Revised Groundwater Flow and Transport Modeling for Assessment of Remediation Status

Ameren Former MGP Site, Taylorville, Illinois

PREPARED FOR

Ameren

DATE
May 5 2026

REFERENCE
0724126



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1. INTRODUCTION

Ameren Services (Ameren) contracted with Environmental Resources Management (ERM) to conduct groundwater flow and solute transport modeling for the former manufactured gas plant (MGP) site located at 917 South Webster Street in Taylorville, Illinois (the Site), (Figure 1). Modeling was conducted to evaluate the influence of the 2023 in-situ stabilization / solidification (ISS) pilot study on the long-term need for groundwater extraction at the Site.

This is a revised Groundwater Flow and Transport Modeling for Assessment of Remediation Status report (the "revised report"), which incorporates comments received from the Illinois Environmental Protection Agency (IEPA). The initial groundwater flow and transport modeling report (ERM 2026) and associated model files were submitted to the IEPA on 10 February 2026, and the IEPA subsequently provided comments on 12 March 2026 (IEPA 2026). A conference call was held between IEPA, Ameren, and ERM on 20 March 2026 to review and discuss the IEPA's 12 March 2026 comment letter. Based upon the discussion on 20 March 2026, ERM submitted letter response to IEPA's comments on 10 April 2026 (ERM 2026a). A follow up conference call was held on 14 April 2026 with the IEPA, Ameren, and ERM to review ERM's response to IEPA's comment letter. The IEPA approved ERM's comment response letter via email on 16 April 2026.

Specifically, this revised report addresses IEPA's request to modify recharge applied to ISS model cells, as the application of recharge to very low-permeability ISS model cells resulted in locally increased simulated groundwater elevations. These elevated potentiometric surfaces were determined to be numerical artifacts associated with applied recharge rather than representative of Site conditions.

As discussed with IEPA on 20 March 2026, ERM's modeling approach is conservative, and the presence of this numerical artifact does not invalidate overall model conclusions. Nevertheless, recharge was removed from ISS areas in the final model to fully align with IEPA's comments as detailed further in Sections 1.3 and 3.1. Discussion with IEPA on 20 March 2026 further confirmed IEPA's acknowledgement that the ISS pilot study activities have been effective in mitigating constituent-of-concern (COC) mobility, thereby substantially reducing the potential for off-site advective migration. Under current Site conditions, IEPA has acknowledged that continued operation of the groundwater treatment system (GWTS) is no longer necessary as a remedial component to maintain protection of the environment.

1.1 PREVIOUS MODELING

Original numerical model files were developed by Barr Engineering (Barr) in 2015 (Barr 2015) using the MODFLOW-SURFACT framework to evaluate potential migration of COCs from the Site in response to long-term pumping and treatment (P&T) shutdown. The 2015 Barr modeling, which was based on soil concentrations remining on the Site after previous remediation efforts, indicated that long term (100+ years) P&T was required to hydraulically contain Site impacts. Based on the findings of the 2015 Barr model, Ameren evaluated alternative remedies to shorten P&T duration and ISS was selected as the remedial method to shorten P&T duration by remediation of residual COCs in groundwater from the former MGP at the Site.

1.2 ISS PILOT STUDY

The 2023 ISS pilot study was conducted to determine if ISS was a feasible remedial alternative. ISS involves the mixing of soil with a pozzolanic agent such as cement, which results in an in-situ solidified/stabilized mass with greatly reduced leaching for residual COCs to groundwater from the former MGP at the Site. The ISS pilot study activities as detailed in the Pilot Study Report (ERM 2025) demonstrated that the leaching of COCs from soils to groundwater was reduced. Therefore, the potential for off-site migration of impacted groundwater has been minimized, with models suggesting that hydraulic containment through groundwater pumping is no longer necessary and that the re-establishment of natural flow conditions after the termination of containment pumping will not result in off-site impact.

