal or exceed 1.00.
(iv) For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

A geotechnical investigation program and stability analyses were performed to evaluate the design, performance, and condition of the earthen dikes of the Bottom Ash Pond. The exploration consisted of hollow-stem auger borings, solid-stem auger borings, piezometer installation, cone penetration tests, and laboratory program including strength and index testing. Data collected from the geotechnical investigation, available design drawings, construction records, inspection reports, previous engineering investigations, and other pertinent historic documents were utilized to perform the safety factor assessment and geotechnical analyses.

In general, the subsurface conditions at the Bottom Ash Pond consist of soft to very stiff embankment fill (clay) intermittently overlying soft to stiff loess (clay), overlying medium stiff to hard residual soils (clay), which in turn overlies shale and limestone bedrock. Phreatic water is typically several feet above the bottom of the embankment.

A representative cross section was analyzed using limit equilibrium slope stability analysis software to evaluate stability of the perimeter dike system and foundations. The cross section was located at the maximum embankment height for the Bottom Ash Pond. Due to the relatively short height of the Bottom Ash Pond embankments and uniform slope orientations, subsurface stratigraphy, and phreatic conditions, a single cross section at the maximum embankment height is sufficient to represent the critical cross section. The cross section was evaluated for each of the loading conditions stipulated in §257.73(e)(1).

A liquefaction susceptibility evaluation did not find soils susceptible to liquefaction within the Bottom Ash Pond dikes or foundation. As a result, the Soils Susceptible to Liquefaction loading condition (§257.73(e)(1)(iv)) is not applicable to the Bottom Ash Pond at the Baldwin Energy Complex.

Results of the Initial Safety Factor Assessments are listed in Table 1.

Table 1 – Summary of Initial Safety Factor Assessments

Loading Conditions	§257.73(e)(1) Subsection	Minimum Factor of Safety	Calculated Factor of Safety
Maximum Storage Pool Loading	(i)	1.50	2.04
Maximum Surcharge Pool Loading	(ii)	1.40	2.04
Seismic	(iii)	1.00	1.43
Soils Susceptible to Liquefaction	(iv)	1.20	Not Applicable

Based on this evaluation, the Bottom Ash Pond meets the requirements in §257.73(e)(1).

3 Certification Statement

CCR Unit: Dynegy Midwest Generation, LLC; Baldwin Energy Complex; Bottom Ash Pond

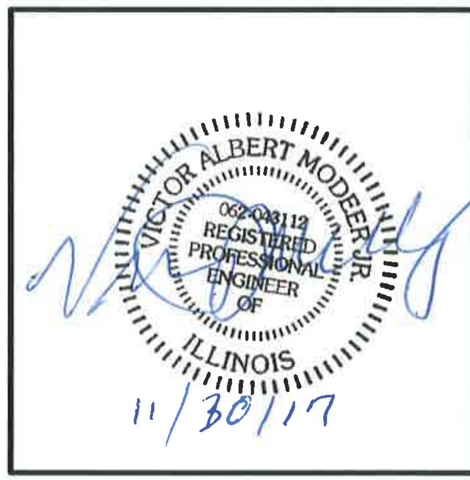
I, Victor A. Modeer, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this CCR Rule Report, and the underlying data in the operating record, has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the initial safety factor assessment dated October 13, 2016 meets the requirements of 40 CFR §257.73(e).

VICTOR A. MODEER JR.

Printed Name

10/13/16

Date



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ATTACHMENT 11 – CLOSURE PLAN (BOTTOM ASH POND)

CLOSURE PLAN FOR EXISTING CCR SURFACE IMPOUNDMENT
40 CFR 257.102(b)
REV 0 – 10/17/2016

SITE INFORMATION			
Site Name / Address	Baldwin Energy Complex / 10901 Baldwin Road, Baldwin, IL 62217		
Owner Name / Address	Dynegy Midwest Generation, LLC / 1500 Eastport Plaza Drive, Collinsville, IL 62234		
CCR Unit	Bottom Ash Pond	Closure Method and Final Cover Type	Close In-Place Clayey Soil Cover with Vegetation

