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ENVIRONMENTAL CONSULTATION & REMEDIATION

KPRG and Associates, Inc.

# CCR COMPLIANCE
# PRELIMINARY CLOSURE ALTERNATIVES ANALYSIS REPORT
# POWERTON FORMER ASH BASIN

**Midwest Generation, LLC**
**Powerton Generating Station**
**13082 East Manito Road**
**Pekin, Illinois**

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## 1.0 <u>INTRODUCTION</u>

Midwest Generation, LLC (Midwest Generation) currently operates the coal-fired generating station, referred to as Powerton Generating Station, located in Pekin, Illinois ("site" or "generating station"). As part of generating electricity and managing the coal combustion residuals (CCR), the station operates two active CCR surface impoundments (the Ash Surge Basin (ASB) and Ash Bypass Basin (ABB.)). As part of the earlier historical operations at the station, the Former Ash Basin (FAB) was used for the management/storage of CCR up until approximately the 1970's and has been identified as an inactive CCR surface impoundment with no liquids or wastewater being directed into the basin. See Figure 1 for a site map of the Powerton Station as well as the FAB. The FAB is regulated as an inactive surface impoundment under the newly promulgated Ill. Adm. Code Title 35, Part 845: Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (State CCR Rule).

In accordance with 35 Illinois Administrative Code Part 845.710(b), a Facility (Owner/Operator) is required to initiate and complete a closure alternatives analysis prior to selecting a final closure method.

This Closure Alternative Analysis is structured to provide the following information:

- The proposed closure alternatives that will be analyzed,
- An analysis of the closure alternatives that meets the requirements set forth in Section 845.710(b)(1) through 845.710(b)(4),
- The results of groundwater contaminant modeling including how the modeled closure alternative will comply with the applicable groundwater protection standards, and
- A description of the fate and transport of contaminants associated with each closure alternative over time, including seasonal variations.

This document presents the results of the closure alternatives analysis for the FAB that was completed in accordance with 845.710.

## 2.0 PHYSICAL SITE CONDITIONS

Due to the age of the FAB, there is no documentation of when it was constructed, the methods used to create it, or the specifications on how it may have been created. The FAB was formally used as a CCR storage area and constructed with fill embankments on the north, east, and west sides; the south side is incised. The ground surface around the FAB ranges from 455 ft above mean sea level (amsl) to 460 ft amsl. An access road is along the perimeter of the FAB in order to access the monitoring wells along the north side of the FAB and the access the other areas of the properties and monitoring wells around the south portion of the FAB. The north and south portions of the FAB were created by the construction of a railroad spur in 2010.

The surface area of the north portion of the FAB is approximately 18 acres. The interior of the north portion of the FAB slopes from the surrounding land to the base of this portion. The side slopes for the north portion are about 2H:1V to an elevation of 445 ft amsl, from which, there is a more gradual slope across the base. The majority of the base of the north portion of the FAB ranges from 444 ft amsl to 441 ft amsl with some low points throughout; the low point of the north portion is approximately 433 ft amsl. The exterior side slopes of the north portion slope gently towards the north and blend into the north low lands. The exterior slopes of the east side of the north FAB slope steeply towards Lost Creek at about 1H:1V. The south embankment of the north portion of the FAB that is adjacent to the railroad spur slopes at about 2.5H:1V.

The surface area of the south portion of the FAB is approximately 13 acres. The interior of the south portion of the FAB slopes from the surrounding land to the base of this portion. The side slopes for the south portion are about 4H:1V to an elevation of 450 ft amsl on the west side, with a lesser slope on the south and east sides. The north side that is adjacent to the railroad spur sloes at about 2.5H:1V. The base slopes gradually away from the base of the embankments, which is elevation 450 ft amsl, to the south portion’s low point of 432 ft amsl. The west side of the FAB is adjacent to the Service Water Basin and the Ash Surge Basin, which creates a level surface on this side. The exterior side slopes of the east side slope gently towards Lost Creek at about 6H:1V. The exterior to the south consists of the access road and other necessary equipment.

### 2.1 Summary of Geology and Hydrogeology

#### *2.1.1 Geology*

The physiography of Tazewell County is made up of end moraines, plains (including flood plains), river terraces and valleys, alluvial fans and loess. The Illinois and Mackinaw River Valleys are the prominent landforms. Several small lakes are located near the western border of the county, which is bound by the Illinois River. Tazewell County is in the Till Plaines Section of the Central Lowland Province. Near surface soils in the vicinity of the subject impoundment have been grouped as Orthents, loamy and Urban Land. Urban Land units are primarily covered by pavement, railroad tracks, and buildings, which typically impede infiltration and are subject to surface runoff. The Orthents, loamy soils are fine to moderately coarse textured soils found in areas that have been modified by filling and leveling. Available water capacity is generally high, while permeability is typically high at the surface level and decreases with depth. Organic matter and plant nutrient content is low in the Orthents, loamy soils (Soil Survey of Tazewell County, Illinois).

Regionally, the stratigraphy in the area consists of approximately 100 to 125 feet of unconsolidated deposits consisting mainly of alluvial sands and gravels with some interspersed clays/silty clays. The unconsolidated deposits are underlain by alternating layers of limestone, shale, and coal of the Carbondale Formation. To evaluate local stratigraphy, water and test well logs were obtained for wells in the general vicinity of the Powerton Generating Station. In addition, well logs from 21 monitoring wells that were installed in the vicinity of the subject surface impoundments were evaluated with those borings ranging in depth from 30 feet to 41 feet. Based on an evaluation of this data, the following general site-specific stratigraphy is defined:

- Fill (16’ to 24.5’ thick) – Consisting of tan, brown and black fine to medium sand/silty sand with some gravel and clay seams. Several locations also included black cinders and brick fragments.

- Clay/silty clay/silts (0’ to approximately 18’ thick) – Consisting of olive, brown and gray clays, silts and silty clays with some more organic rich layers. May locally contain fine silty sand and/or fine sand. This unit is not mappable across the site (i.e., discontinuous).

- Sand and gravel (thickness undetermined; borings terminate within unit) – Consisting of light brown, brown and/or gray medium to coarse sands and gravels.

Although no specific borings were extended into the sedimentary bedrock beneath this facility, water well logs obtained for water wells in the vicinity of the Powerton Generating Station indicate shale bedrock is encountered from approximately 35 to 140 feet bgs, depending on the location of the specific well. The boring logs indicate limestone was encountered from approximately 99 to 103 feet below ground surface just northeast of the Powerton Generating Station and in close proximity to the Illinois River.

There are no underground mines beneath the subject CCR surface impoundment.

### *2.1.2 Hydrogeology*

Based on information from the Soil Survey of Tazewell County, the average annual precipitation is approximately 36 inches with about 62% of that total falling between April and September of any given year. The average seasonal snowfall is approximately just over 26 inches. The nearest natural surface water body is the Lost Creek which bends around the eastern edge of the FAB and property boundary. Lost Creek is an ephemeral stream that only flows during and after precipitation events. The Illinois River is located to the north of the subject CCR units. Powerton Lake is located to the west-northwest.

Groundwater beneath the Powerton Generating Station occurs under water table conditions. Saturated conditions are generally encountered between 18 to 32 feet bgs, depending on the well location. The monitoring wells at the station are used to monitor the three basins, Ash Surge Basin, Ash Bypass Basin, and the FAB, present at the Powerton Station. The FAB monitoring well network consists of upgradient monitoring wells MW-01 and MW-10, and downgradient monitoring wells MW-02, MW-03, MW-04, and MW-05. The Ash Bypass Basin/Ash Surge Basin CCR monitoring well network consists of upgradient monitoring wells MW-01, MW-09, and MW-

19, and downgradient monitoring wells MW-08, MW-11, MW-12, MW-15, MW-17, and MW-18.

CCR monitoring wells MW-08, MW-12, MW-15 and MW-17 are screened within the shallow, localized, saturated clay/silt unit. The remaining monitoring wells have deeper screens, within the more extensive sand and gravel unit. All the wells associated with the FAB monitoring network are screened within the extensive sand unit which underlies the area (i.e., the localized shallow clay/silty clay unit does not extend beneath the FAB). Table 1 provides groundwater elevation measurements obtained for the on-site monitoring wells surrounding the FAB (upgradient wells MW-01 and MW-10 and downgradient wells MW-02 thru MW-05). A review of the hydrograph shows some temporal fluctuations with the highest water levels generally occurring within the first or second quarters of the year.

Groundwater elevation data from all wells in the area, including the specific CCR monitoring wells associated with the subject FAB has been collected. The water levels from wells screened in the clay/silt unit and the water levels from monitoring wells screened within the sand unit were evaluated separately and used to determine the flow for each unit. Groundwater flow within the more extensive sand unit, which extends under the FAB, shows general flow in a northerly direction with flow components to the northwest and northeast towards the Illinois River. The groundwater elevation ranges from 442 ft amsl at the south end of the FAB to 438 ft amsl along the north side of the FAB. The groundwater elevations for the FAB monitoring wells are shown in Table 1. The groundwater flows north and discharges into the Illinois River.

The FAB is located within the sandy gravel soil unit. The horizontal hydraulic gradient, flow direction, and an estimated rate of groundwater flow was determined for each groundwater sampling event from 3rd quarter 2015 through 2nd quarter 2021. The average hydraulic gradient over this time is 0.0045 ft/ft with a minimum of 0.0008 ft/ft and a maximum of 0.0147 ft/ft. The average estimated seepage velocity is 1.56 ft/day with a minimum of 0.2745 ft/day and a maximum of 5.97 ft/day. The groundwater flow direction was consistently determined to be north/northwest over this time.

At this time, based on the geology and the site-specific hydrogeology discussions, the groundwater beneath the CCR surface impoundments is considered as Class I Potable Resource Groundwater in accordance with Section 620.210. It is noted, however, that a Groundwater Management Zone (GMZ) and an Environmental Land Use Control ("ELUC") have been established where the CCR surface impoundments are located as part of a Compliance Commitment Agreement (CCA) between Midwest Generation and Illinois EPA. The ELUC states that the groundwater shall not be used as potable water. The GMZ and ELUC occupy the same extent of the Powerton property.

A survey of all potable water sources within a 2,500 feet radius of the Midwest Generation Powerton Generating Station was completed by Natural Resources Technology (NRT) in 2009. As part of the initial operating permit preparation, KPRG evaluated the previously completed water well survey by NRT and reviewed the new Illinois State Geological Survey database and interactive map references as "ILWATER". Twelve wells were identified within a 2,500-foot radius of the Station's subject CCR surface impoundments, which includes the FAB. Two wells were identified off-site to the east and upgradient of the FAB. There were eight wells identified on the Powerton Station property on the ILWATER interactive map all of which were older construction wells installed by previous Ownership. Discussions with facility personnel indicate that all eight of these wells were taken out of service/abandoned. Two wells are at the far western boundary of the 2,500 foot radius and are part of the six water wells currently on the Powerton Station property that are in use (the remaining four wells are located further west, outside the 2,500 foot search radius). These two wells are screened within the sand/gravel aquifer but are not directly downgradient of the surface impoundments and are separated from those units by the intake and outfall channels. They are regularly sampled and analyzed for potable water constituents. The sampling results consistently comply with potable water regulations.

Based on the geology of the site presented in Section 2.1.1 and the above hydrogeology discussions, the primary contaminant migration pathway for a potential release from the subject CCR surface impoundments would be downward migration to groundwater within the unconsolidated silty clay or sand/gravel aquifer. Due to the proximity to the Illinois River and/or plant intake channel, which are hydrogeologic flow boundaries, minimal to no downward vertical flow mixing would be anticipated. There are no other utility or man-made preferential pathway corridors that would act to intercept potentially the flow to move any contamination in a direction other than under natural groundwater flow conditions. There are no potable water wells between the impoundments and anticipated flow discharge boundaries. In addition, as previously discussed, there are no potable surface water intakes on the Illinois River either along or within at least several miles downstream of the subject site.

The FAB is subject to the federal CCR Rule, 40 CFR Part 257, and the Illinois CCR Rule, 35 Ill. Adm. Code Part 845. As required under the Federal CCR Rule and the Illinois CCR Rule, groundwater sampling has been occurring for the monitoring wells within the monitoring network for the FAB. This data is provided in Table 2 for the FAB.

## 3.0 IDENTIFICATION OF CLOSURE ALTERNATIVES

The FAB is considered an inactive CCR surface impoundment subject to the State CCR Rule 35 Ill. Adm. Code Part 845. In accordance with Section 845.700(b), the FAB has been determined to be an unlined CCR surface impoundment and is required to close. Closure of the FAB must be completed either by leaving the CCR in place and installing a final cover system or through removal of the CCR and decontamination of the CCR surface impoundment, as described in Sections 845.720 through 845.760. Prior to selecting a closure method, a closure alternatives analysis must be completed in accordance with the requirements of 845.710.

The closure alternatives evaluated in accordance with Sections 845.710(b) through 845.710(d) are as follows:

- Alternative Closure Scenario 1: Complete removal of CCR including alternative modes of transporting the CCR in accordance with Sections 845.710(c) and 845.740.
- Alternative Closure Scenario 2: Leave CCR in both the north and south portions of FAB and install a final cover system.
- Alternative Closure Scenario 3: Consolidate the CCR in the southern portion of the FAB and install a final cover system.
- Alternative Closure Scenario 4: Leave the CCR in place via in-situ soil stabilization and install a final cover system.

Geosyntec and Patrick Engineering both created alternatives for closing the FAB. Geosyntec's alternative consisted of consolidating the CCR from the north portion with the CCR in the south portion and capping the consolidated CCR with a final cover system. Patrick Engineering's alternative was to construct two different final cover systems over the CCR with one on the north portion CCR and the other on the south portion CCR. Those two alternatives are included as part of this evaluation with Geosyntec's alternative included as Alternative Closure Scenario 3 and Patrick Engineering's alternative included as Alternative Closure Scenario 2. The Geosyntec and Patrick Engineering alternatives were adjusted as necessary from their original designs to comply with 35 Ill. Adm. Code Part 845, since these closure alternatives were created prior to the state laws' enactment.

A brief description of each closure alternative is presented below.

### 3.1 Alternative Closure Scenario 1: Closure by Removal

The FAB was historically used for CCR disposal up until the 1970's. At that time, the FAB was one large area of approximately 40 acres (1,698,096 square feet) that was used to contain CCR. In 2010, a railroad was constructed through the FAB to allow railroad cars to enter onto the Powerton property. Soil borings conducted at the site have determined the horizontal and vertical extent of the deposited CCR material in both the north portion and south portion of the FAB. In general, the CCR in the north portion ranges from the ground surface (443 ft amsl to 434 ft amsl) to 18 feet below ground surface (bgs) to 9 feet bgs (425 ft amsl). The CCR in the south portion ranges from the ground surface (447 ft amsl to 432 ft amsl) to 18 feet bgs to 3 feet bgs (429 ft amsl).

As stated in 845.740(a), closure by removal consists of removing all CCR and decontaminating all areas affected by releases of CCR from the CCR surface impoundment. CCR removal and decontamination of the CCR surface impoundment are complete when all CCR and CCR residues, containment system components such as the impoundment liner and contaminated subsoils, and CCR impoundment structures and ancillary equipment have been removed. To execute closure by removal of the FAB, the following activities would occur:

- Dewater any standing water in the north and south portions of the FAB along with dewatering during excavation;
- Install erosion control measures, prior to earthwork;
- Construct access roads into the FAB to allow for equipment access to the extent of the CCR for excavating and loading;
- Excavate and stage CCR to allow for additional dewatering;
- Load the CCR into haul trucks and transport for off-site disposal.

The estimated quantity of CCR material that would require excavation from the north portion of the FAB is 466,000 CY and the south portion is 241,000 CY; which is the bank/in-place quantity based upon the existing site elevations and the estimated depth of the CCR material using the boring logs performed along the perimeter of the FAB. The extent of the removal areas and post-excavation contours are shown on Figure 1. As the bank/in-place material is removed, it may be stockpiled and staged as necessary to allow for any additional dewatering from the CCR prior to it being loaded and transported offsite. As the CCR is excavated, it is expected to swell by approximately 30%, which creates a handling and transportation volume of 606,000 CY from the north portion and 314,000 CY from the south portion. The slopes of the north and south portions of the FAB will be sloped at approximately 2H:1V post excavation.

As part of this scenario, continuous dewatering will be necessary to remove material down to the lowest elevation. Dewatering would be necessary for an estimated 600 days, or up to 3 years based on 240 working days per year. A more detailed discussion of this closure alternative relative to established evaluation criteria is provided in Section 4.0. Detailed cost estimates in accordance with Section 845.710(d)(1) are provided in Table 4. The cost for closure by removal uses Indian Creek Landfill as the disposal facility; however, no discussions for disposal at Indian Creek Landfill have occurred at this time.

As part of closure by removal as required by 845.740(b), groundwater monitoring must continue for three (3) years or for three years after groundwater monitoring does not show an exceedance of the groundwater protection standard established under 845.600, whichever is longer. A discussion of this closure alternative option relative to established evaluation criteria is provided in Section 4.0.

### *3.1.1 Availability of Nearby Landfill Space*

As stated above, closure by removal and disposal at an existing off-site landfill will require dewatering, excavation, loading, transportation, and disposal of an estimated combined 920,000 CY of CCR from the north (606,000 CY) and south (314,000 CY) portions of the FAB. There are three landfills within 64 miles of the Powerton station, 1) Indian Creek Landfill No. 2, 2) Peoria City/County Landfill No. 2, and 3) Envirofil of Illinois, Inc.

Indian Creek Landfill No. 2 is approximately 20 miles from the station and the closest of the three identified landfills. Peoria City/County Landfill No. 2 is approximately 25 miles and the second closest landfill and Envirofil of Illinois, Inc. is approximately 64 miles from the station and the farthest of the three landfills. In regards to the closure by removal scenario and off-site disposal of CCR, the available landfill capacity based on IEPA's 2020 Landfill Capacity Report at each facility is as follows:

- Indian Creek Landfill No. 2 – 35,912,756 CY with 31.8 years of life expectancy based on the current disposal rate.

- Peoria City/County Landfill No. 2 – 2,900,562 CY with 3.6 years of life expectancy based on the current disposal rate.

- Envirofil of Illinois, Inc. – 17,078,304 CY with 94.3 years of life expectancy based on the current disposal rate.

GFL Environmental, Inc. operates Indian Creek Landfill No. 2 that accepts municipal waste and non-hazardous special industrial waste. As noted above the amount of material that would require disposal is 920,000 CY and the capacity of the landfill is greater than 35 million CY, which is enough to contain the amount of CCR requiring disposal. Access to this landfill would require truck traffic on county/state highways and local township roads. As of the date of this report being posted prior to the public meeting, discussions with the landfill were not able to occur because the landfill could not be reached. Continued efforts will be made to discuss the availability of the landfill capacity and if CCR disposal is a possibility.

The Peoria City/County Landfill No. 2 is jointly owned by the County and City of Peoria. The landfill is operated by Waste Management. This landfill is used for the disposal of municipal solid waste from County and City residents. Only 2.9 million CY of disposal capacity is available and this landfill is used for waste disposal by the City and the County. Therefore, this landfill is not a practical option for disposal of any CCR from the FAB.

Waste Management operates the Envirofil of Illinois, Inc. landfill. This landfill has a 5-year average disposal rate of 181,020 CY and accepted 174,717 CY in 2020. The amount of CCR from the FAB is 920,000 CY, which is five (5) times the 2020 disposal rate. The projected time to remove all of the CCR from the FAB is approximately 300 to 600 days, which is approximately 1.5 to 3 years based on 200 working days per year and a yearly disposal rate of 306,667 CY to 613,333 CY. It is unlikely this landfill will accept only waste from the FAB for up to three years, which will extend the time required for disposal. In addition, this landfill is 64 miles from the Powerton station, which creates a long turn-around time for each truck and decreases the loads per day that can be disposed of. It should be noted that the Envirofil of Illinois, Inc. landfill is less than one mile from an environmental justice area. This landfill is not a practical option for disposal of CCR from the FAB.