1.3 UPDATED MODELING

This report presents ERM's modeling assessment which included review and repurposing of the original Barr 2015 numerical groundwater flow and solute transport model files. For this 2025 modeling effort, ERM simulated the termination of pumping at the Site and thereby the resumption of ambient regional groundwater flow conditions at the Site in response to the ISS pilot study activities. The updated model was used for a predictive simulation reflective of simulating dissolved phase plume movement presented at current, 5–year, 15–year, and 30–year time snapshots (representing 2024, 2029, 2039, and 2054). ERM's updates to the previous Barr model included the addition the following data:

- Reduced hydraulic conductivity at pilot study ISS columns, which was obtained from ISS performance sampling quality control samples (ERM 2025);
- Removed applied recharge at ISS model cells to align with IEPA 12 March 2026 comment discussed above. Additionally, as-built conditions for the drilling platform in Areas 2 and 3, where the ISS pilot study was implemented, a SKAPS CT-160 non-woven geotextile liner and an Orb-Weave 24 Mil high-density polyethylene (HDPE) geomembrane liner was placed as a continuous sheet to physically separate backfilled materials. The liner was topped with approximately 1 foot of compacted CA-6 stone aggregate effectively diverting precipitation from interfacing with the ISS application, as shown in Figure 2 (ERM 2026b);
- Baseline groundwater COC mass from groundwater analytical data obtained from the Q4 2023 groundwater monitoring event, representing conditions after the pilot study ISS columns were implemented;
- Groundwater elevation from gauging data obtained from the Site extraction well and monitoring wells in January 2024;
- Groundwater analytical data from ISS performance groundwater monitoring well data collected bi-weekly from July 2023 through May 2024 to verify fate and transport parameters (ERM 2026b); and
- Updated the carbon-water partition coefficient (Koc) for benzene to 0.0589 m^3/kg to calculate an accurate distribution coefficient (Kd) for transport simulations.

2. INITIAL GROUNDWATER CONCENTRATION AND COC SELECTION

2.1 COCS AND COMPARISON STANDARD SELECTION

The COCs evaluated with this model include known or suspected COCs that have been detected in Site groundwater and represent compounds that have a variety of degradation and transport properties.

The COCs included in the groundwater flow model include benzene, naphthalene, and benzo(a)anthracene (B(a)A). Benzo(a)pyrene (B(a)P) was also considered for inclusion in the groundwater flow model. However, due to the low solubility of this constituent in groundwater, which is approximately one order of magnitude lower than B(a)A, and lack of B(a)P detections in any on-site groundwater monitoring wells with the exception of GW-4R, B(a)P was not included as a COC for this model.

During the 2023 ISS pilot study, IEPA requested future clean up objectives (CUOs) for any alternative remediation method, requiring amendment of the 1992 ROD CUOS to the IEPA Groundwater Quality Standards listed in Illinois Administrative Code (IAC) Title 35 Part 620 (Part 620). Therefore, IEPA Part 620 groundwater standards amended April 11, 2025, are used for compliance comparison in this groundwater model.

2.2 INITIAL PLUME GENERATION

Initial groundwater plume concentrations were obtained from analytical data collected during the Q4 2023 groundwater monitoring event for the three COCs listed above (ERM 2023). The COC groundwater plume distributions were managed using the Leapfrog software interface aligning analytical data in three-dimensional (3D) space before porting to the numerical modeling interface. Leapfrog software uses kriging (a geostatistical interpolation method) to estimate the spatial distribution of COCs based on sampled data, creating a smooth, continuous 3D representation of the plume that reflects both the data values and their spatial relationships. It should be noted analytical results from unfiltered samples collected at monitoring well GW-20 historically contain detections of B(a)A and B(a)P which reflect suspended sediment rather than dissolved phase groundwater related to the Site. As a result, the analytical data from GW-20 were not considered in the generation of the initial groundwater plume.