CLOSURE PLAN DESCRIPTION	
(b)(1)(i) – Narrative description of how the CCR unit will be closed in accordance with this section.	The Bottom Ash Pond will be dewatered, as necessary, to facilitate closure by leaving CCR in place. The CCR in the Bottom Ash Pond will be shaped and graded. The final cover will be sloped to promote drainage and stormwater runoff will be conveyed through a series of drainage channels on the cover system to a perimeter drainage channel. The non-CCR perimeter drainage channel will direct stormwater from the cover system to the existing Secondary Pond located on the southwest side of the Bottom Ash Pond. Existing inlet pipes into the Bottom Ash Pond and the existing outlet pipes from the Bottom Ash Pond to the Secondary Pond and to the Cooling Lake will be removed from service. In accordance with 257.102(b)(3), this initial written closure plan will be amended to provide additional details after the final engineering design for the grading and cover system is completed, if the final design would substantially affect this written closure plan. This initial closure plan reflects the information available to date.
(b)(1)(iii) – If closure of the CCR unit will be accomplished by leaving CCR in place, a description of the final cover system and methods and procedures used to install the final cover.	The soils for the final cover system will be placed directly on top of the graded CCR material to achieve final grades and will include (from bottom up): 1) 18" of compacted earthen material with a permeability of less than or equal to the permeability of the natural subsoils present at the site or no greater than $1x10^{-5}$ cm/sec, whichever is less; 2) 6" of soil capable of sustaining native plant growth; and 3) planted native grasses. Emplaced CCR material will be regraded as fill and supplemented with borrow soils as necessary to achieve design grades. Earthen material will be placed, graded, and compacted to meet the thickness and permeability as discussed above for the cover system. Organic earthen material will be placed on top of the 18" of compacted soils to create a 6" soil layer capable of sustaining native plant growth. The final cover surface will be seeded and vegetated. The final cover slope will have a minimum slope of 2% and will be graded to convey stormwater runoff to drainage channels on the cover system to a perimeter channel, which leads to the existing Secondary Pond.

(b)(1)(iii) – How the final cover system will achieve the performance standards in 257.102(d).	
(d)(1)(i) Control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere.	The permeability of the final cover will be equal to or less than the permeability of the natural subsoils present below the CCR material or permeability no greater than $1x10^{-5}$ cm/sec, whichever is less. Therefore, the permeability of the final cover system will not be greater than $1x10^{-5}$ cm/sec. The final cover system will be graded with a minimum 2% slope.
(d)(1)(ii) – Preclude the probability of future impoundment of water, sediment, or slurry.	The final cover will be installed with a minimum 2% slope. Drainage channels will be installed with a minimum 0.5% slope.
(d)(1)(iii) – Include measures that provide for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period.	The final cover will have a minimum 2% slope and drainage channels will have minimum 0.5% slope. Drainage channels will be lined with turf reinforced mats where required to reduce the potential for erosion. The final slope of the berms and cover will meet the stability requirements to prevent sloughing or movement of the final cover system.

CLOSURE PLAN DESCRIPTION	
(d)(1)(iv) – Minimize the need for further maintenance of the CCR unit.	The final cover will be vegetated to minimize erosion and maintenance.
(d)(1)(v) – Be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices.	Closure is estimated to be completed no later than five years upon commencement of closure activities.
(d)(2)(i) – Free liquids must be eliminated by removing liquid wastes or solidifying the remaining wastes and waste residue.	The unit will be dewatered sufficiently, as necessary, to remove the free liquids to provide a stable base for the construction of the final cover system.
(d)(2)(ii) – Remaining wastes must be stabilized sufficiently to support the final cover system.	Dewatering as necessary and regrading of existing in-place CCR will sufficiently stabilize the waste such that the final cover will be supported.
(d)(3) – A final cover system must be installed to minimize infiltration and erosion, and at minimum, meets the requirements of (d)(3)(i).	The final cover will consist of a minimum 18" earthen material layer with permeability equal to or less than the permeability of the natural subsoils or no greater than $1x10^{-5}$ cm/sec, whichever is less. Therefore, the permeability of the final cover system will be not greater than $1x10^{-5}$ cm/sec. Erosion will be minimized with a soil layer of no less than 6" of earthen material capable of sustaining native plant growth. The final cover surface will be seeded and vegetated.
(d)(3)(i) – The design of the final cover system must be included in the written closure plan.	When the design of the final cover system is completed, the written closure plan will be amended if the final design would substantially change this written closure plan. The design of the final cover system will meet the requirements of §(d)(3)(i)(A) – (D) as described below.
(d)(3)(i)(A) – The permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than $1x10^{-5}$cm/sec, whichever is less.	The permeability of the final cover will be equal to or less than the permeability of the natural subsoils or no greater than $1x10^{-5}$ cm/sec, whichever is less. Therefore, the permeability of the final cover system will be designed to meet this requirement.
(d)(3)(i)(B) – The infiltration of liquids through the closed CCR unit must be minimized by the use of an infiltration layer than contains a minimum of 18 inches of earthen material.	The final cover will include a minimum of 18" of compacted earthen material with a permeability equal to or less than the permeability of the natural subsoils or no greater than $1x10^{-5}$ cm/sec, whichever is less. Therefore, the permeability of the final cover system will be not greater than $1x10^{-5}$ cm/sec.
(d)(3)(i)(C) – The erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth.	The final cover will include a minimum of 6" of an earthen erosion layer that is capable of sustaining native plant growth. The final cover will be seeded and vegetated.
(d)(3)(i)(D) – The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.	The final cover will be installed with a minimum 2% slope and will incorporate calculated settlement as well as differential settling and subsidence.