### *3.1.2 Modes of Transport*

As required by 845.710(c)(1), this closure by removal analysis includes evaluating whether the CCR can be transported from the site for disposal by rail, barge, low-polluting trucks, or some combination of these transportation modes. These are discussed below.

#### *3.1.2.1 Rail Transport*

The site currently has railroad access that is used to deliver coal to the station for use in the electricity generating process. The site coal delivery system is only designed to unload coal from the rail cars and store on site, but not designed to load the rail cars. In order to load rail cars a new permanent system would have to be designed and constructed or existing commercially available equipment would need to be evaluated to determine if a temporary loading system could be erected. In the event a temporary loading system could be erected, the closest landfill to the site is the Indian Creek Landfill and its location was evaluated in relation to the railroad system and the Powerton station. The location of the railroad that travels from the vicinity of the Powerton station does not go towards the Indian Creek Landfill, instead it travels southeast towards Green Valley and Delavan, which are the closest locations to the landfill, but they are still at least 10.5 miles and eight (8) miles, from the landfill, respectively. The ability to unload a railroad car at either of these locations is unknown, but in the event the CCR could be unloaded, it would still need to be loaded onto dump trucks to be taken to the CCR to the landfill. Transporting the CCR by rail is not a viable option because of the logistics necessary to use the rail system to load, unload, and transport the CCR.

#### *3.1.2.2 Barge Transport*

The Powerton station is close to the Illinois River, but no slip or loading point for a barge exists. A loading point could be constructed, but a structural evaluation of the bank would first be required. The landfills that are nearest to the Powerton station are not located near any major rivers that would be able to accommodate barge traffic. The Indian Creek Landfill is located near the Mackinaw River, but based on the mapped appearance of the river, it seems unlikely a barge would be able to traverse the river. In addition, the river does not enter the landfill complex and the CCR material would still need to be off loaded from the barge and loaded onto a truck for final disposal in the landfill. It is likely that loading and unloading facilities would need to be constructed at both ends of the barge trip. Not only will this require time for permitting, but also access agreements would be needed with landowners that may be unwilling to agree. Finding a location with the facilities needed to unload the CCR may require transporting it many miles downstream or upstream, which increases the chance an accident may occur. Based on these factors, transporting the CCR via barge is not a viable transportation option.

#### *3.1.2.3 New On-Site Landfill*

As required by 845.710(c)(2), this closure by removal analysis includes identifying whether an on-site landfill is present on the property or if an on-site landfill could be constructed. The Powerton station property does not have an existing onsite landfill or the existing available land to construct a new on-site landfill. The Powerton property consists of approximately 2,048 acres. The majority of the Powerton station property is occupied by Powerton Cooling Lake and the remainder of the property is occupied by the buildings that house the electricity generating equipment, coal storage area, CCR surface impoundments, non-CCR surface impoundments, FAB, low lands, and green space. Powerton Cooling Lake consists of 1,583 acres; the area occupied by the electrical substation, surface impoundments, parking lot, generating building, and ancillary areas associated with the electricity generating process is 214.4 acres; the coal storage area is 61.5 acres; the surface impoundments occupy 27.3 acres; the FAB is 23 acres; the southwest green space is 58.8 acres; and the northern low lands area is 80 acres.

The area necessary to construct a landfill to contain the 707,000 CY from the FAB is approximately 30 acres if the CCR was placed to a thickness of 20 feet. The majority of the CCR would have to be placed above ground because the groundwater elevation in the area is approximately 20 to 25 feet bgs and minimal excavation can occur to place CCR below the ground surface. As a result, berms must be constructed as a perimeter to contain the CCR. The 30 acres is only the space required for CCR storage, additional land would be needed for property line setbacks, the leachate collection equipment, access roads, groundwater monitoring network, and other necessary equipment. Because of the groundwater elevation, any landfill would be constructed with a base only ten feet bgs, which means any remaining portion of the landfill, would extend above ground up to 14 feet to allow for the necessary space for the CCR and the final cover construction. The only areas at the Powerton station where a landfill could be constructed are the green space to the southwest and the low land areas to the north. The southwest area is not acceptable for a landfill because this is where the water supply wells for the station are located and the entire area is within the floodplain. The low land area to the north is adjacent to the Illinois River, classified as a wetland, and within the floodplain. The only areas at the station that are not within the floodplain are already occupied by an electrical substation, surface impoundments, parking lot, generating building, and ancillary equipment associated with electricity generating process.

Since there is not adequate space within the current Powerton Station footprint to build a new on-site landfill, adjacent parcels that could potentially be purchased were also evaluated. Two properties to the south appear to be farmland or vacant land based on aerial photography. These properties are south and southeast of E. Manito Road and are not owned by Midwest Generation. The property to the south is approximately 111 acres and the property to the southeast is approximately 79 acres. As stated previously, the area necessary to construct a landfill to contain the 707,000 CY from the FAB is approximately 22 acres if the CCR was placed to a thickness of 20 feet. The 22 acres is only the space required for CCR storage, additional land would be needed for the leachate collection equipment, access roads, and other necessary equipment. These properties appear to be adequate based on the total property size; however, it is unlikely they are viable options to construct a landfill. First, the sale of these properties is not certain. Second, the construction of a new landfill includes the sitting process, which requires local approval and local approval is not guaranteed. The property to the south is still actively farmed and it is not certain the owner would want to forgo the yearly income of farming for the one-time sale of the land for the construction of a landfill.

These properties to the south have water wells located on them. The property directly to the south has two water wells that limit the available space of the property because of the setback requirements when locating a new landfill. The property to the

## 3.2 Alternative Closure Scenario 2: Closure in Place

The closure in place scenario would consist of leaving the existing CCR in place and constructing a final cover system (FCS) over both the north and the south portions of the FAB in accordance with 845.750. This alternative was previously evaluated as a closure alternative in 2019 and has been reviewed and modified to comply with 35 Ill. Adm. Code Part 845. The final cover system would consist of a geomembrane low permeability layer, which is topped with an alternative final protective layer that provides equivalent performance to a soil final protective layer. The FCS would be sloped to allow for precipitation to runoff and drain off the FCS. The north FAB FCS would drain into the low lands to the north and the south FAB FCS would drain to the east and Lost Creek. The approximate FCS grades and contours for the north and south portions of the FAB are shown on Figure 2.

The FCS product that would be used is the proprietary ClosureTurf cover system created by Watershed Geo. The ClosureTurf FCS consists of a geomembrane low permeability layer that also incorporates a drainage layer. The final protective layer is replaced with engineered synthetic turf that is infilled with sand/small aggregate to provide ballast to the synthetic turf. The infiltration layer will be a 60-mil HDPE geomembrane with a hydraulic conductivity that is no greater than $1x10^{-7}$ cm/sec. The engineered synthetic turf is comprised of polyethylene fibers that are tufted through a double layer of woven geotextiles that are highly UV and heat resistant. The engineered synthetic turf is then infilled with small aggregate that is approximately 1/8 inch to 1/4 inch diameter in size. The small aggregate is brushed into the synthetic turf to ensure that it settles to the bottom of the turf, which provides ballast and prevents the turf's movement during wind events.

The FCS on the north portion of the FAB would be sloped from the existing perimeter embankment to a low point near the center to allow for drainage and collection of precipitation. Precipitation would then drain from the near center low point towards a drainage structure and from the drainage structure to the former inlet channel, west of the FAB. Trapezoidal shaped drainage channels on the surface of the FCS would be used to channel precipitation to the drainage structure. The drainage channels would be shaped as part of the grading process to create the necessary FCS contours and elevations. The embankment elevations range from 455 ft amsl to 457 ft amsl and will slope to a center elevation of approximately 442 ft amsl, at which point the FCS slopes towards the drainage structure. The drainage structure would drain the precipitation from the FCS through an underground pipe that discharges into the former intake channel. Approximately 70,000 CY of additional fill material is needed over the existing CCR to achieve the desired elevations.

The FCS on the south portion of the FAB would be sloped from the existing perimeter embankment to a low point near the northwest corner of the FCS to allow for drainage of precipitation. From the northwest corner, precipitation would drain through a pipe under the existing railroad track and into the drainage structure in the north portion of the FAB. The south FAB FCS will also have trapezoidal shaped channels, like the north FAB FCS, on the surface that will allow precipitation to drain from the FCS. The drainage channels would be shaped as part of the grading process to create the necessary FCS contours and elevations. The south FAB embankment elevations range from 458 ft amsl on the west half to 452 ft amsl on the east half of the south FAB portion. The FCS on the south portion of the FAB will drain from the embankments towards a northwest corner elevation of approximately 440 ft amsl. Approximately 44,000 CY of additional fill material is needed over the existing CCR to achieve the desired elevations.

Each portion of the FAB will be dewatered to allow for the upper portion of the CCR to dry out so the fill material can be placed on top. As the fill material is placed, it will be graded as needed and compacted to prevent future settling. The soils used in the FCS will consist of clean material sourced from as close to the FAB as possible. Because of the quantity needed, multiple soil sources may be required. Once the desired grades have been achieved in each portion of the FAB, the ClosureTurf FCS would then be placed on top of the sloped surface with the geomembrane being attached to the discharge structure, the synthetic turf placed on top of the geomembrane, and the turf infilled with sand/small aggregate.

The promulgated Illinois State CCR Rule, 35 Ill. Adm. Code Part 845, requires that CCR surface impoundments not be located within a floodplain, which is different from the previously promulgated Federal CCR Rule, 40 CFR Part 257, which did not regulate the presence of CCR surface impoundments in floodplains. The existing FAB is present within the 100-year floodplain, which has an elevation of approximately 457 ft amsl. To prevent future ponding that may occur if a flood condition occurs at the FAB, the construction of an embankment adjacent to the north perimeter of the FAB is included in this closure scenario. The embankment will extend from the existing north FAB embankment up to an elevation of 460 ft amsl and then slope at 3H:1V down to the existing ground surface. The construction of this embankment will require 49,000 CY of clean fill material.

A discussion of this closure alternative option relative to established evaluation criteria is provided in Section 4.0.

### 3.3 Alternative Closure Scenario 3: Consolidation with Closure in Place

Scenario 3 consists of removing the CCR from the north portion of the FAB and placing in the south portion and constructing a final cover system. This alternative was previously evaluated as a FAB closure alternative in 2016, which has been reviewed and modified as needed based on Part 845. The CCR from the north portion of the FAB would be either hydraulically dredged into the south portion of the FAB or mechanically excavated and dumped into the south portion of the FAB. The dredged CCR would be contained, allowing for the CCR to settle and the water to drain into the excavated north portion of the FAB. Dumped CCR material would be stockpiled and allowed to drain as necessary. Once the CCR material placed in the south portion of the FAB is sufficiently dried, it will be graded to achieve the desired elevations needed for the FCS. The embankment that surrounds the north portion of the FAB would also be excavated and placed in the south portion of the FAB. The FCS would then be constructed on top of all the consolidated CCR. The south FAB FCS would be crowned in the middle, sloping toward perimeter drainage channels. The perimeter drainage channels would drain towards the railroad berm, which would contain two storm pipes that traverse through the railroad berm and drain precipitation into the excavated former north portion of the FAB.

The FCS product that would be used is the proprietary ClosureTurf cover system created by Watershed Geo. The ClosureTurf FCS consists of a geomembrane low permeability layer that also incorporates a drainage layer. The final protective layer is replaced with engineered synthetic turf that is infilled with sand/small aggregate to provide ballast to the synthetic turf. The infiltration layer will be a 60-mil HDPE geomembrane with a hydraulic conductivity that is no greater than $1x10^{-7}$ cm/sec. The engineered synthetic turf is comprised of polyethylene fibers that are tufted through a double layer of woven geotextiles that are highly UV and heat resistant. The engineered synthetic turf is then infilled with small aggregate that is approximately 1/8 inch to 1/4 inch diameter in size. The small aggregate is brushed into the synthetic turf to ensure that it settles to the bottom of the turf, which provides ballast and prevents the turf's movement during wind events.

Two collection points would be located along the northwestern and northeastern perimeter of the FCS to transport runoff off the cover. The collection points would each drain water through a pipe that traverses trough the existing railroad berm and discharges into the north portion of the FAB. The pipes would discharge onto riprap to prevent erosion of the embankment slopes.

A discussion of this closure alternative option relative to established evaluation criteria is provided in Section 4.0.

### 3.4 Alternative Closure Scenario 4: Closure in place with In-Situ Solidification/Stabilization

The in-situ solidification/stabilization (ISS) treatment of the CCR in the north portion of the FAB would be completed over an approximate 763,000 square feet area and in the south portion of the FAB would be completed over an approximate 653,700 square feet area. This alternative would include the ISS of approximately 556,000 CY of CCR in the north portion and approximately 241,000 CY of CCR in the south portion. The ISS would be applied by soil mixing from the top of the CCR to the bottom most extent of the CCR as identified by site boring logs. The ISS treatment range in the north portion extends from elevation 440 ft amsl to elevation 424 ft amsl, which consists of a treatment thickness range of 16 feet. The ISS treatment range in the south portion extends from elevation 440 ft amsl to elevation 428 ft amsl, which consists of a treatment thickness range of 12 feet. In areas where CCR is below a layer of clean overburden, excavation may be performed to allow ISS to be performed only at the targeted CCR layer. For purposes of this closure alternatives analysis, it is assumed the ISS will be implemented through auger mixing; however, bucket mixing may be used in some areas based on unknown site conditions.

ISS treatment consists of adding reagents to physically bind/solidify and/or chemically react/stabilize the CCR, resulting in a solidified or stabilized mass with reduced constituent mobility and leachability. The ISS will isolate the CCR from human contact and from groundwater by encapsulating in a low permeable monolith. Active reagents used in ISS can include pozzolanic compounds such as cement or blast furnace slag to produce a solidified material, reducing contact with groundwater and surface water. Other additives such as bentonite may be included to help lower permeability especially in sandy formations in which the FAB is located. The reagents and additives are typically mixed with water to create a flowable and pumpable slurry that is then mixed with the CCR. The effectiveness and reagent mix for solidification/stabilization would need to be evaluated in a treatability study. Samples would be collected from the CCR in the north and south portions of the FAB and bench top testing would be performed to determine the proper mix design. It may be necessary to use multiple mix designs to treat the ISS based on site factors.

Performing ISS will result in expansion of the treated CCR. This expansion is typically 10% to 25% of the original treatment volume. Depending on the soil type, the expansion can range from 10% for sandy materials to 25% or more for clayey materials. Once such application of ISS to treat sandy silty fill material resulted in ISS swell of up to 40%. Testing during the ISS treatability study and the ISS pilot test will provide an estimate of the ISS swell expected from the CCR. For this closure alternative analysis, the swell volume estimate will be 30% to present a conservative estimate of the cost and volume of ISS.

The completed ISS treatment area would be covered with clean soil and seeded. The extent of the treatment area requiring additional clean soil is 1,434,200 square feet and requires approximately 95,000 CY to achieve the necessary grades to prevent ponding water. The clean soil cover would be sloped to allow water to drain towards the perimeter of the ISS treatment area. Conceptually, the cover installation would consist of direct placement of clean fill with six inches of topsoil on the treated ISS area, feathered to match adjacent grades. The cover will be at least two feet thick including topsoil thickness. The FCS will be graded to ensure positive drainage and minimize ponding. For the purposes of this report, it is assumed the cover will be vegetated to reduce soil erosion, thereby minimizing release of soil to the Illinois River. Material used for the surface barrier will consist of material imported from non-contaminated sites and/or sources. It is assumed 10% more material will be required to allow for compaction of the fill and topsoil to achieve a total of a two-foot cover. Stockpiles of on-site materials may be used in the FCS cover.

## 4.0 CLOSURE ALTERNATIVES EVALUATION CRITERIA

The closure alternatives were evaluated based on requirements under State CCR Rule Part 845.710(b)(1) through 845.710(b)(4). The evaluation criteria consisted of the following:

- Long- and short-term effectiveness and protectiveness, including reliability;
- Effectiveness of controlling future releases;
- Ease or difficulty of implementation; and
- The degree to which concerns of the community residents are addressed.

Each closure alternative was evaluated using the above criteria and that evaluation is provided in Table 3. The following highlights are provided from that evaluation. Groundwater modeling was performed in accordance with 845.710(d)(2) and 845.710(d)(3) to assist in evaluating the long- and short-term effectiveness of each closure alternative. A discussion of the groundwater modeling and the results are presented in Section 5.

*Alternative Closure Scenario 1: Closure by Removal*

- Removing the CCR from the FAB would require excavating and hauling 920,000 CY, which would take about 920 days to execute based on 50 truckloads per day and 15 cubic yards per truck.

- Removing the CCR would remove any remaining amounts of the CCR mass. Groundwater monitoring has shown that impacts to groundwater are not present downgradient and any elevated constituents that have been detected in the groundwater are not from the FAB.

- Not removing the CCR would eliminate the volume of material disposed at a landfill, and reduce the number of trucks traveling to and from the station.

- Additionally, the truck traffic removing the CCR will negatively affect the neighboring properties, including air quality and noise pollution, since the entrance and egress for the trucking would be directly via E. Manito Road and not through any residential neighborhood.

- This option will require at least 3 years of post-closure monitoring.

*Alternative Closure Scenario 2: Closure in Place*

- ClosureTurf has successfully been used around the country to close CCR surface impoundments and landfills.

- The ClosureTurf final cover will require approximately 149,000 CY of clean fill material and more overall truck traffic to and from the site because the FAB has to be filled to achieve the necessary grades and elevations. It will require approximately 200 days to deliver clean fill to the site based on 50 truckloads per day and 15 CY per truck.

- The ClosureTurf and soil infill will cover the CCR, prevent infiltration into the CCR, and prevent any human or animal contact.

- The ClosureTurf option will require 30 years of post-closure monitoring.

- The existing CCR mass remaining will not cause groundwater impacts. Groundwater monitoring has shown that impacts to groundwater are not present downgradient and any elevated constituents that have been detected in the groundwater are not from the FAB.

*Alternative Closure Scenario 3: Consolidation with Closure in Place*

- ClosureTurf has successfully been used around the country to close CCR surface impoundments and landfills.

- The ClosureTurf final cover will require moving approximately 314,000 CY from the north FAB to the south FAB. Currently, the proposed method for moving the material is hydraulic dredging.

- In addition, 68,000 CY of clean fill material would be needed to achieve the necessary grades and elevations. It will require approximately 91 days to fill the FAB based on 50 truckloads per day and 15 CY per truck.

- The ClosureTurf and soil infill will cover the CCR, prevent infiltration into the CCR, and prevent any human or animal contact.

- The ClosureTurf option will require 30 years of post-closure monitoring.

- The existing CCR mass remaining will not cause groundwater impacts. Groundwater monitoring has shown that impacts to groundwater are not present downgradient and any elevated constituents that have been detected in the groundwater are not from the FAB.

*Alternative Closure Scenario 4: Closure in place with In-Situ Solidification/Stabilization*

- ISS is expected to contain and stabilize the CCR and is anticipated to be an adequate and reliable means of reducing the leaching potential of the CCR if it is exposed to groundwater and precipitation.

- Placement and maintenance of soil cover would provide adequate and reliable means of controlling erosion of and exposures to stabilized CCR.

- ISS and targeted excavation of mass material and installation of the cover would result in impacts to the community relative to truck traffic and noise during the construction. However, as materials requiring offsite disposal are minimized, this disturbance would be less than the first two alternatives.