3. GROUNDWATER FLOW AND TRANSPORT OVERVIEW

Previous groundwater flow and transport was simulated within the MODFLOW-SURFACT environment (HydroGeoLogic Inc. 1996, Barr 2015). Updated groundwater flow was simulated using MODFLOW-NWT (Niswonger et al 2011), and COC transport with MT3DMS (Zheng and Wang 1999).

Model construction consists of 10 layers representing Site geology, model properties, and Site boundary conditions, and are discussed in *Groundwater Modeling Summary Report – Former CIPS MGP SITE, Taylorville, Illinois* (Barr 2015). Layer development was assessed during review of the model, which included the inclusion of any new and relevant data obtained after the post-2015 modeling conducted by Barr. Site boundary conditions consisted of active west extraction well simulation, precipitation as recharge, and multiple river and constant head boundary cells. The 2015 Barr report also states model calibration as being satisfactory, which was the basis for ERM's decision to use this model.

3.1 ISS COLUMN REPRESENTATION

Hydraulic conductivity and bulk density were updated to reflect the location and depth of pilot study areas. Table 1 summarizes laboratory analytical results where hydraulic conductivity and bulk density values represent averages based on performance sample results collected during the ISS pilot study for permeability and grout density testing. Porosity was set to represent the decreased effective porosity in solidified soils. Detailed properties are presented in ERM (2025). As previously discussed, applied modeled recharge was removed from ISS model cells where hydraulic conductivity values were reduced to be reflective of field-applied ISS locations (Figure 2). The IEPA 12 March 2026 Response Letter to Groundwater Flow and Transport Modeling Assessment of Remediation Status and the ERM 10 April 2026 Response to IEPA Comment Letter are included in Appendix A and B, respectively.

Barr (2015) used a bulk density of 1,800 kg/m^3 for native soil across the model domain, which exceeds the bulk density of the ISS columns. ERM modified the native soil bulk density to a decreased bulk density of 1,200 kg/m^3. Decreasing the bulk density allows water and COCs to transport more readily, resulting in more conservative model results.

TABLE 1 PILOT STUDY COLUMN AND NATIVE SOIL PROPERTIES

Soil Type	Hydraulic Conductivity (m/day)	Bulk Density (kg/m^3)	Porosity
Pilot Study Column	0.00051	1,418	0.05
Native Soil	20.0	1,200	0.30

Note: m/day – meters per day; kg/m^3 – kilograms per cubic meter.

4. FLOW MODEL VERIFICATION

Model verification was completed to ensure any adjustments by ERM did not impact functionality and resulting predictions of flow and transport. Verification was completed using a total of 22 groundwater elevation measurements collected from onsite and offsite monitoring wells on 26 January 2024 and the average daily groundwater recovery rate of 33 gallons per minute (gpm) observed during January 2024 at the currently active west extraction well. Resulting calibration statistics showed a Normalized Root Mean Square Error (NRMSE) of 9.9 percent, within industry accepted standards, a maximum mass balance discrepancy of 0.02 percent and a low mean residual error of 0.56 feet. Simulated groundwater contours are shown on Figure 3. For comparison, the original simulated groundwater contours are shown in the Barr 2015 report. A verification scatter plot is depicted in Figure 4.

Based on this model, using field measured groundwater elevations, simulated water levels are reflective of groundwater conditions. Groundwater flow direction is also consistent with current measured field conditions, with flow from the Site generally south, as shown on Figure 3. The representation of groundwater flow conditions is critical and provides confidence that predictive COC transport will be accurate.

5. FATE AND TRANSPORT

As noted above, COC fate and transport was simulated using MT3DMS (Zheng and Wang 1999). Fate and transport parameters were derived from prior modeling efforts (Barr 2015) and subsequently adjusted with pilot study performance groundwater monitoring analytical data obtained bi-weekly from July 2023 through May 2024.

Chemical parameters for the modeled COCs are noted in Table 2.