INVENTORY AND AREA ESTIMATES	
(b)(1)(iv) – Estimate of the maximum inventory of CCR ever on-site over the active life of the CCR unit	10,320,000 cubic yards
(b)(1)(v) – Estimate of the largest area of the CCR unit ever requiring a final cover	177 acres

CLOSURE SCHEDULE	
(b)(1)(vi) – Schedule for completing all activities necessary to satisfy the closure criteria in this section, including an estimate of the year in which all closure activities for the CCR unit will be completed. The schedule should provide sufficient information to describe the sequential steps that will be taken to close the CCR unit, including major milestones and the estimated timeframes to complete each step or phase of CCR unit closure.	
The milestone and the associated timeframes are initial estimates. Some of the activities associated with the milestones will overlap. Amendments to the milestones and timeframes will be made as more information becomes available.	
Written Closure Plan	October 17, 2016
Notification of Intent to Close Placed in Operating Record	No later than the date closure of the CCR unit is initiated. Closure to commence in accordance with the applicable timeframes in 40 CFR 257.102(e).
Agency coordination and permit acquisition • Coordinating with state agencies for compliance • Acquiring state permits	 Year 1 – 5 (estimated) Year 1 (estimated)
Mobilization	Year 1 (estimated)
Dewater and stabilize CCR • Complete dewatering, as necessary • Complete stabilization of CCR	 Year 2 (estimated) Year 2 (estimated)
Grading • Grading of CCR material in pond to facilitate surface water drainage	Year 2 - 5 (estimated)
Installation of final cover	Year 2 - 5 (estimated)
Estimate of Year in which all closure activities will be completed	Year 5

AMENDMENT AND CERTIFICATION	
(b)(3)(i) – The owner or operator may amend the initial or any subsequent written closure plan developed pursuant to 257.102(b)(1) at any time. (b)(3)(ii) – The owner or operator must amend the written closure plan whenever: (A) There is a change in the operation of the CCR unit that would substantially affect the written closure plan in effect; or (B) Before or after closure activities have commenced, unanticipated events necessitate a revision of the written closure plan. (b)(3)(iii) – The owner or operator must amend the closure plan at least 60 days prior to a planned change in the operation of the facility or CCR unit, or no later than 60 days after an unanticipated event requires the need to revise an existing written closure plan. If a written closure plan is revised after closure activities have commenced for a CCR unit, the owner or operator must amend the current closure plan no later than 30 days following the triggering event.	This initial closure plan will be amended as required by 257.102(b)(3) and, as allowed by 257.102(b)(3), may be amended at any time, including as more information becomes available.
(b)(4) – The owner or operator of the CCR unit must obtain a written certification from a qualified professional engineer that the initial and any amendment of the written closure plan meets the requirements of this 40 CFR 257.102.	Certification by a qualified professional engineer will be appended to this plan.

Certification Statement 40 CFR § 257.102 (d)(3)(iii) – Design of the Final Cover System for a CCR Surface Impoundment

CCR Unit: Dynegy Midwest Generation, LLC; Baldwin Energy Complex; Bottom Ash Pond

I, Victor Modeer, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the design of the final cover system as included in the initial written closure plan, dated October 17, 2016, meets the requirements of 40 CFR § 257.102.

Victor Modeer, PE, D.GE

Printed Name

10/11/16

Date

VICTOR ALBERT MODEER JR.
062-043112
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

11/30/17

Certification Statement 40 CFR § 257.102 (b)(4) – Initial Written Closure Plan for a CCR Surface Impoundment

CCR Unit: Dynegy Midwest Generation, LLC; Baldwin Energy Complex; Bottom Ash Pond

I, Victor Modeer, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the information contained in the initial written closure plan, dated October 17, 2016, meets the requirements of 40 CFR § 257.102.

Victor Modeer, PE, D.GE

Printed Name

10/11/16

Date

VICTOR ALBERT MODEER JR.
062-043112
REGISTERED PROFESSIONAL ENGINEER OF ILLINOIS

11/30/17

ADDENDUM NO. 1
BALDWIN BOTTOM ASH POND CLOSURE PLAN

This Addendum No. 1 to the Closure Plan for Existing Coal Combustion Residuals (CCR) Impoundment for the Baldwin Bottom Ash Pond at the Baldwin Energy Complex, Revision 0 - October 17, 2016 has been prepared to meet the requirements of Title 40 of the Code of Federal Regulations (40 C.F.R.) Section 257.103(f)(2)(v)(D) as a component of the demonstration that the Baldwin Bottom Ash Pond qualifies for a site-specific alternative deadline to initiate closure due to permanent cessation of a coal-fired boiler by a certain date.

The Baldwin Bottom Ash Pond will begin construction of closure by April 17, 2025 and cease receipt and placement of CCR and non-CCR wastestreams by no later than July 17, 2027 as indicated in the Baldwin Power Station Alternative Closure Demonstration dated September 29, 2020. Closure will be completed by October 17, 2028 within the 5-year timeframe included in the Closure Schedule identified in the Baldwin Bottom Ash Pond Closure Plan in accordance with 40 C.F.R. § 257.102(f)(ii).

All other aspects of the Closure Plan remain unchanged.

CERTIFICATION

I, Eric J. Tlachac, a Qualified Professional Engineer in good standing in the State of Illinois, certify that the information in this addendum 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
Ramboll Americas Engineering Solutions, Inc., f/k/a O'Brien & Gere Engineers, Inc.
Date: September 29, 2020

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