- Approximately 707,000 in-place CY of CCR would be treated with ISS.

- The leaching potential of CCR would be irreversibly reduced through ISS. The mobility of CCR into surface water or via flooding (i.e., associated with erosion) would be further reduced by installation of the soil cover.

## 5.0 GROUNDWATER MODELING

This section discusses the results of the groundwater modeling and a description of the fate and transport of each closure alternative over time in accordance with 845.710(d)(2) and 845.710(d)(3). The modeling that was conducted is based on a theoretical distribution of dissolved contaminants beneath the FAB, assuming a mass, to demonstrate the impact of the alternative closure scenarios on the spread of contaminants.

To conduct the support modeling a theoretical unit mass with a concentration of "1" was established beneath the FAB and projected forward in time 100 years with advection and dispersion to establish an equilibrated distribution of contaminants in groundwater if the FAB were the mass. The equilibrated distribution (base case) of the mass was then used as the initial concentrations in the groundwater for model runs to simulate the closure alternatives to evaluate corresponding improvement in groundwater quality from the base case scenario. The modeling runs are provided on the slides included in Attachment 1.

### 5.1 Alternative Closure Scenario 1 Modeling

From this initial equilibrated model run, in Scenario 1, the mass was removed and the change in concentrations were modeled over 5-years, 25-years, 50-years, and 100-years. The modeling runs identified reductions in concentrations by 5 years and the mass had completely moved through the groundwater system by 25 years and beyond. These modeling runs are shown on Slides 6 and 7 located in Attachment 1. On each slide, the base case run is illustrated on the left side and the alternative closure scenario is illustrated on the right side. Since the results for the 25-years, 50-years, and 100-years modeling runs are the same, they are included on the same slide. Slide 7 illustrates the concentration decay over time at a hypothetical midpoint in the groundwater system between the FAB and the Illinois River.

### 5.2 Alternative Closure Scenario 2 Modeling

The modeling of Scenario 2 consisted of starting with the initial equilibrated model run, the mass remaining in the north and south portions of the FAB, and then removing the precipitation recharge into the mass by simulating the presence of a FCS on the north and the south. Reviewing Slide 9, which projects out 5-years, indicates that groundwater impacts near the Illinois River do not change from the initial equilibrated model run. The 25-years, 50-years, and 100-years projections on Slide 10 indicate no increases in groundwater concentrations at the river. It should be noted that the concentrations in the groundwater system reach steady state after 25 years, which is why the 25-years, 50-years, and 100-years modeling runs are combined on the same slide. Slide 11 illustrates the concentration decay over time at a hypothetical midpoint in the groundwater system between the FAB and the Illinois River.

### 5.3 Alternative Closure Scenario 3 Modeling

The modeling of Scenario 3 consisted of starting with the initial equilibrated model run, the mass consolidated and remaining in only the south portion of the FAB, and then removing the precipitation recharge into the mass by simulating the presence of a FCS on the south portion of the FAB. The precipitation recharge in the north portion of the FAB is occurs in this scenario because the formerly present in the north portion of the FAB has been removed. Reviewing Slide 13, which projects out 5-years, indicates that groundwater impacts near the Illinois River have reduced by approximately 10% (from a theoretical maximum concentration of 0.9 to a concentration of 0.8) and the east-west width of the mass is reduced. The 25-years, 50-years, and 100-years projections on Slide 14 indicate a continued decrease in groundwater concentrations at the river, from a theoretical maximum concentration of 0.8 to a concentration of 0.7. It should be noted that the concentrations in the groundwater system reach steady state after 25 years, which is why the 25-years, 50-years, and 100-years modeling runs are combined on the same slide. Slide 15 illustrates the concentration decay over time at a hypothetical midpoint in the groundwater system between the FAB and the Illinois River.

### 5.4 Alternative Closure Scenario 4 Modeling

The modeling of Scenario 4 consisted of starting with the initial equilibrated model run, the mass remaining in the north and south portions of the FAB, removing the recharge into the mass by simulating the presence of a FCS on the north and the south, and having a hydraulic barrier around the perimeter of the FAB that reduces the permeability through the mass material. This scenario simulates the in-situ stabilization of the CCR, with a remedial objective permeability of the CCR mass equal to or less than $1x10^{-7}$ cm/sec. Reviewing Slide 18, which projects out 5-years, indicates that groundwater mass near the Illinois River decreased by 20% from a maximum theoretical concentration of 0.9 to a concentration of 0.7. The east-west width of the groundwater mass also decreases. The 25-years, 50-years, and 100-years projections on Slide 19 indicate the mass had completely moved through the groundwater system by 25 years and beyond. Slide 20 illustrates the concentration decay over time at a hypothetical midpoint in the groundwater system between the FAB and the Illinois River.

### 5.5 Seasonal Variations Modeling

As further required by the State CCR Rule, seasonal fluctuations of the groundwater system were considered. To estimate the potential impacts on contaminant migration under a seasonally varying groundwater flow system, a 100-year transient flow model was simulated with alternating periods of higher and lower recharge to groundwater. The flow model simulated 6 months of higher recharge (April through September) and 6 months of lower recharge (October through March), reflecting trends in the long-term average monthly precipitation records. The initial equilibrated contaminant distribution again served as the starting conditions, Scenario 2 and Scenario 4 were applied to the mass, and the concentrations were modeled with advection and dispersion. The results of the Scenario 2 modeling are the same as the modeling results discussed in Section 5.2. The modeling results for Scenario 4 are the same for the 25+ years modeling events and the results for the 5-years seasonality modeling results are only slightly different from the results discussed in Section 5.4. The groundwater mass footprint is generally the same with slight variations in the mass gradations throughout the footprint. The results of the seasonal variation results for Scenario 4's 5-year projection is shown on Figure 5.

These modeling runs are used as part of evaluating the long- and short-term effectiveness of each closure option, as shown in Table 3.

## 6.0 <u>SUMMARY</u>

Four closure scenarios were evaluated as part of the closure alternatives analysis for closure of the FAB in accordance with 845.710(b). The four options evaluated are as follows:

1) Closure by removal;
2) Closure in place in both the north and south portions of the FAB with a FCS;
3) Closure in place by consolidating all CCR in south portion of FAB with a FCS;
4) Closure in place with in-situ solidification/stabilization in both north and south portions with a soil cover.

The options were evaluated based on effectiveness/protectiveness, ease of implementation, and addressing the concerns of the community residents.

Closure by removal would require the excavation, transportation, and disposal of 920,000 CY of warning layer material and take greater than 1,200 days to complete. The CCR removed is assumed to be disposed of at Indian Creek Landfill No. 2 for the purposes of evaluating this alternative. If this alternative were to move forward, discussions with the landfill would have to occur prior to selecting this alternative. The area of the removed CCR would be graded to prevent further erosion and slope degradation. Once the closure by removal is complete, groundwater monitoring in accordance 845.600 would occur for three (3) years.

The closure in place in both the north and south portions of the FAB scenario requires filling both the north and south portions to achieve the proper grades and constructing the FCS on this fill material. This scenario would require the north portion to be filled with approximately 70,000 CY of additional material in order to bring the grade up to the proper elevation to allow precipitation to gravity flow off the FCS. The south portion would require to be filled with approximately 44,000 CY of additional material in order to bring the grade up to the proper elevation to allow precipitation to gravity flow off the FCS. The ClosureTurf FCS system would then be placed on top of the fill material in both the north and south portions. Each FCS is sloped to drain towards a new discharge structure that will be installed in the southwest corner of the north portion FCS. From this drainage structure, a new underground pipe would be installed to drain water to the old intake channel. The south portion would drain through a pipe installed through the railroad spur berm and into the new drainage structure.

To prevent future ponding that may occur if a flood condition occurs at the FAB, the construction of an embankment adjacent to the north perimeter of the FAB is included in this closure scenario. The embankment will extend from the existing north FAB embankment up to an elevation of 460 ft amsl (the floodplain elevation is 457 ft amsl) and then slope at 3H:1V down to the existing ground surface. The construction of this embankment will require 49,000 CY of clean fill material.

This option would take approximately 200 days to complete and groundwater monitoring in accordance with 845.600 would occur for thirty (30) years.

The in-situ solidification/stabilization (ISS) treatment of the CCR in the north portion of the FAB would be completed over an approximate 763,000 square feet area and in the south portion of the FAB would be completed over an approximate 654,000 square feet area. This alternative would include the ISS of approximately 556,000 CY of CCR in the north portion and approximately 241,000 CY of CCR in the south portion. The ISS would be applied by soil mixing from the top of the CCR to the bottom most extent of the CCR.

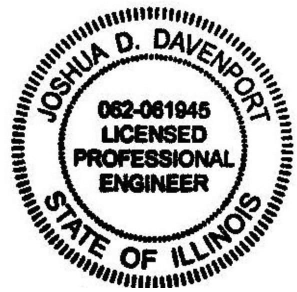
The completed ISS treatment area would be covered with clean soil and seeded. The extent of the treatment area requiring additional clean soil is 1,417,000 square feet and requires approximately 95,000 CY to achieve the necessary grades to prevent ponding water. The clean soil cover would be sloped to allow water to drain towards the perimeter of the ISS treatment area. Conceptually, the cover installation would consist of direct placement of clean fill with six inches of topsoil on the treated ISS area, feathered to match adjacent grades. The FCS will be graded to ensure positive drainage and minimize ponding and it is assumed the cover will be vegetated to reduce soil erosion. Each soil cover will be sloped to drain towards a new discharge structure that will be installed in the southwest corner of the north portion. From this drainage structure, a new underground pipe would be installed to drain water to the old intake channel. The south portion would drain through a pipe installed through the railroad spur berm and into the new drainage structure.

## 7.0 PROFESSIONAL ENGINEER'S CERTIFICATION

This closure alternatives analysis has been prepared in accordance with 35 Ill. Adm. Code 845.710.

Joshua D. Davenport, P.E.
Illinois Professional Engineer

SEAL



# TABLES

Table 1. Former Ash Basin Groundwater Elevations - Midwest Generation, LLC, Powerton Station, Pekin, IL

| Well ID | Date | Top of Casing Elevation (ft above MSL) | Depth to Groundwater (ft below TOC) | Groundwater Elevation (ft above MSL) |
|---|---|---|---|---|
| MW-01 (Upgradient) | 11/16/2015 | 465.24 | 26.04 | 439.20 |
| | 2/22/2016 | 465.24 | 21.90 | 443.34 |
| | 5/16/2016 | 465.24 | 21.83 | 443.41 |
| | 8/15/2016 | 465.24 | 23.89 | 441.35 |
| | 11/14/2016 | 465.24 | 23.38 | 441.86 |
| | 2/13/2017 | 465.24 | 21.71 | 443.53 |
| | 5/1/2017 | 465.24 | 18.87 | 446.37 |
| | 6/20/2017 | 465.24 | 21.54 | 443.70 |
| | 8/25/2017 | 465.24 | 24.70 | 440.54 |
| | 11/8/2017 | 465.24 | 24.92 | 440.32 |
| | 5/17/2018 | 465.24 | 22.66 | 442.58 |
| | 8/8/2018 | 465.24 | 26.05 | 439.19 |
| | 10/30/2018 | 465.24 | 24.69 | 440.55 |
| | 2/25/2019 | 465.24 | 19.44 | 445.80 |
| | 4/29/2019 | 465.24 | 20.15 | 445.09 |
| | 8/26/2019 | 465.24 | 23.85 | 441.39 |
| | 2/24/2020 | 465.24 | 20.71 | 444.53 |
| | 4/27/2020 | 465.24 | 20.90 | 444.34 |
| | 12/7/2020 | 465.24 | 25.69 | 439.55 |
| | 4/7/2021 | 465.24 | 22.20 | 443.04 |
| | 5/10/2021 | 465.24 | 23.41 | 441.83 |
| MW-02 (Downgradient) | 6/20/2017 | 462.60 | 22.04 | 440.56 |
| | 8/23/2017 | 462.60 | 28.42 | 434.18 |
| | 11/7/2017 | 462.60 | 26.08 | 436.52 |
| | 5/17/2018 | 462.60 | 23.26 | 439.34 |
| | 8/7/2018 | 462.60 | 29.70 | 432.90 |
| | 10/30/2018 | 462.60 | 26.77 | 435.83 |
| | 2/25/2019 | 462.60 | 17.02 | 445.58 |
| | 4/29/2019 | 462.60 | 19.26 | 443.34 |
| | 8/26/2019 | 462.60 | 27.45 | 435.15 |
| | 2/24/2020 | 462.60 | 20.35 | 442.25 |
| | 4/27/2020 | 462.60 | 20.51 | 442.09 |
| | 12/7/2020 | 462.60 | 28.71 | 433.89 |
| | 4/7/2021 | 462.60 | 21.95 | 440.65 |
| | 5/10/2021 | 462.60 | 23.01 | 439.59 |
| MW-03 (Downgradient) | 6/20/2017 | 462.48 | 22.31 | 440.17 |
| | 8/23/2017 | 462.48 | 28.18 | 434.30 |
| | 11/7/2017 | 462.48 | 25.38 | 437.10 |
| | 5/17/2018 | 462.48 | 22.62 | 439.86 |
| | 8/7/2018 | 462.48 | 29.17 | 433.31 |
| | 10/30/2018 | 462.48 | 24.71 | 437.77 |
| | 2/25/2019 | 462.48 | 17.20 | 445.28 |
| | 4/29/2019 | 462.48 | 18.85 | 443.63 |
| | 8/26/2019 | 462.48 | 27.65 | 434.83 |
| | 2/24/2020 | 462.48 | 20.18 | 442.30 |
| | 4/27/2020 | 462.48 | 20.43 | 442.05 |
| | 12/7/2020 | 462.48 | 28.61 | 433.87 |
| | 4/7/2021 | 462.48 | 21.73 | 440.75 |
| | 5/10/2021 | 462.48 | 22.98 | 439.50 |

Table 1. Former Ash Basin Groundwater Elevations - Midwest Generation, LLC, Powerton Station, Pekin, IL

| Well ID | Date | Top of Casing Elevation (ft above MSL) | Depth to Groundwater (ft below TOC) | Groundwater Elevation (ft above MSL) |
|---|---|---|---|---|
| MW-04 (Downgradient) | 6/20/2017 | 460.57 | 22.15 | 438.42 |
| | 8/28/2017 | 460.57 | 28.49 | 432.08 |
| | 11/7/2017 | 460.57 | 25.62 | 434.95 |
| | 5/17/2018 | 460.57 | 24.13 | 436.44 |
| | 8/7/2018 | 460.57 | 29.23 | 431.34 |
| | 10/30/2018 | 460.57 | 26.58 | 433.99 |
| | 2/25/2019 | 460.57 | 15.45 | 445.12 |
| | 4/29/2019 | 460.57 | 15.88 | 444.69 |
| | 8/26/2019 | 460.57 | 27.35 | 433.22 |
| | 2/24/2020 | 460.57 | 19.81 | 440.76 |
| | 4/27/2020 | 460.57 | 19.76 | 440.81 |
| | 12/7/2020 | 460.57 | 28.50 | 432.07 |
| | 4/7/2021 | 460.57 | 21.90 | 438.67 |
| | 5/10/2021 | 460.57 | 23.92 | 436.65 |
| MW-05 (Downgradient) | 11/16/2015 | 458.58 | 26.39 | 432.19 |
| | 2/22/2016 | 458.66 | 21.12 | 437.54 |
| | 5/16/2016 | 458.66 | 16.58 | 442.08 |
| | 8/15/2016 | 458.66 | 23.59 | 435.07 |
| | 11/14/2016 | 458.66 | 22.72 | 435.94 |
| | 2/13/2017 | 458.66 | 19.13 | 439.53 |
| | 5/1/2017 | 458.66 | 13.09 | 445.57 |
| | 6/20/2017 | 458.66 | 19.43 | 439.15 |
| | 8/28/2017 | 458.66 | 25.38 | 433.20 |
| | 11/7/2017 | 458.66 | 22.91 | 435.67 |
| | 5/17/2018 | 458.66 | 21.54 | 437.04 |
| | 8/7/2018 | 458.66 | 26.17 | 432.41 |
| | 10/30/2018 | 458.66 | 23.97 | 434.61 |
| | 2/25/2019 | 458.66 | 13.21 | 445.45 |
| | 4/29/2019 | 458.66 | 15.40 | 443.26 |
| | 8/26/2019 | 458.66 | 24.35 | 434.31 |
| | 2/24/2020 | 458.66 | 17.25 | 441.41 |
| | 4/27/2020 | 458.66 | 17.41 | 441.25 |
| | 12/7/2020 | 458.66 | 25.65 | 433.01 |
| | 4/7/2021 | 458.66 | 19.40 | 439.26 |
| | 5/10/2021 | 458.66 | 21.38 | 437.28 |
| MW-10 (Upgradient) | 6/22/2017 | 457.31 | 13.46 | 443.85 |
| | 8/24/2017 | 457.31 | 16.39 | 440.92 |
| | 11/9/2017 | 457.31 | 16.86 | 440.45 |
| | 5/16/2018 | 457.31 | 14.88 | 442.43 |
| | 8/8/2018 | 457.31 | 17.88 | 439.43 |
| | 10/30/2018 | 457.31 | 17.04 | 440.27 |
| | 2/25/2019 | 457.31 | 11.28 | 446.03 |
| | 4/29/2019 | 457.31 | 11.88 | 445.43 |
| | 8/26/2019 | 457.31 | 15.89 | 441.42 |
| | 2/24/2020 | 457.31 | 12.64 | 444.67 |
| | 4/27/2020 | 457.31 | 12.75 | 444.56 |
| | 12/7/2020 | 457.31 | 17.80 | 439.51 |
| | 4/7/2021 | 457.31 | 14.21 | 443.10 |
| | 5/10/2021 | 457.31 | 15.58 | 441.73 |

MSL - Mean Sea Level
TOC - Top of Casing

Table 2. Groundwater Analytical Results - Midwest Generation, LLC, Powerton Station, Pekin, IL. Former Ash Basin.

| Well | Date | Boron | Calcium | Chloride | Fluoride | pH | Sulfate | Total Dissolved | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Lead | Lithium | Mercury | Molybdenum | Radium 226 + 228 | Selenium | Thallium |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 11/16/2015 | 1.0 | 98 | 44 | 0.17 | 7.07 | 93 | 530 | < 0.003 | < 0.001 | 0.057 | ^ < 0.001 | < 0.0005 | < 0.005 | < 0.001 | * < 0.0005 | < 0.01 | < 0.0002 | < 0.0050 | 0.744 | < 0.0025 | * < 0.002 |
| | 2/25/2016 | 0.2 | 110 | 42 | 0.16 | 7.23 | 54 | 460 | < 0.003 | 0.0025 | 0.053 | < 0.001 | < 0.0005 | < 0.005 | 0.0014 | 0.0019 | < 0.01 | < 0.0002 | < 0.005 | < 0.722 | 0.0029 | < 0.002 |
| | 5/20/2016 | 0.34 | 100 | 44 | 0.17 | 6.95 | 65 | 430 | < 0.003 | 0.0081 | 0.062 | < 0.001 | < 0.0005 | 0.007 | 0.0053 | 0.011 | < 0.01 | < 0.0002 | < 0.005 | < 0.953 | < 0.0025 | < 0.002 |
| | 8/17/2016 | 0.27 | 78 | 39 | 0.25 | 7.16 | 50 | 530 | < 0.003 | 0.0014 | 0.048 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | 0.0014 | < 0.01 | < 0.0002 | 0.0057 | < 0.491 | < 0.0025 | < 0.002 |
| | 11/16/2016 | 0.18 | 97 | 39 | 0.21 | 7.22 | 32 | 500 | < 0.003 | 0.0051 | 0.056 | < 0.001 | < 0.0005 | < 0.005 | 0.0044 | 0.0082 | < 0.01 | < 0.0002 | 0.0059 | < 0.618 | < 0.0025 | < 0.002 |
| | 2/14/2017 | 0.18 | 120 | 55 | 0.17 | 7.30 | 60 | 550 | < 0.003 | 0.0041 | 0.056 | < 0.001 | < 0.0005 | < 0.005 | 0.0045 | 0.0076 | < 0.01 | < 0.0002 | 0.0056 | < 0.837 | < 0.0025 | < 0.002 |
| | 5/3/2017 | 0.19 | 86 | 66 | 0.16 | 7.41 | 45 | 460 | < 0.003 | 0.0015 | 0.045 | < 0.001 | < 0.0005 | < 0.005 | 0.0033 | 0.0067 | < 0.01 | < 0.0002 | < 0.005 | 0.574 | < 0.0025 | < 0.002 |
| | 6/21/2017 | 0.18 | 85 | 58 | 0.18 | 7.60 | 47 | 540 | < 0.003 | < 0.001 | 0.040 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | 0.0061 | < 0.418 | < 0.0025 | < 0.002 |
| MW-01 up-gradient | 8/25/2017 | 0.56 | 86 | 41 | 0.18 | 7.41 | 63 | 490 | < 0.003 | < 0.001 | 0.049 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | 0.0059 | 0.775 | < 0.0025 | < 0.002 |
| | 11/8/2017 | 0.57 | 130 | 38 | 0.12 | 6.69 | 61 | 640 | < 0.003 | < 0.001 | 0.083 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | 0.343 | < 0.0025 | < 0.002 |
| | 5/17/2018 | 0.15 | 88 | 50 | 0.12 | 6.70 | 48 | 540 | < 0.003 | < 0.001 | 0.045 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | 0.00068 | < 0.01 | < 0.0002 | < 0.005 | < 0.396 | < 0.0025 | < 0.002 |
| | 8/8/2018 | 0.14 | 86 | 48 | 0.13 | 6.80 | 43 | 430 | < 0.003 | < 0.001 | 0.051 | <^ 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | 0.579 | < 0.0025 | < 0.002 |
| | 4/30/2019 | 0.07 | 78 | 54 | 0.17 | 7.20 | 27 | 450 | < 0.003 | 0.0014 | 0.039 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | 0.0017 | < 0.01 | < 0.0002 | < 0.005 | < 0.656 | < 0.0025 | < 0.002 |
| | 8/26/2019 | 0.57 | 100 | 39 | 0.13 | 7.15 | 71 | 550 | < 0.003 | < 0.001 | 0.053 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | 0.802 | < 0.0025 | < 0.002 |
| | 2/24/2020 | 0.28 | 87 | 53 | 0.21 | 7.19 | 34 | 410 | < 0.003 | < 0.001 | 0.044 | < ^ 0.001 | < 0.0005 | < 0.005 | < 0.001 | 0.00057 | < 0.01 | < 0.0002 | < 0.005 | < 0.478 | < 0.0025 | < 0.002 |
| | 4/28/2020 | 0.33 | 110 | 46 | 0.19 | 7.17 | 41 | 470 | NA | < 0.001 | 0.051 | NA | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | 0.628 | < 0.0025 | < 0.002 |
| | 12/7/2020 | 0.59 | 100 | 54 | 0.25 | 7.22 | 55 | 640 | NA | < 0.001 | 0.058 | NA | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | 0.0052 | < 0.542 | < 0.0025 | < 0.002 |
| | 5/11/2021 | 0.21 | 85 | 51 | 0.21 | 7.52 | 37 | 450 | < 0.003 | < 0.001 | 0.043 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | 0.01 | 0.521 | < 0.0025 | < 0.002 |
| | 6/22/2017 | 0.46 | 100 | 48 | 0.19 | 6.81 | 54 | 1.0 | < 0.003 | 0.0023 | 0.250 | < 0.001 | < 0.0005 | < 0.005 | 0.008 | 0.003 | < 0.01 | < 0.0002 | < 0.005 | 0.408 | 0.0042 | < 0.002 |
| | 8/24/2017 | 0.32 | 93 | 51 | 0.18 | 7.14 | 57 | 480 | < 0.003 | 0.0020 | 0.220 | < 0.001 | < 0.0005 | < 0.005 | 0.007 | 0.003 | < 0.01 | < 0.0002 | < 0.005 | 0.564 | 0.0044 | < 0.002 |
| | 11/9/2017 | 0.36 | 98 | 48 | 0.18 | 6.78 | 64 | 500 | < 0.003 | < 0.0010 | 0.220 | < 0.001 | < 0.0005 | < 0.005 | 0.004 | < 0.001 | < 0.01 | < 0.0002 | < 0.005 | 1.020 | 0.0034 | < 0.002 |
| | 5/16/2018 | 0.42 | 93 | 44 | 0.19 | 7.64 | 80 | 530 | < 0.003 | 0.0010 | 0.220 | < 0.001 | < 0.0005 | < 0.005 | 0.021 | 0.001 | < 0.01 | < 0.0002 | < 0.005 | 1.550 | 0.0050 | < 0.002 |
| | 8/8/2018 | 0.39 | 99 | 58 | 0.19 | 7.10 | 60 | 550 | < 0.003 | 0.0012 | 0.220 | <^ 0.001 | < 0.0005 | < 0.005 | 0.014 | 0.001 | < 0.01 | < 0.0002 | < 0.005 | < 0.551 | 0.0062 | < 0.002 |
| | 10/30/2018 | 0.34 | 110 | 49 | 0.22 | 7.65 | 49 | 510 | < 0.003 | 0.0110 | 0.410 | < 0.001 | 0.0008 | 0.024 | 0.047 | 0.023 | 0.02 | < 0.0002 | < 0.005 | 3.00 | 0.0046 | < 0.002 |
| MW-10 up-gradient | 2/26/2019 | 0.39 | 150 | 48 | 0.21 | 6.77 | 36 | 540 | < 0.003 | 0.0220 | 0.590 | < 0.005 | 0.0015 | 0.063 | 0.081 | 0.036 | 0.03 | < 0.0002 | 0.007 | 4.130 | 0.0041 | < 0.002 |
| | 5/1/2019 | 0.35 | 92 | 50 | 0.22 | 6.81 | 30 | 470 | < 0.003 | 0.0023 | 0.270 | < 0.001 | < 0.0005 | < 0.005 | 0.011 | 0.0028 | < 0.01 | < 0.0002 | < 0.005 | 1.330 | 0.0037 | < 0.002 |
| | 8/26/2019 | 0.30 | 84 | 48 | 0.19 | 7.09 | 30 | 410 | < 0.003 | 0.0017 | 0.190 | < 0.001 | < 0.001 | < 0.005 | 0.007 | 0.0016 | < 0.01 | < 0.0002 | < 0.005 | 1.540 | 0.0050 | < 0.002 |
| | 2/25/2020 | 1.40 | 110 | 45 | 0.23 | 6.82 | 59 | 500 | < 0.003 | 0.0033 | 0.280 | < ^ 0.001 | < 0.0005 | 0.0086 | 0.011 | 0.0046 | < 0.01 | < 0.0002 | < 0.005 | 1.07 | 0.0058 | < 0.002 |
| | 4/28/2020 | 1.00 | 110 | 41 | 0.24 | 6.80 | 64 | 550 | NA | 0.0022 | 0.250 | NA | NA | < 0.005 | 0.0065 | 0.0017 | NA | NA | < 0.005 | 0.639 | 0.0054 | NA |
| | 12/8/2020 | 2.40 | 120 | 44 | 0.26 | 7.11 | 71 | 550 | NA | 0.0015 | 0.280 | NA | NA | < 0.005 | 0.0089 | 0.0023 | NA | < 0.0002 | < 0.005 | 1.76 | 0.0031 | NA |
| | 5/11/2021 | 0.64 | 100 | 52 | 0.24 | 7.01 | 59 | 540 | < 0.003 | 0.0011 | 0.260 | < 0.001 | < 0.001 | < 0.005 | 0.008 | 0.0009 | < 0.01 | < 0.0002 | < 0.005 | 1.42 | 0.0049 | < 0.002 |
| | 6/20/2017 | 0.33 | 90 | 55 | 0.19 | 7.01 | 47 | 500 | < 0.003 | 0.0012 | 0.075 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | < 0.341 | < 0.0025 | < 0.002 |
| | 8/23/2017 | V 1.30 | 86 | 49 | 0.19 | 7.40 | 61 | 440 | < 0.003 | < 0.001 | 0.062 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | 0.833 | < 0.0025 | < 0.002 |
| | 11/7/2017 | 3.70 | 98 | 46 | 0.17 | 7.10 | 88 | 550 | < 0.003 | 0.0014 | 0.091 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | < 0.309 | 0.0027 | < 0.002 |
| | 5/15/2018 | 0.22 | 80 | 45 | 0.23 | 7.71 | 54 | 500 | < 0.003 | 0.0013 | 0.065 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | 0.0004 | < 0.005 | < 0.408 | < 0.0025 | < 0.002 |
| | 8/7/2018 | 1.50 | 89 | 54 | 0.15 | 7.09 | 51 | 530 | < 0.003 | 0.0016 | 0.067 | <^ 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | 0.622 | < 0.0025 | < 0.002 |
| MW-02 down-gradient | 10/30/2018 | 0.23 | 86 | 43 | 0.17 | 7.83 | 34 | 480 | < 0.003 | 0.0015 | 0.067 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | 0.564 | < 0.0025 | < 0.002 |
| | 2/26/2019 | 0.07 | 69 | 49 | 0.16 | 7.82 | 23 | 400 | < 0.003 | 0.0026 | 0.041 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | 0.0013 | < 0.01 | < 0.0002 | < 0.005 | < 0.425 | < 0.0025 | < 0.002 |
| | 4/30/2019 | 0.12 | 79 | 48 | 0.16 | 7.60 | 30 | 440 | < 0.003 | 0.0013 | 0.048 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | < 0.441 | < 0.0025 | < 0.002 |
| | 8/26/2019 | 0.51 | 86 | 50 | 0.18 | 7.13 | 32 | 400 | < 0.003 | 0.0011 | 0.065 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | 1.180 | < 0.0025 | < 0.002 |
| | 2/24/2020 | 0.33 | 89 | 53 | 0.20 | 7.43 | 37 | 410 | < 0.003 | 0.0011 | 0.061 | < ^ 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | 0.485 | < 0.0025 | < 0.002 |
| | 4/28/2020 | 0.33 | 90 | 50 | 0.20 | 7.32 | 41 | 430 | NA | 0.0016 | 0.06 | NA | NA | < 0.005 | < 0.001 | < 0.0005 | NA | NA | < 0.005 | < 0.54 | < 0.0025 | NA |
| | 12/9/2020 | 0.66 | 100 | 41 | 0.15 | 7.78 | 64 | 430 | NA | < 0.001 | 0.076 | NA | NA | < 0.005 | < 0.001 | < 0.0005 | NA | < 0.0002 | 0.0059 | < 0.471 | < 0.0025 | NA |
| | 5/11/2021 | 0.23 | 79 | 51 | 0.21 | 7.70 | 37 | 370 | < 0.003 | 0.0015 | 0.057 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | 0.010 | < 0.528 | < 0.0025 | < 0.002 |

Notes: All units are in mg/l except pH is in standard units.
V- Serial dilution exceeds control limits.
H- Sample was prepped or analyzed beyond specified holding time

F1 - MS and/or MSD Recovery outside of limits.
* - LCS or LCSD is outside acceptance limits.
^ - Denotes instrument related QC exceeds the control limits

NA - Not Analyzed

Table 2. Groundwater Analytical Results - Midwest Generation, LLC, Powerton Station, Pekin, IL. Former Ash Basin.

| Well | Date | Boron | Calcium | Chloride | Fluoride | pH | Sulfate | Total Dissolved | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Lead | Lithium | Mercury | Molybdenum | Radium 226 + 228 | Selenium | Thallium |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MW-03 down-gradient | 6/20/2017 | 0.4 | 76 | 54 | 0.29 | 7.26 | 49 | 480 | < 0.003 | 0.0013 | 0.066 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | < 0.325 | < 0.0025 | < 0.002 |
| | 8/23/2017 | 0.40 | 79 | 52 | 0.28 | 7.44 | 52 | 430 | < 0.003 | 0.0010 | 0.066 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | 1.200 | < 0.0025 | < 0.002 |
| | 11/7/2017 | 0.31 | 79 | 62 | 0.26 | 7.04 | 61 | 460 | < 0.003 | 0.0013 | 0.068 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | 0.588 | < 0.0025 | < 0.002 |
| | 5/15/2018 | 0.35 | 87 | 66 | 0.27 | 7.53 | 77 | 520 | < 0.003 | 0.0010 | 0.059 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | < 0.489 | < 0.0025 | < 0.002 |
| | 8/7/2018 | 0.40 | 82 | 67 | 0.22 | 6.60 | 49 | 500 | < 0.003 | 0.0015 | 0.067 | <^ 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | < 0.341 | < 0.0025 | < 0.002 |
| | 10/30/2018 | 0.20 | 74 | 44 | 0.25 | 7.84 | 26 | 400 | < 0.003 | 0.0014 | 0.056 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | < 0.354 | < 0.0025 | < 0.002 |
| | 2/26/2019 | 0.06 | 74 | 56 | 0.24 | 7.49 | 25 | 410 | < 0.003 | 0.0013 | 0.054 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | 0.0007 | < 0.01 | < 0.0002 | < 0.005 | < 0.399 | < 0.0025 | < 0.002 |
| | 4/30/2019 | 0.28 | 74 | 49 | 0.22 | 7.17 | 38 | 390 | < 0.003 | < 0.001 | 0.060 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | < 0.668 | < 0.0025 | < 0.002 |
| | 8/26/2019 | 0.31 | 75 | 50 | 0.26 | 7.17 | 14 | 380 | < 0.003 | 0.0014 | 0.069 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | < 0.444 | < 0.0025 | < 0.002 |
| | 2/24/2020 | 0.33 | 87 | 53 | 0.22 | 7.10 | 65 | 470 | < 0.003 | < 0.001 | 0.066 | < ^ 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | < 0.400 | < 0.0025 | < 0.002 |
| | 4/28/2020 | 0.24 | 86 | 46 | 0.22 | 7.03 | 79 | 410 | NA | 0.0013 | 0.066 | NA | NA | < 0.005 | < 0.001 | < 0.0005 | NA | NA | < 0.005 | < 0.498 | 0.0036 | NA |
| | 12/9/2020 | 0.86 | 92 | 45 | 0.28 | 7.46 | 60 | 390 | NA | < 0.001 | 0.086 | NA | NA | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | < 0.432 | < 0.0025 | NA |
| | 5/11/2021 | 0.22 | 75 | 49 | 0.21 | 7.33 | 38 | 390 | < 0.003 | < 0.001 | 0.070 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | < 0.519 | < 0.0025 | < 0.002 |
| MW-04 down-gradient | 6/20/2017 | 0.5 | 77 | 55 | 0.29 | 7.45 | 53 | 480 | < 0.003 | < 0.001 | 0.0025 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | < 0.343 | < 0.0025 | < 0.002 |
| | 8/28/2017 | V 0.73 | 90 | 89 | 0.33 | 7.13 | 110 | 680 | < 0.003 | < 0.001 | 0.028 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | 0.013 | < 0.246 | < 0.0025 | < 0.002 |
| | 11/7/2017 | 0.60 | 110 | 94 | 0.24 | 6.80 | 130 | 650 | < 0.003 | < 0.001 | 0.051 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | < 0.332 | 0.0092 | < 0.002 |
| | 5/15/2018 | 0.68 | 87 | 66 | 0.27 | 7.63 | 100 | 630 | < 0.003 | < 0.001 | 0.037 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | 0.661 | < 0.0025 | < 0.002 |
| | 8/7/2018 | 0.79 | 84 | 71 | 0.32 | 6.72 | 49 | 510 | < 0.003 | 0.0011 | 0.031 | <^ 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | 0.006 | < 0.334 | < 0.0025 | < 0.002 |
| | 10/30/2018 | 0.54 | 100 | 80 | 0.24 | 7.55 | 91 | 690 | < 0.003 | < 0.001 | 0.049 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | 0.423 | < 0.0025 | < 0.002 |
| | 2/26/2019 | 0.38 | 79 | 55 | 0.25 | 7.18 | 52 | 490 | < 0.003 | 0.0013 | 0.033 | < 0.001 | < 0.0005 | < 0.005 | 0.001 | 0.0012 | < 0.01 | < 0.0002 | < 0.005 | 0.366 | < 0.0025 | < 0.002 |
| | 4/30/2019 | 0.36 | 74 | 48 | 0.25 | 7.08 | 35 | 380 | < 0.003 | < 0.001 | 0.026 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | < 0.684 | < 0.0025 | < 0.002 |
| | 8/26/2019 | 0.64 | 91 | 60 | 0.24 | 7.08 | 14 | 490 | < 0.003 | < 0.001 | 0.032 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | 0.008 | 1.090 | < 0.0025 | < 0.002 |
| | 2/24/2020 | 0.34 | 81 | 49 | 0.20 | 7.05 | 67 | 440 | < 0.003 | < 0.001 | 0.024 | < ^ 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | 0.595 | < 0.0025 | < 0.002 |
| | 4/28/2020 | 0.55 | 76 | 52 | 0.27 | 7.03 | 47 | 380 | NA | < 0.001 | 0.025 | NA | NA | < 0.005 | < 0.001 | < 0.0005 | NA | NA | < 0.005 | < 0.465 | < 0.0025 | NA |
| | 12/9/2020 | 0.57 | 92 | 88 | 0.32 | 7.10 | 94 | 580 | NA | < 0.001 | 0.034 | NA | NA | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | 0.0076 | < 0.411 | < 0.0025 | NA |
| | 5/11/2021 | 0.61 | 77 | 44 | 0.33 | 7.22 | 76 | 410 | < 0.003 | < 0.001 | 0.025 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | 0.533 | < 0.0025 | < 0.002 |
| MW-05 down-gradient | 5/17/2016 | 0.70 | 100 | 85 | 0.35 | 7.08 | 120 | 660 | < 0.003 | < 0.001 | 0.051 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | < 0.373 | < 0.0025 | < 0.002 |
| | 8/16/2016 | 0.69 | 110 | 97 | 0.30 | 6.85 | 150 | 830 | < 0.003 | < 0.001 | 0.060 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | < 0.452 | < 0.0025 | < 0.002 |
| | 11/15/2016 | 0.93 | 94 | 66 | 0.23 | 6.96 | 77 | 620 | < 0.003 | < 0.001 | 0.051 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | 0.449 | < 0.0025 | < 0.002 |
| | 2/14/2017 | 0.79 | 100 | 100 | 0.25 | 7.25 | 170 | 760 | < 0.003 | < 0.001 | 0.062 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | 0.00091 | < 0.01 | < 0.0002 | < 0.005 | < 0.359 | < 0.0025 | < 0.002 |
| | 5/1/2017 | 0.70 | 100 | 92 | 0.28 | 7.60 | 170 | 710 | < 0.003 | < 0.001 | 0.059 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | 0.0066 | < 0.439 | < 0.0025 | < 0.002 |
| | 6/20/2017 | 0.64 | 89 | 63 | 0.28 | 7.32 | 78 | 550 | < 0.003 | < 0.001 | 0.048 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | 0.0061 | < 0.365 | < 0.0025 | < 0.002 |
| | 8/28/2017 | 0.62 | 110 | 120 | 0.33 | 7.05 | 210 | 870 | < 0.003 | < 0.001 | 0.064 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | 0.0085 | 0.381 | < 0.0025 | < 0.002 |
| | 11/7/2017 | 0.51 | 99 | 110 | 0.31 | 6.87 | 160 | 990 | < 0.003 | < 0.001 | 0.058 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | < 0.341 | < 0.0025 | < 0.002 |
| | 5/15/2018 | 0.61 | 130 | 89 | 0.29 | 7.70 | 210 | 910 | < 0.003 | < 0.001 | 0.062 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | < 0.005 | < 0.390 | < 0.0025 | < 0.002 |
| | 8/7/2018 | 0.49 | 110 | 120 | 0.32 | 6.56 | 180 | 890 | < 0.003 | < 0.001 | 0.054 | <^ 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | 0.0069 | 0.523 | < 0.0025 | < 0.002 |
| | 4/30/2019 | 0.56 | 84 | 73 | 0.36 | 6.96 | 120 | 590 | < 0.003 | < 0.001 | 0.041 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | 0.0061 | < 0.709 | < 0.0025 | < 0.002 |
| | 8/26/2019 | 0.57 | 110 | 75 | 0.29 | 7.01 | 110 | 660 | < 0.003 | < 0.001 | 0.050 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | 0.0067 | 0.651 | < 0.0025 | < 0.002 |
| | 2/24/2020 | 0.54 | 110 | 70 | 0.36 | 6.90 | 120 | H 700 | < 0.003 | < 0.001 | 0.057 | < ^ 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | 0.0061 | 0.506 | < 0.0025 | < 0.002 |
| | 4/28/2020 | 0.49 | 110 | 56 | 0.37 | 6.87 | 130 | 620 | NA | 0.001 | 0.052 | NA | NA | < 0.005 | < 0.001 | < 0.0005 | NA | NA | 0.0074 | 0.508 | < 0.0025 | NA |
| | 12/9/2020 | 0.53 | 98 | 78 | 0.31 | 6.91 | 110 | 670 | NA | < 0.001 | 0.05 | NA | NA | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | 0.0072 | 0.569 | < 0.0025 | NA |
| | 5/11/2021 | 0.5 | 83 | 52 | 0.38 | 7.20 | 100 | 530 | < 0.003 | < 0.001 | 0.04 | < 0.001 | < 0.0005 | < 0.005 | < 0.001 | < 0.0005 | < 0.01 | < 0.0002 | 0.0062 | < 0.525 | < 0.0025 | < 0.002 |

Notes: All units are in mg/l except pH is in standard units.
V- Serial dilution exceeds control limits.
H- Sample was prepped or analyzed beyond specified holding time

F1 - MS and/or MSD Recovery outside of limits.
* - LCS or LCSD is outside acceptance limits.
^ - Denotes instrument related QC exceeds the control limits

NA - Not Analyzed

**Table 3 - Closure Alternatives Evaluation**

| 35 Ill. Adm. Code Part 845.710(b)(1) through 845.710(b)(4) Requirements | | Closure Alternatives | | | |
|---|---|---|---|---|---|
| | | Closure by Removal for Pond Re-use | Closure-in-Place with a Final Cover System | Consolidation & Closure-in-Place with a Final Cover System | Closure-in-Place with Insitu Stabilization/Solidification |
| 845.710(b)(1)(A) | Magnitude of existing risk reduction | The excavation and removal of the CCR from the FAB would remove a potential source. This will prevent about 38 inches per year of precipitation from passing through the unsaturated CCR into the groundwater. The groundwater modeling has shown that by previously removing the CCR source material, a reduction of at least 90% would occur in groundwater concentrations after 25 years. | Closing the CCR in place with the ClosureTurf final cover system will prevent infiltration through the CCR material that may be present. The final cover system also eliminates human/animal exposure to any CCR, in addition to removing the hazard of an open area. The final cover system would be constructed by filling the FAB with clean material and covering with a geomembrane infiltration layer that has a permeability of 1 x $10^{-13}$ cm/s, which is covered with a synthetic turf/sand infill erosion layer. This type of cover system has been used throughout the country since 2009 to effectively close CCR surface impoundments. The existing groundwater monitoring (through second quarter 2021) has shown that groundwater impacts above the proposed GWPSs are not present. The groundwater modeling has shown that a reduction of 10% of groundwater concentrations would occur after 5 years and the groundwater concentrations would reach a steady state condition after 25 years with no further increases in groundwater concentrations. | Closing the CCR in place with the ClosureTurf final cover system will prevent infiltration through the CCR material that may be present. The final cover system also eliminates human/animal exposure to any CCR, in addition to removing the hazard of an open area. The final cover system would be constructed by first dredging the north FAB CCR into the south, filling the south FAB with clean material and covering with a geomembrane infiltration layer that has a permeability of 1 x $10^{-13}$ cm/s, which is covered with a synthetic turf/sand infill erosion layer. This type of cover system has been used throughout the country since 2009 to effectively close CCR surface impoundments. The existing groundwater monitoring (through second quarter 2021) has shown that groundwater impacts above the proposed GWPSs are not present. The groundwater modeling has shown that a reduction of 20% of groundwater concentrations would occur after 5 years and the groundwater concentrations would reach a steady state condition after 25 years with no further increases in groundwater concentrations. | Closing the CCR in place with treating the CCR with in-situ solidification/stabilization will prevent infiltration through the CCR material that may be present. The soil cover also eliminates human/animal exposure to any CCR, in addition to removing the hazard of an open area. The ISS would be conducted by mixing the CCR with reagents (cement, bentonite) using either an excavator bucket or a large diameter auger, followed up by filling over the ISS with clean material and covering with topsoil and then seeded. The ISS would have a permeability of less than 1 x $10^{-7}$ cm/s. This type of technology has been used throughout the country since the 1960's to effectively treat impacted soil throughout the country. The existing groundwater monitoring (through second quarter 2021) has shown that groundwater impacts above the proposed GWPSs are not present. The groundwater modeling has shown that a reduction of greater than 90% of groundwater concentrations would occur after 5 years and the groundwater concentrations would reach a steady state condition after 25 years. |
| 845.710(b)(1)(B) | Likelihood of future CCR releases | Since the CCR would be removed, the likelihood of a future CCR release is eliminated. Groundwater monitoring results have shown that no concentrations existing above the proposed GWPSs. | Covering the CCR would prevent the future release of CCR because it would not be exposed to surface water runoff and the potential for erosion. Groundwater monitoring through second quarter 2021 does not show any groundwater concentrations greater than the proposed GWPSs. Releases of CCR to the Illinois River has not been identified. The material brought on-site would be evaluated to determine that it will not cause a future release. | Covering the CCR would prevent the future release of CCR because it would not be exposed to surface water runoff and the potential for erosion. Groundwater monitoring through second quarter 2021 does not show any groundwater concentrations greater than the proposed GWPSs. Releases of CCR to the Illinois River has not been identified. The material brought on-site would be evaluated to determine that it will not cause a future release. | Solidifiying and covering the CCR would prevent the future release of CCR because it would not be exposed to surface water runoff, infiltration, and the potential for erosion. Groundwater monitoring through second quarter 2021 does not show any groundwater concentrations greater than the proposed GWPSs. Releases of CCR to the Illinois River has not been identified. The material brought on-site would be evaluated to determine that it will not cause a future release. |
| 845.710(b)(1)(C) | Long-term management required | Long-term management of the FAB would be very minimal because the CCR would be removed. Therefore, there is no potential for future releases and no inspections required. Groundwater monitoring is required in accordance with 845.740(b) and 845.600. Groundwater monitoring is required for at least 3 years. | Post-closure activities will be required in accordance with 845.780 which includes regular inspections of the ClosureTurf FCS and groundwater monitoring. The post-closure period is at least 30 years. | Post-closure activities will be required in accordance with 845.780 which includes regular inspections of the ClosureTurf FCS and groundwater monitoring. The post-closure period is at least 30 years. | Post-closure activities will be required in accordance with 845.780 which includes regular inspections of the soil cover and groundwater monitoring. The post-closure period is at least 30 years. |
| 845.710(b)(1)(D) | Short-term risks to the community during closure activities | The short-term risk to the community is very minimal to non-existent. The only potential risk would be from an increase in truck traffic hauling the CCR for offsite disposal and truck traffic returning to the site because each truck will make multiple trips per day for disposal. Over 61,000 truck loads is required to haul the CCR off-site for disposal. This has the potential to cause 0.761 traffic accident injuries and 0.036 traffic accident fatalities based on a 40-mile round trip for each truckload. 61,000 truckloads has the potential to produce over 420 lbs of particulate matter emissions. | The short-tem risk to the community is minimal and would come from the increased truck traffic bringing the fill material and ClosureTurf FCS supplies to the site. Filling the FAB to the required elevations would require approximately 114,000 CY of additional clean material from off-site and approximately 7,600 trucks to transport this material. The north embankment construction would require approximately 78,000 CY of additional clean fill material from offsite and approximately 5,200 truckloads. This has the potential to cause 0.1894 traffic accident injuries and 0.0089 traffic accident fatalities based on a 20-mile round trip for each truckload. The total number of truckloads has the potential to produce approximately 61 lbs of particulate matter emissions. | The short-tem risk to the community is minimal and would come from the increased truck traffic bringing the fill material and ClosureTurf FCS supplies to the site. Filling the FAB to the required elevations would require approximately 68,000 CY of additional clean material from off-site and approximately 4,550 trucks to transport this material. This has the potential to cause 0.065 traffic accident injuries and 0.0031 traffic accident fatalities based on a 20-mile round trip for each truckload. The total number of truckloads has the potential to produce approximately 21 lbs of particulate matter emissions. | The short-tem risk to the community is minimal and would come from the increased truck traffic bringing the fill material and ClosureTurf FCS supplies to the site. Filling the FAB to the required elevations would require approximately 95,600 CY of additional clean material from off-site and approximately 6,375 trucks to transport this material. This has the potential to cause 0.1062 traffic accident injuries and 0.005 traffic accident fatalities based on a 20-mile round trip for each truckload. The total number of truckloads has the potential to produce approximately 34 lbs of particulate matter emissions. |
| 845.710(b)(1)(E) | Time to complete closure, post-closure or 845.740(b) groundwater monitoring | Excavation and disposal of the FAB's 920,000 CY of CCR is estimated to take over 1,200 days, based on disposing of 50 trucks/day of CCR. Post-closure activities are not required when closure by removal is performed, but groundwater monitoring must be conducted for at least 3 years after closure activities. | The total anticipated time to complete closure construction is 8 months and post-closure activities will take 30 years, which includes groundwater monitoring. | The total anticipated time to complete closure construction is 12 months and post-closure activities will take 30 years, which includes groundwater monitoring. | The total anticipated time to complete closure construction up to 24 months and post-closure activities will take 30 years, which includes groundwater monitoring. |
| 845.710(b)(1)(F) | Potential threat to human health and environment | The potential threat to human health and the environment is minimal to non-existent because the CCR source material has been removed. Groundwater monitoring has shown that impacts to groundwater are not present. | The potential threat to human health and the environment is minimal to non-existent because the CCR has been covered and no exposure routes are available. Groundwater monitoring through second quarter 2021 has shown that impacts to groundwater are not present. | The potential threat to human health and the environment is minimal to non-existent because the CCR in the north has been removed and consolidated with the CCR in south which is then covered and no exposure routes are available. Groundwater monitoring through second quarter 2021 has shown that impacts to groundwater are not present. | The potential threat to human health and the environment is minimal to non-existent because the CCR has been solidified and covered and no exposure routes are available. Groundwater monitoring through second quarter 2021 has shown that impacts to groundwater are not present. |

**Table 3 - Closure Alternatives Evaluation**

| 35 Ill. Adm. Code Part 845.710(b)(1) through 845.710(b)(4) Requirements | | Closure Alternatives | | | |
|---|---|---|---|---|---|
| | | Closure by Removal for Pond Re-use | Closure-in-Place with a Final Cover System | Consolidation & Closure-in-Place with a Final Cover System | Closure-in-Place with Insitu Stabilization/Solidification |
| 845.710(b)(1)(G) | Long-term reliability of engineering/institutional controls | Having removed all the CCR is the most reliable alternative because the potential for any source material to remain is non-existent. | Geomembrane final cover systems and specifically ClosureTurf have been used throughout the country to effectively prevent CCR and other solid wastes from impacting human health and the environment. | Geomembrane final cover systems and specifically ClosureTurf have been used throughout the country to effectively prevent CCR and other solid wastes from impacting human health and the environment. | The ISS treatment creates a solidified/stabilized monolith of CCR with cement and sometimes bentonite to improve impermeability. The typical lifespan of concrete is greater than 30 years up to 100 years and the neutral pH of the groundwater will not degrade the monolith, extending its lifespan. |
| 845.710(b)(1)(H) | Potential for future corrective action | Because the CCR has already been removed, the need for future corrective actions is not present. | Groundwater concentrations above the proposed GWPSs are not present and groundwater modeling has shown that the concentrations will decrease with the closure alternative, so the potential for future correction is minimal. | Groundwater concentrations above the proposed GWPSs are not present and groundwater modeling has shown that the concentrations will decrease with the closure alternative, so the potential for future correction is minimal. | Groundwater concentrations above the proposed GWPSs are not present and groundwater modeling has shown that the concentrations will decrease greater than 90% after 10 years with this closure alternative, so the potential for future correction is minimal. |
| 845.710(b)(2)(A) | The extent containment reduces further releases | The CCR has been removed from the FAB and the potential for further releases is non-existent. Groundwater monitoring has shown that impacts are not present. | The CCR would remain within the confinements of the FAB and below the FCS. Previous groundwater monitoring has shown that a release of CCR has not occurred. The geomembrane used in the FCS prevent the infiltration of water thereby preventing any further release. | The CCR would remain within the confinements of the south FAB and below the FCS. Previous groundwater monitoring has shown that a release of CCR has not occurred. The geomembrane used in the FCS prevent the infiltration of water thereby preventing any further release. | The CCR would remain within the confinements of the FAB and solidified using cement. The permeability would be less than 1x10$^{-7}$ cm/s, preventing groundwater and precipitation from traveling through the CCR thereby preventing any further release. Previous groundwater monitoring has shown that a release of CCR has not occurred. The soil cover minimizes the direct contact to the solidified CCR. |
| 845.710(b)(2)(B) | Extent of the use of treatment technologies | Treatment will not be occurring as part of this closure alternative. The only technology used is the construction equipment to execute the removal. | Treatment will not be occurring as part of this closure alternative. ClosureTurf technology will be used to create the FCS. ClosureTurf consists of a geomembrane liner with synthetic turf and sand/small aggregate on top of the geomembrane. ClosureTurf has been successfully used at other CCR surface impoundments and landfills as cover systems. | Treatment will not be occurring as part of this closure alternative. ClosureTurf technology will be used to create the FCS. ClosureTurf consists of a geomembrane liner with synthetic turf and sand/small aggregate on top of the geomembrane. ClosureTurf has been successfully used at other CCR surface impoundments and landfills as cover systems. | ISS is the treatment technology that will be used as part of this scenario, No other technologies will be used. The completed ISS monolth will be covered with a soil cover that is then seeded. |
| 845.710(b)(3)(A) | Degree of difficulty associated with constructing technology | Removing and disposing of the CCR is not diffult work and many contractors are able to perform work. Finding a disposal location would be the most difficult beauce existing facilities may not accept the CCR and the permitting and constructing of a new landfill is difficult due to potential environmental and local resistance and available of materials. | Filling, grading, and compacting clean soil into the FAB is not difficult. This is a process that has been occurring for many years and several construction companies in the area are capable of performing this work. The installation of the ClosureTurf system is not difficult, but the provider of ClosureTurf requires a certified company perform the work. This limits the availability of installation contractors because the certified list of contractors is a limited number. ClosureTurf has been successfully installed in over 17 states throughout the country beginning in 2009. These states include New York, California, Minnesota, and Massachusetts. | Dredging, grading, and compacting clean soil into the FAB is not difficult. hydraulic dredging has routinely been performed throughout the country. This is a process that has been occurring for many years and several construction companies in the area are capable of performing this work. The installation of the ClosureTurf system is not difficult, but the provider of ClosureTurf requires a certified company perform the work. This limits the availability of installation contractors because the certified list of contractors is a limited number. ClosureTurf has been successfully installed in over 17 states throughout the country beginning in 2009. These states include New York, California, Minnesota, and Massachusetts. | ISS has been effectively used since the 1960's. The companies that routinely perform ISS treatment do not have difficulties with implementing this scenario. |
| 845.710(b)(3)(B) | Expected operational reliability of the technologies | This closure alternative does not require the operation of any technologies. The construction equipment that would be used to excavate and haul the CCR are expected to operate without interruption. | ClosureTurf has operated reliably at the other installations around the country. ClosureTurf experienced a hurricane in South Carolina that produced a 26-inch rainfall, which did not damage the ClosureTurf and so minimally displaced the sand infill that no maintenance was required. | ClosureTurf has operated reliably at the other installations around the country. ClosureTurf experienced a hurricane in South Carolina that produced a 26-inch rainfall, which did not damage the ClosureTurf and so minimally displaced the sand infill that no maintenance was required. | ISS has been effectively used to treatment soil impacts and CCR. QA/QC efforts as part of the treatment is constantly performed and has shown that permeabilites are routinely less than 1x10$^{-7}$ cm/s. Unconfined compressive strength of the soil is typically greater than 50 psi. |
| 845.710(b)(3)(C) | Need to coordinate with and obtain necessary approvals and permits from other agencies | This closure alternative would require approval from the Illinois EPA. | This closure alternative would require approval from the Illinois EPA. | This closure alternative would require approval from the Illinois EPA. | This closure alternative would require approval from the Illinois EPA. |
| 845.710(b)(3)(D) | Availability of necessary equipment and specialists | Equipment and personnel are easily available to excavate the CCR. Locating a disposal location is the most difficult part of this alternative. | This closure alternative would require a contractor that is approved by Watershed Geo to install ClosureTurf. Several contractors throughout the country have been certified to install ClosureTurf. The availability of a certified ClosureTurf installer is less than an earthwork contractor, but it should not be a concern. | This closure alternative would require a contractor that is capable of performing hydraulic dredging and a contractror approved by Watershed Geo to install ClosureTurf. Several contractors throughout the country have been certified to install ClosureTurf. The availability of a hydraulic dredging contractor and certified ClosureTurf installer is less than an earthwork contractor, but it should not be a concern. | This closure alternative would require a contractor that is capable of performing in-situ solidification/stabilization. Several contractors throughout the country are able to perform this work. The availability of an ISS contractor is less than an earthwork contractor, but it should not be a concern. |

**Table 3 - Closure Alternatives Evaluation**

| 35 Ill. Adm. Code Part 845.710(b)(1) through 845.710(b)(4) Requirements | | Closure Alternatives | | | |
|---|---|---|---|---|---|
| | | **Closure by Removal for Pond Re-use** | **Closure-in-Place with a Final Cover System** | **Consolidation & Closure-in-Place with a Final Cover System** | **Closure-in-Place with Insitu Stabilization/Solidification** |
| 845.710(b)(3)(E) | Available capacity and location of needed treatment, storage, and disposal services | The available capacity of disposal for 920,000 CY is expected to be difficult to obtain. The location for any disposal is unknown and would require contacting proper disposal facilities in the area to inquire about space availability. Based on the 2020 Landfill Capacity Report, Indian Creek Landfill No. 2 has capacity in excess of 35 million CY, but at this time it is unkown the existing contracted air space. | This closure alternative does not require treatment, storage, or disposal services. Any storage of materials would occur at the station | This closure alternative does not require treatment, storage, or disposal services. Any storage of materials would occur at the station | This alternative does not require any disposal or storage services. Any storage of materials would occur at the station. This alternative uses the ISS treatment technology performed by specialized contractors trained in this type of work. These contractors are specialized, however, there availability is not detrimental to the completion of this alternative. |
| 845.710(b)(4) | Degree to which community concerns are addressed | All the potential closure alternatives address the community concerns. The community is concerned about the potential for future groundwater contamination which is addressed by the closure alternatives. The groundwater monitoring through second quarter 2021 has shown that impacts are not present. | All the potential closure alternatives address the community concerns. The community is concerned about the potential for future groundwater contamination which is addressed by the closure alternatives. The installation of a FCS would prevent the infiltration of precipitation which would minimize contamination of groundwater from the remaining CCR. | All the potential closure alternatives address the community concerns. The community is concerned about the potential for future groundwater contamination which is addressed by the closure alternatives. The consolidation of CCR and installation of a FCS would prevent the infiltration of precipitation which would minimize contamination of groundwater from the remaining CCR. | All the potential closure alternatives address the community concerns. The community is concerned about the potential for future groundwater contamination which is addressed by the closure alternatives. The stabilization/solidification would prevent the infiltration of precipitation which would minimize contamination of groundwater from the remaining CCR. |
| 845.710(d)(4) | Assessment of Impacts to Waters in the State | This closure alternative does not impact the Des Plaines River or the station's intake channel. The groundwater modeling performed in support of this analysis has shown that any theoretical impacts to the river are reduced to less than 90% of the original concentration after 25 years. Existing groundwater monitoring through second quarter 2021 has shown that impacts in downgradient monitoring wells are not present or not associated with the FAB. | This closure alternative does not impact the Des Plaines River or the station's intake channel. Existing groundwater monitoring through second quarter 2021 has shown that impacts in downgradient monitoring wells are not present or not associated with the FAB. | This closure alternative does not impact the Des Plaines River or the station's intake channel. Existing groundwater monitoring through second quarter 2021 has shown that impacts in downgradient monitoring wells are not present or not associated with the FAB. | This closure alternative does not impact the Des Plaines River or the station's intake channel. Existing groundwater monitoring through second quarter 2021 has shown that impacts in downgradient monitoring wells are not present or not associated with the FAB. |

**Table 4: Closure Alternatives Analysis Cost Estimates Comparison**

**Scenario 1: Closure Costs for Closure By Removal & Disposal at Indian Creek Landfill**

| Construction Activity | Cost |
|---|---|
| Mobilization/Demobilization | $25,000 |
| Site Preparation | $60,025 |
| Dewatering | $206,294 |
| FAB North Excavation | $17,208,428 |
| FAB South Excavation | $8,698,775 |
| Indian Creek Landfill RDF Disposal | $42,323,176 |
| **Construction Subtotal** | $68,521,699 |

| | |
|---|---|
| Construction Management (4.5%) | $3,083,476 |
| Engineering & Design (10%) | $2,619,852 |
| Owner Construction Supervision (4.5%) | $3,083,476 |
| 30% Contingency | $20,556,510 |

| | |
|---|---|
| **CLOSURE TOTAL** | $97,865,013 |

**Scenario 2: Closure Costs for Closure in Place with a Final Cover System**

| Construction Activity | Cost |
|---|---|
| Mobilization/Demobilization | $25,000 |
| Site Preparation | $60,025 |
| Dewatering | $53,572 |
| FAB North & South Site Grading | $3,934,218 |
| ClosureTurf Cover System | $3,934,048 |
| North Embankment Construction | $1,972,160 |
| **Construction Subtotal** | $9,979,024 |

| | |
|---|---|
| Construction Management (4.5%) | $449,056 |
| Engineering & Design (10%) | $800,686 |
| Owner Construction Supervision (4.5%) | $360,309 |
| 30% Contingency | $2,993,707 |

| | |
|---|---|
| **CLOSURE TOTAL** | $14,582,783 |

**Scenario 3: Closure Costs for Closure in Place with Consolidation & Final Cover System**

| Construction Activity | Cost |
|---|---|
| Mobilization/Demobilization & Site Preparation | $1,019,837 |
| Dewatering | $128,330 |
| Dredging from North FAB | $1,446,000 |
| South FAB Fill | $383,575 |
| South FAB Final Cover System | $1,694,215 |
| Restoration | $2,738,008 |
| **Construction Subtotal** | $7,409,965 |

| | |
|---|---|
| Construction Management (4.5%) | $333,448 |
| Engineering & Design (10%) | $467,196 |
| Owner Construction Supervision (4.5%) | $333,448 |
| 30% Contingency | $2,222,989 |

| | |
|---|---|
| **CLOSURE TOTAL** | $10,767,047 |

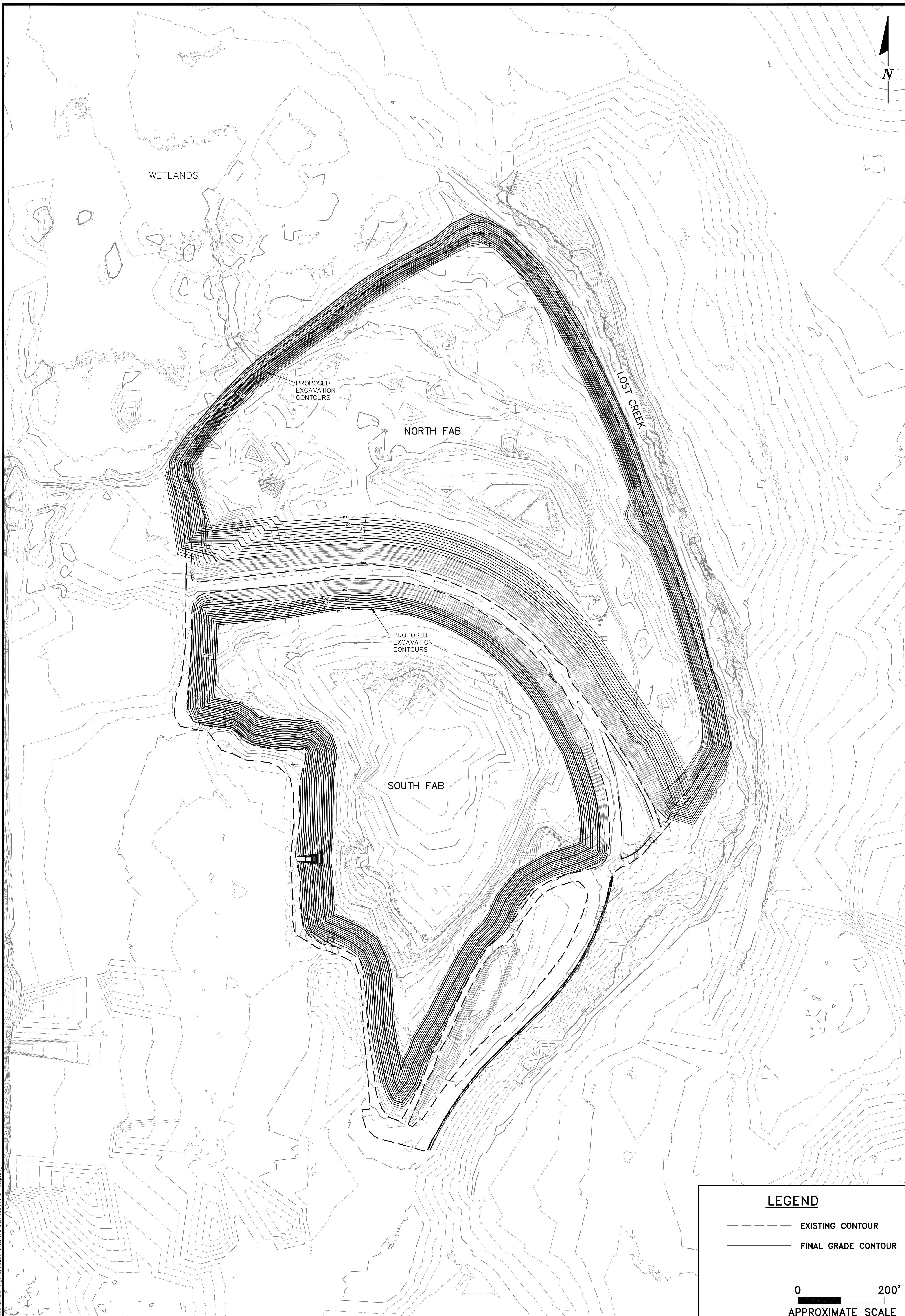
**Scenario 4: In-Situ Stabilzation with Soil Cover**

| Construction Activity | Cost |
|---|---|
| Mobilization/Demobilization & Site Preparation | $25,000 |
| Site Preparation | $12,761 |
| Dewatering | $7,129 |
| FAB North & South ISS | $58,821,578 |
| Soil Cover System | $904,555 |
| Discharge Structure & Drainage Piping | $282,440 |
| **Construction Subtotal** | $60,053,464 |

| | |
|---|---|
| Construction Management (4.5%) | $2,702,406 |
| Engineering & Design (10%) | $5,977,102 |
| Owner Construction Supervision (4.5%) | $2,702,406 |
| 30% Contingency | $18,016,039 |

| | |
|---|---|
| **CLOSURE TOTAL** | $89,451,417 |

# FIGURES




PRELIMINARY—FOR REVIEW ONLY

ENVIRONMENTAL CONSULTATION & REMEDIATION

KPRG

KPRG and Associates, inc.

14665 West Lisbon Road, Suite 1A Brookfield, Wisconsin 53005 Telephone 262-781-0475 Facsimile 262-781-0478

414 Plaza Drive, Suite 106 Westmont, Illinois 60559 Telephone 630-325-1300 Facsimile 630-325-1593

| | |
|---|---|
| CLOSURE BY REMOVAL SITE MAP | |
| FORMER ASH BASIN—POWERTON STATION<br>PEKIN, ILLINOIS | |
| Scale: 1" = 200' | Date: April 18, 2022 |
| KPRG Project No. 19620.1 | FIGURE 1 |

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PRELIMINARY—FOR REVIEW ONLY

ENVIRONMENTAL CONSULTATION & REMEDIATION

KPRG

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414 Plaza Drive, Suite 106 Westmont, Illinois 60559 Telephone 630-325-1300 Facsimile 630-325-1593

| | |
|---|---|
| CLOSURE IN PLACE ON NORTH & SOUTH FAB PORTIONS SITE MAP | |
| FORMER ASH BASIN—POWERTON STATION PEKIN, ILLINOIS | |
| Scale: 1" = 200' | Date: April 18, 2022 |
| KPRG Project No. 19620.1 | FIGURE 2 |


PRELIMINARY–FOR REVIEW ONLY

ENVIRONMENTAL CONSULTATION & REMEDIATION
KPRG
KPRG and Associates, inc.
14665 West Lisbon Road, Suite 1A Brookfield, Wisconsin 53005 Telephone 262-781-0475 Facsimile 262-781-0478
414 Plaza Drive, Suite 106 Westmont, Illinois 60559 Telephone 630-325-1300 Facsimile 630-325-1593

CLOSURE IN PLACE BY CONSOLIDATION WITH COVER SITE MAP

FORMER ASH BASIN–POWERTON STATION
PEKIN, ILLINOIS

| | |
|---|---|
| Scale: 1" = 200' | Date: April 18, 2022 |
| KPRG Project No. 19620.1 | FIGURE 3 |

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PRELIMINARY–FOR REVIEW ONLY

ENVIRONMENTAL CONSULTATION & REMEDIATION

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414 Plaza Drive, Suite 106 Westmont, Illinois 60559 Telephone 630-325-1300 Facsimile 630-325-1593

CLOSURE IN PLACE BY IN-SITU STABILIZATION WITH SOIL COVER SITE MAP

FORMER ASH BASIN–POWERTON STATION
PEKIN, ILLINOIS

| | |
|---|---|
| Scale: 1" = 200' | Date: April 18, 2022 |
| KPRG Project No. 19620.1 | FIGURE 4 |

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LEGEND

NON-SEASONAL CONTOURS

SEASONALITY CONTOURS

0 150'

APPROXIMATE SCALE

PRELIMINARY-FOR REVIEW ONLY

ENVIRONMENTAL CONSULTATION & REMEDIATION

KPRG

KPRG and Associates, inc.


14665 West Lisbon Road, Suite 1A Brookfield, Wisconsin 53005 Telephone 262-781-0475 Facsimile 262-781-0478

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CLOSURE SCENARIO 4 5-YEARS MODELING SEASONALITY TEST

FORMER ASH BASIN-POWERTON STATION PEKIN, ILLINOIS

Scale: 1" = 150' | Date: April 18, 2022

KPRG Project No. 19620.1 | FIGURE 5

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# ATTACHMENT 1

# Midwest Generation Groundwater Modeling Powerton

APRIL 2022

BAS GROUNDWATER CONSULTING

KPRG

ENVIRONMENTAL CONSULTATION & REMEDIATION

KPRG and Associates, Inc.

# Model Scenarios

DRAFT

- From the calibrated, steady-state flow system:
  - Mass concentration of "1" beneath FAB, run forward for 100 years. Move mass with advection and dispersion

  Model Scenarios:

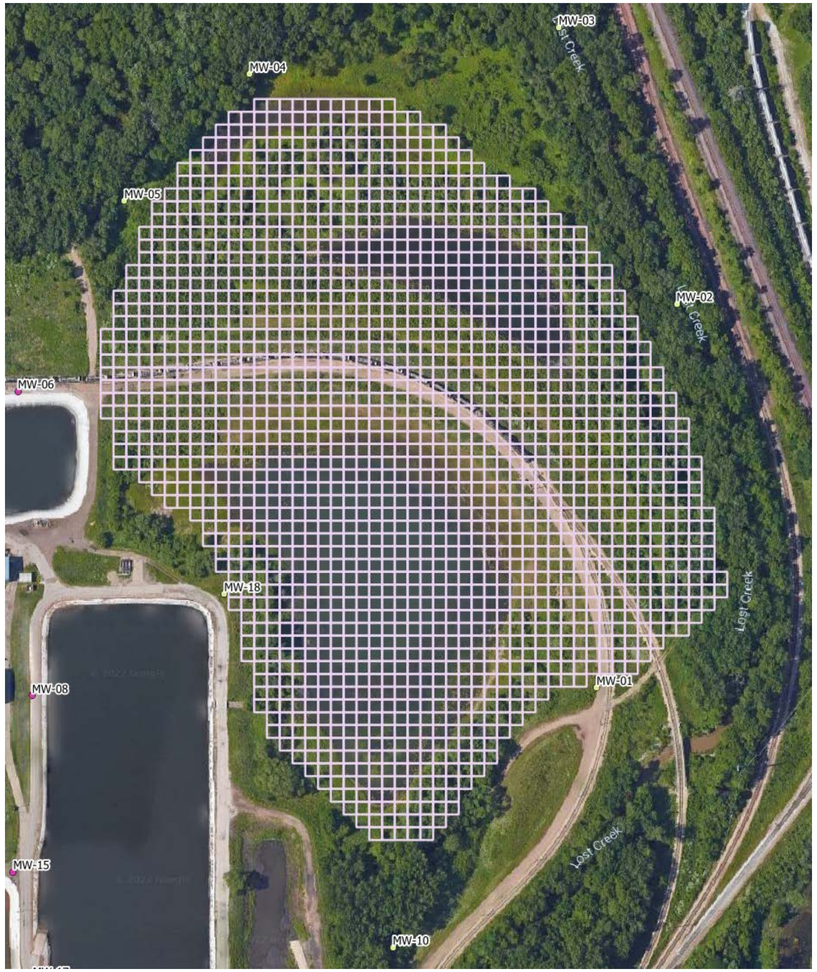
  - Use the distribution of mass concentration from year 100 in base run as the initial concentrations
  - Steady-state flow models

  1. Remove the mass, run for 100 years.
  2. Keep mass concentration of "1" in North and South FAB, remove flux (recharge) in pond area. Run for 100 years.
  3. Keep mass concentration of "1" in the Southern FAB and remove from the Northern FAB. Set flux (recharge) through northern pond to background recharge. Remove flux (recharge) in the southern pond area. Run for 100 years.
  4. Keep mass concentration of "1" in the northern and southern FAB but reduce Kv of layers 1&2 (~20 ft) in the FAB area to 1E-07 cm/s (2.83E-04 ft/d) and put in a Horizontal Flow Barrier (HFB) surrounding the FAB with K of 1E-07 cm/s (2.83E-04 ft/d) in layers 1&2. Remove flux (recharge) in the pond area. Run for 100 years.

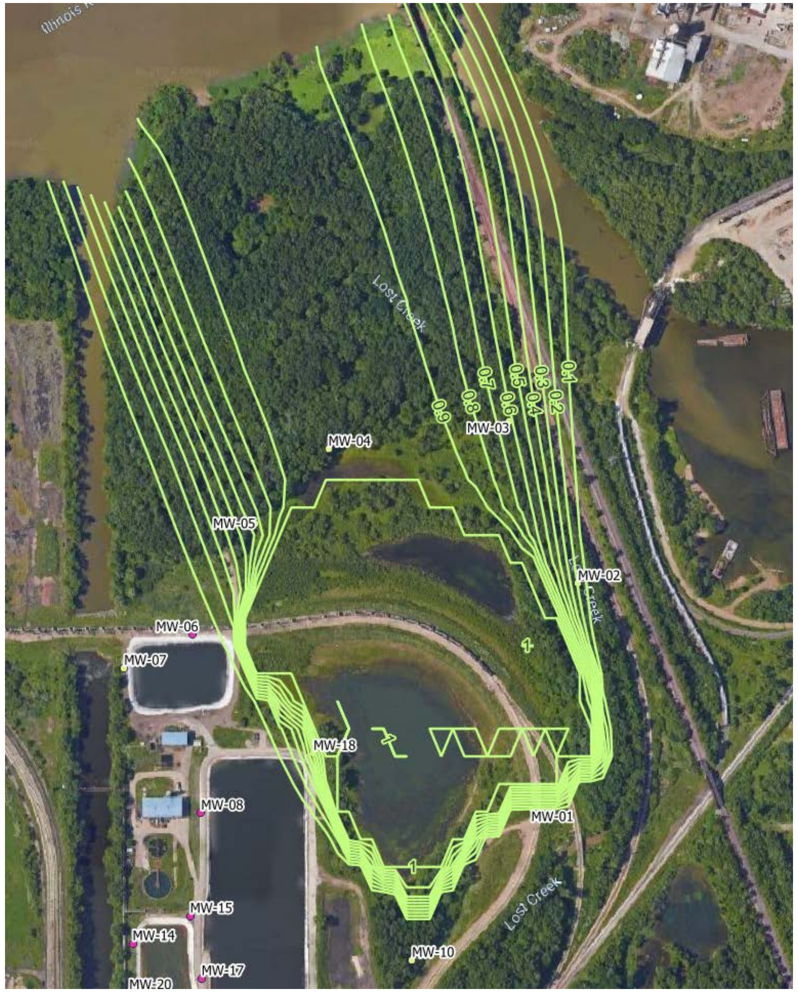
# Starting Concentrations

DRAFT

- Constant mass beneath FAB applied here:




- Resulting plume after 100 years



# Model Scenario #1

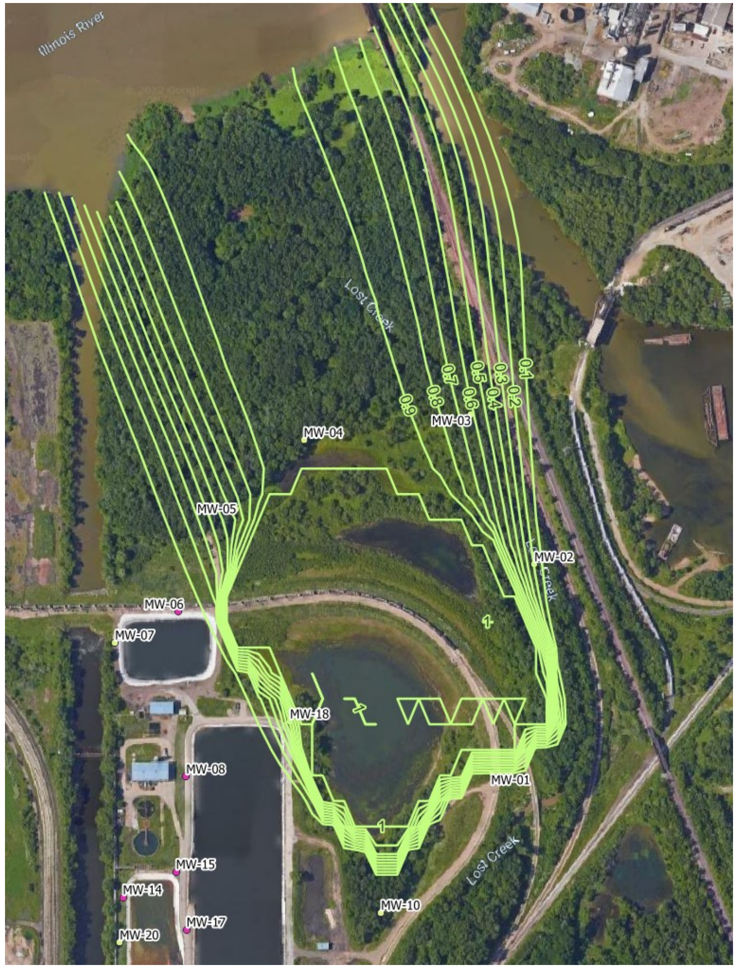
DRAFT

- Model Scenario 1
  - Use the distribution of mass concentration from year 100 in base run as the initial concentrations
  - Steady-state flow model
    1. Remove the mass, run for 100 years. *i.e.: if there were a continuous mass at FAB, that created an equilibrated (steady-state) plume from the pond toward the river – then remove that mass, how would concentrations change over time.*

# 5-year plume distribution

DRAFT

- Starting Conditions

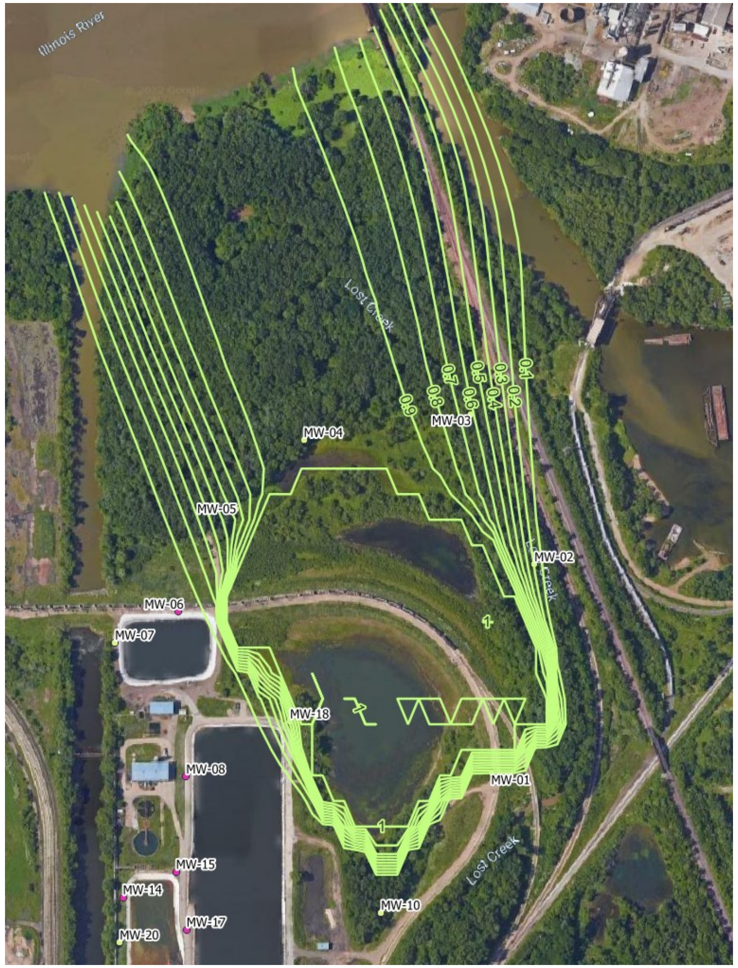



- 5 Years

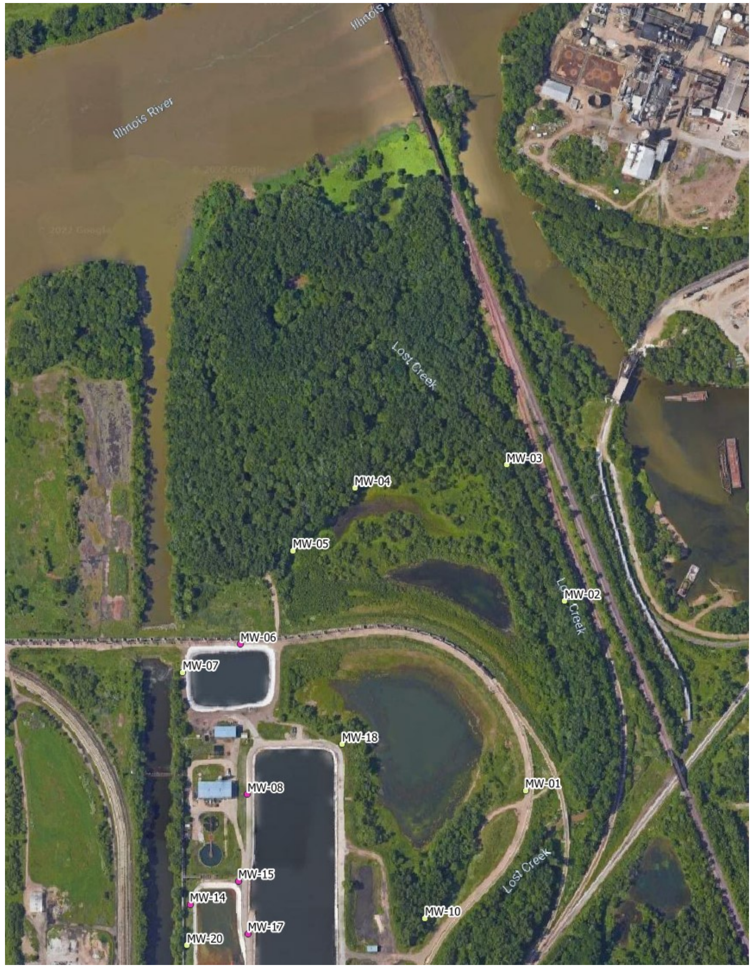
# 25+ year plume distribution

DRAFT

- Starting Conditions




- 25/50/100 Years

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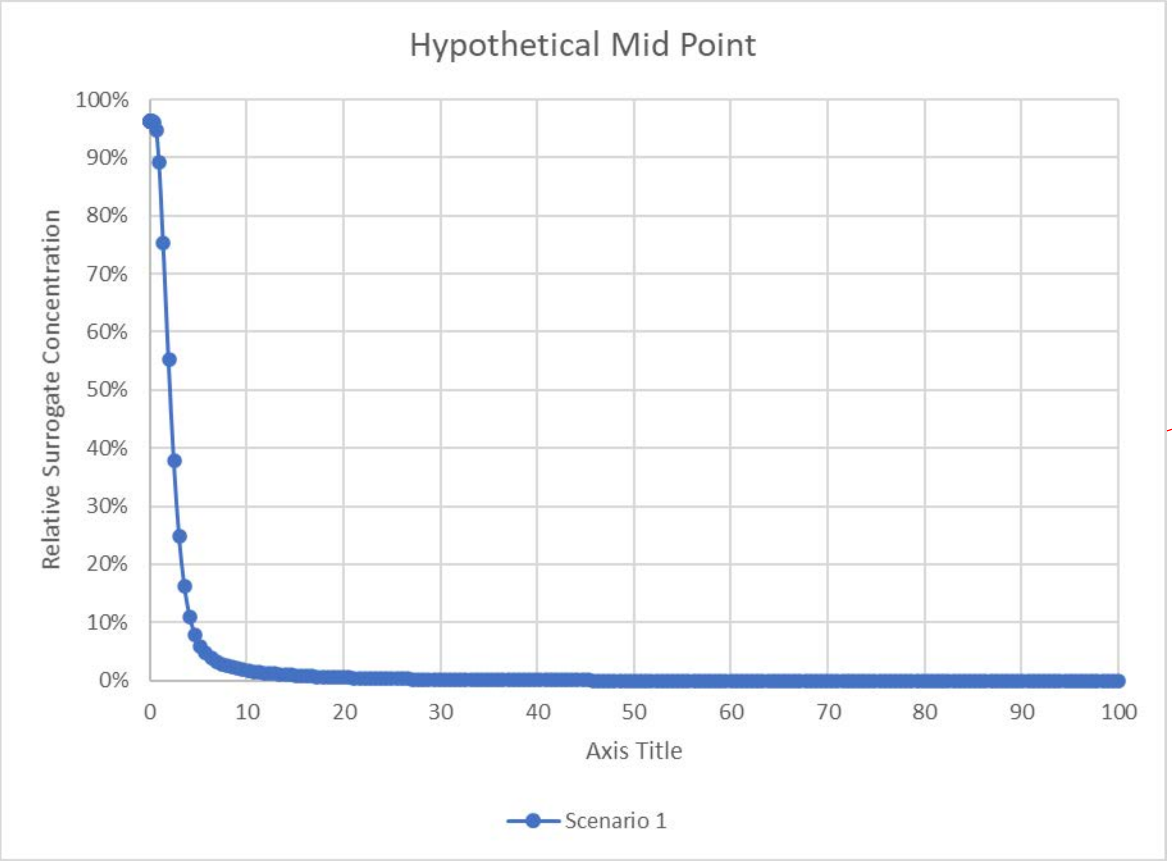
# Decay over Time

DRAFT




- Starting Conditions

# Model Scenario #2

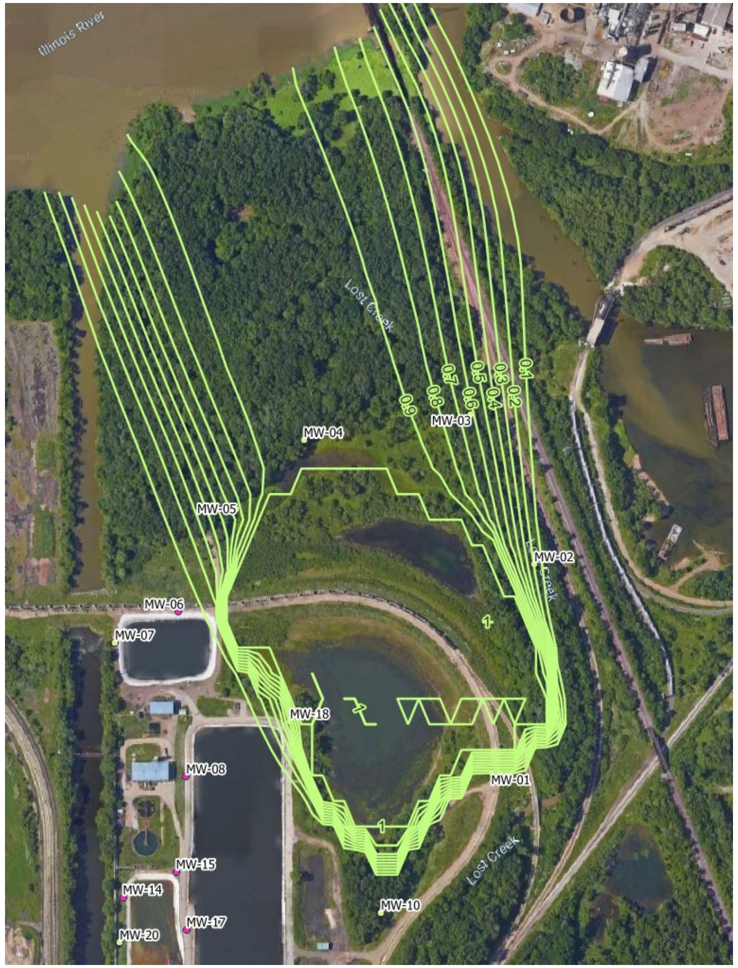
DRAFT

- Model Scenario 2
  - Use the distribution of mass from year 100 in base run as the initial concentrations
  - Steady-state flow model
    2. Keep mass in North and South FAB, remove flux in from both ponds. Run for 100 years.

# 5-year plume distribution

DRAFT

- Starting Conditions

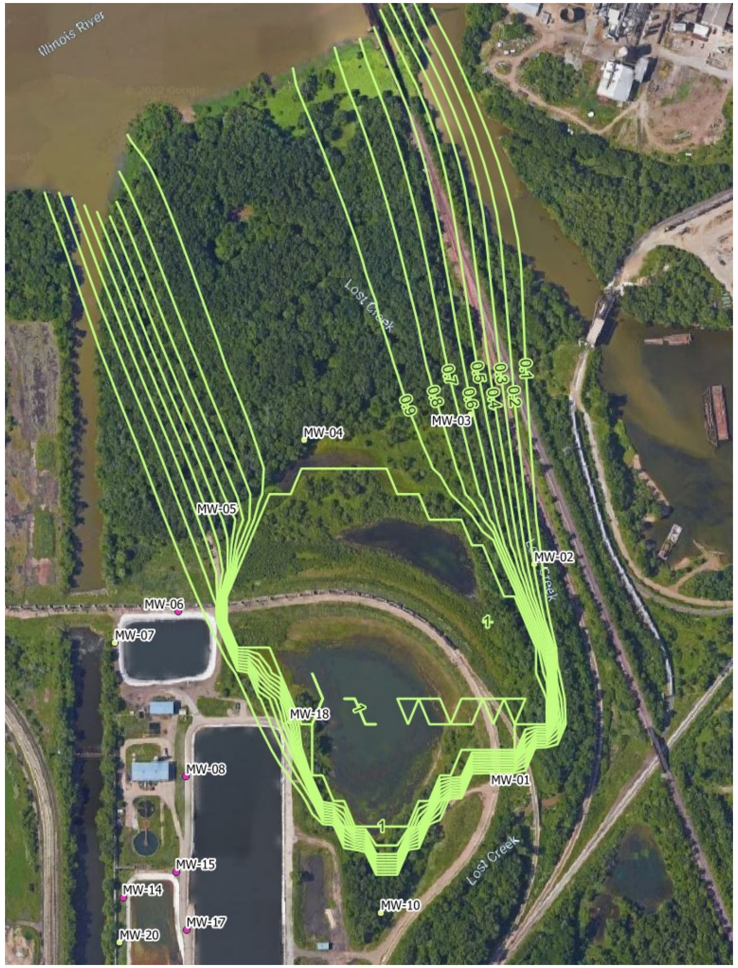



- 5 Years

# 25+ year plume distribution

DRAFT

- Starting Conditions

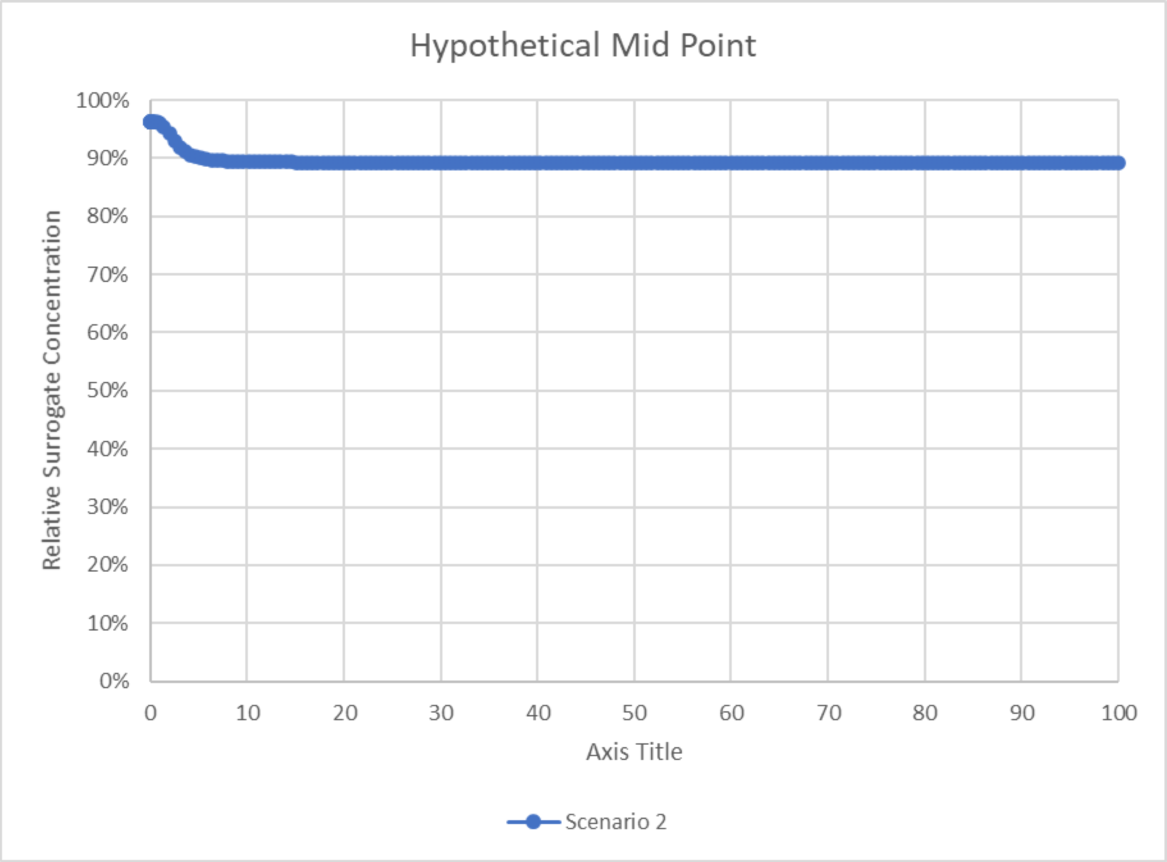



- 25/50/100 Years


*Concentrations reach steady state after 25 years*

# Decay over Time

DRAFT




- Starting Conditions

# Model Scenario #3

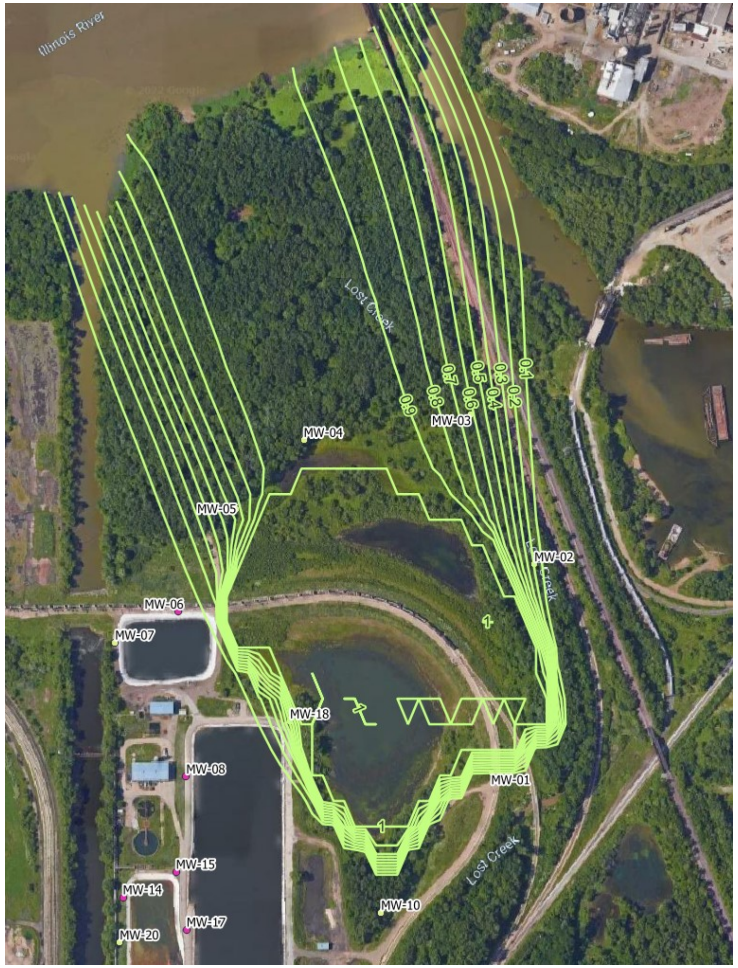
DRAFT

- Model Scenario 3
  - Use the distribution of mass from year 100 in base run as the initial concentrations
  - Steady-state flow model
    3. Keep mass concentration of “1” in the Southern FAB and remove from the Northern FAB (*see image*). Set flux in north pond area to background recharge. Remove flux (recharge) into south pond area. Run for 100 years.

# 5-year plume distribution

DRAFT

- Starting Conditions




- 5 Years

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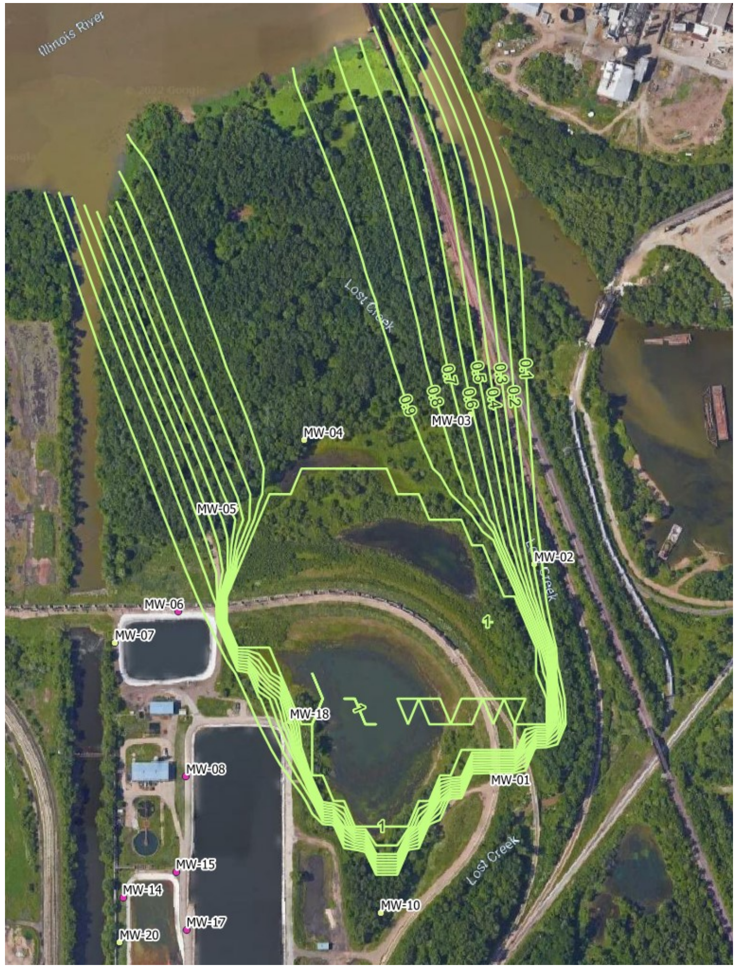
# 25+ year plume distribution

**DRAFT**

- Starting Conditions




- 25/50/100 Years


*Concentrations reach steady state after 25 years*

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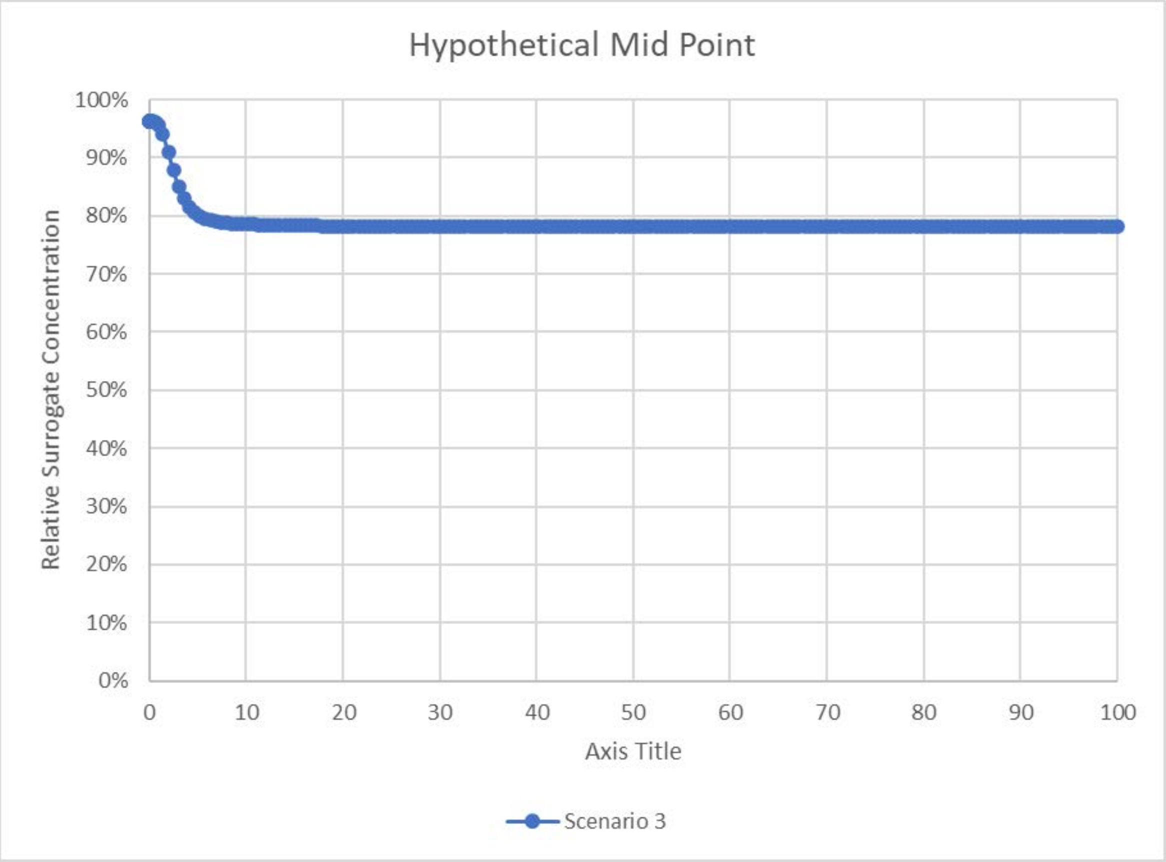
# Decay over Time

DRAFT




- Starting Conditions

# Model Scenario #4

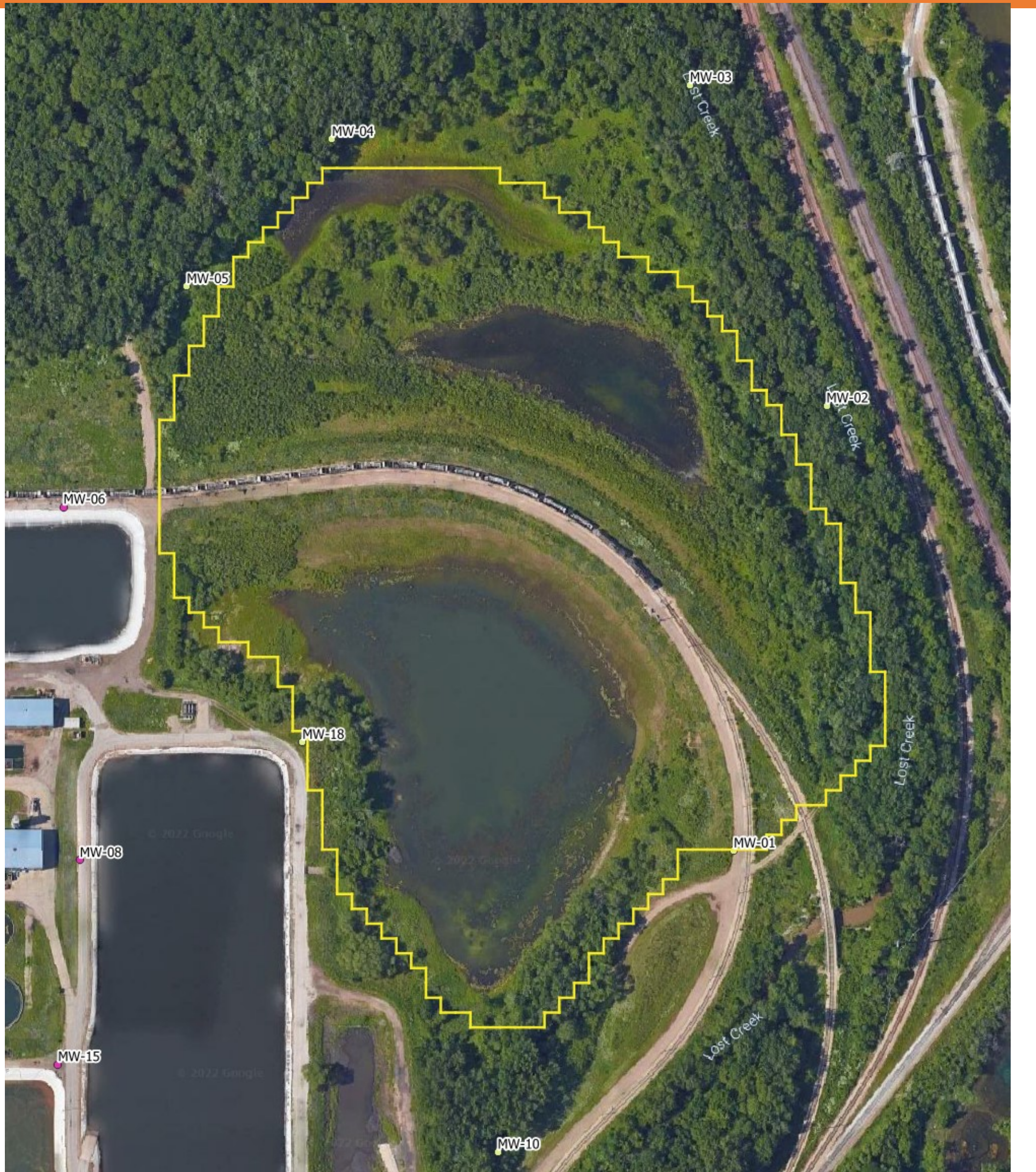
DRAFT

- Model Scenario 4
  - Use the distribution of mass from year 100 in base run as the initial concentrations
  - Steady-state flow model
    4. Keep mass concentration of “1” in the northern and southern FAB but reduce Kv of layers 1&2 (~20 ft) in the FAB area to 1E-07 cm/s (2.83E-04 ft/d), and put in a HFB surrounding the FAB with K of 1E-07 cm/s (2.83E-04 ft/d) in layers 1&2. Remove flux (recharge) through both ponds. Run for 100 years.

# Model Scenario #4

DRAFT

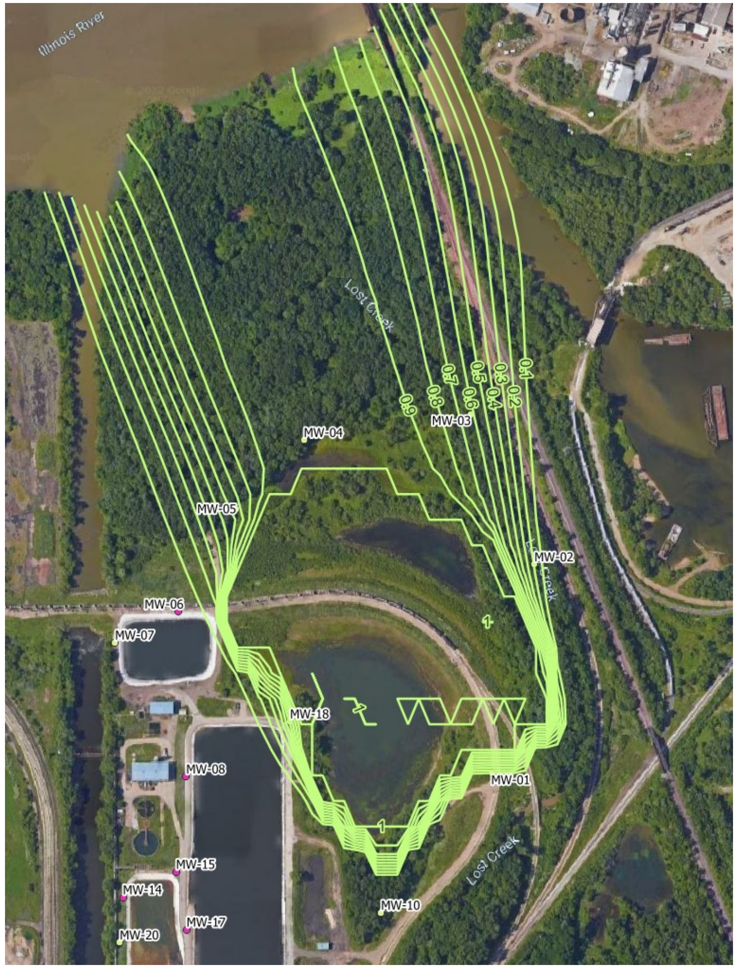
- Model Scenario 4
  - The HFB barrier wall was drawn around the entire footprint of the mass in the FAB, in model layers 1 & 2 (~20 feet deep).
  - The HFB was assigned a K of 1E-07 cm/s
  - Layers 1&2 were assigned a Kv of 1E-07 cm/s in this polygon area



# 5-year plume distribution

DRAFT

- Starting Conditions

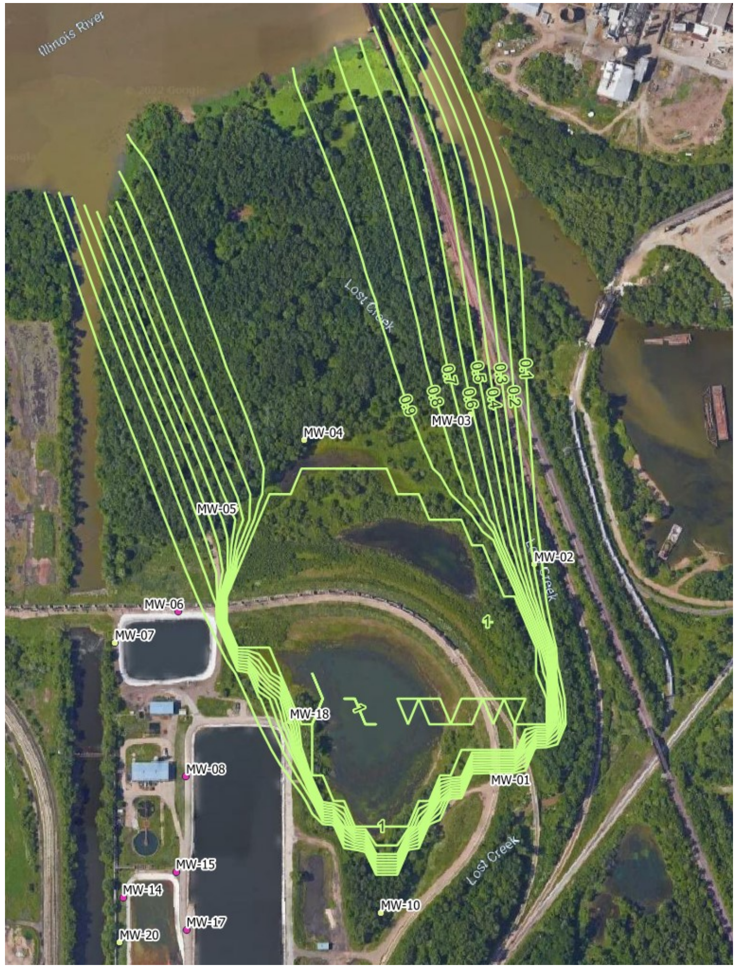



- 5 Years

# 25+ year plume distribution

DRAFT

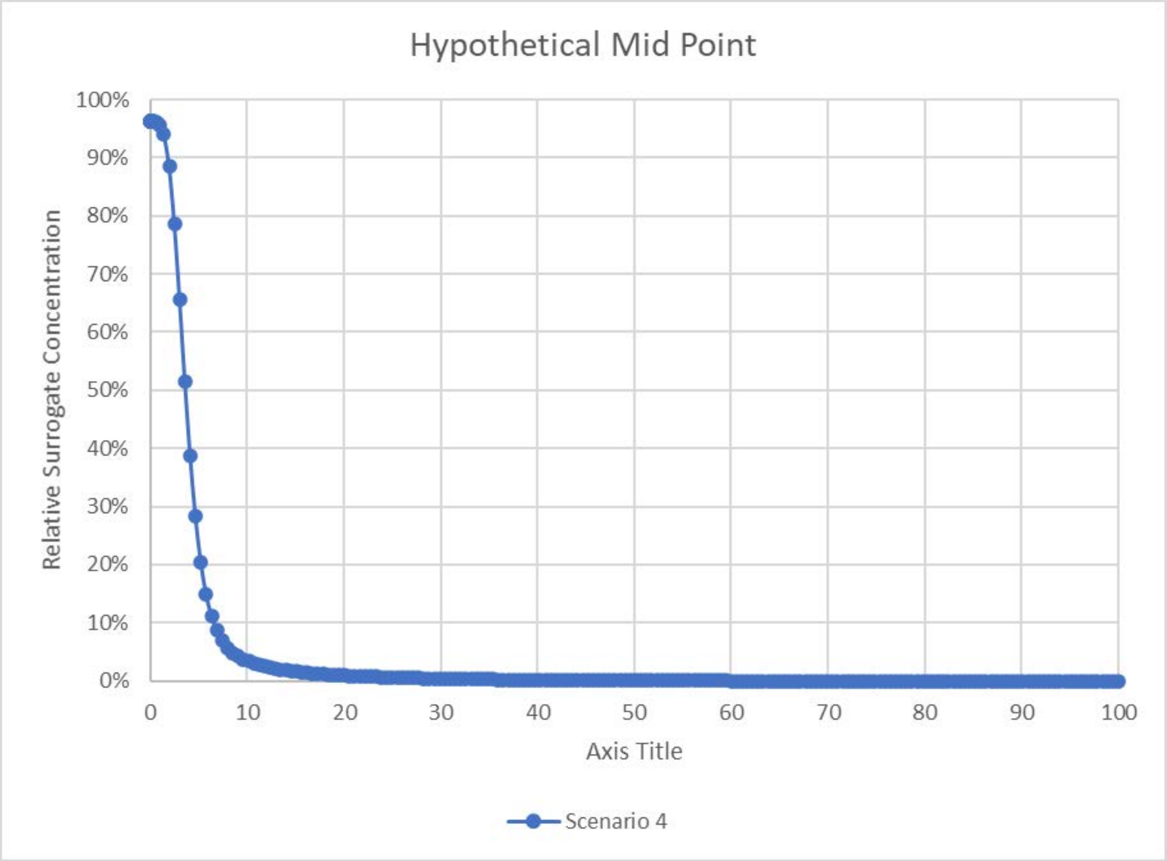
- Starting Conditions




- 25/50/100 Years

# Decay over Time

DRAFT




- Starting Conditions