TABLE 2 TRANSPORT PARAMETERS

COC	[2]K_d [m^3/kg]	[3]Half Life [days]
Benzene	[1]0.00024	[1]150
Naphthalene	[1]0.002	[1]400
B(a)A	0.715	269

Note: m^3/kg – cubic meters per kilogram; [1]values adjusted to reflect historical monitoring data; [2]$K_d = K_{oc} * f_{oc}$ where K_{oc} is organic carbon water partition coefficient and f_{oc} is fraction of organic carbon. f_{oc} was estimated to be 0.004 through calibration. [3]Half life represents the time required for a COC concentration to reduce to half of its initial value.

6. SOLUTE TRANSPORT SIMULATION AND RESULTS

Using the updated model with initialized dissolved-phase groundwater concentration distributions for benzene, naphthalene, and B(a)A, fate and transport simulations were performed to assess COC migration following pumping cessation considering reduced hydraulic conductivity in the areas of ISS columns installed during the 2023 pilot study.

6.1 GROUNDWATER TRANSPORT SIMULATION RESULTS

The resulting initial plume footprints are shown in Figures 5 through 7. Each footprint represents a composite of concentrations across all model layers, providing a combined depiction of COC distribution that can be compared against IEPA Part 620 standards.

Figures 5 through 7 illustrate the current and predicted COC movement in groundwater at the Site over time intervals of current conditions, 5 years, 15 years, and 30 years (2024, 2029, 2039, and 2054). Model results quantify a reduction in simulated benzene mass of approximately 93.7 percent within five years following ISS implementation. Naphthalene concentrations decrease by approximately 45 percent, with limited localized migration simulated along the southeastern margin of ISS model cells. Both benzene and naphthalene are predicted to be below the applicable IEPA Part 620 Groundwater Quality Standards within five years post-ISS. BaA is not predicted to decrease appreciably in mass due to its relatively immobile and stable nature; however, modeled transport indicates minimal to no downgradient migration.

7. MODEL LIMITATIONS

A groundwater model is a simplified representation of a complex physical system, developed for a specific purpose. It is constructed using data—often collected and interpreted by third parties—along with the prevailing conceptual understanding of subsurface conditions and professional judgment applied by the modeling team. Given the inherent limitations of available data and the non-unique nature of model development, multiple plausible interpretations may exist. As a result, a degree of uncertainty is inherent in constructing a complex, multi-layer numerical flow and solute transport model intended to predict system responses to specific actions within a defined geographic area. The following outlines key limitations and uncertainties associated with this modeling effort:

- The model aims to represent bulk groundwater flow where local scale complexities cannot realistically be simulated.
- Spatial and temporal plume distributions are limited to monitoring data. Concentrations residing between monitoring points are estimated via interpolation. Plume interpolation is conservative and overestimates concentration magnitude and extent.

ERM has high confidence in this model for a variety of reasons, including:

- ERM used an existing model that has previously accurately modeled Site flow and transport conditions.
- ERM conducted a Pre-Remedial Delineation Investigation (PRDI) in 2022 as reported in the *Pre-Remedial Delineation Investigation Report*, dated 2023 (ERM 2023a) to accurately define the presence, concentration, and distribution of subsurface soil impacts.
- The PRDI also provided subsurface hydrogeologic and analytical information for which the model simulates.
- Verification modeling successfully replicated groundwater elevations and COC distribution within accepted model parameters.

Continued post-pilot study groundwater sampling from monitoring wells immediately downgradient of the Site is continuing to support model results.

8. CONCLUSIONS

ERM updated the 2015 Barr numerical groundwater flow and transport model to evaluate the impacts of the ISS pilot study activities completed in 2023 and the potential cessation of continued Site groundwater extraction. The model incorporated updated measurements from the ISS pilot study columns QA/QC samples, June 2024 groundwater elevation data, analytical groundwater data obtained during 2023 fourth quarter groundwater sampling, and groundwater performance monitoring analytical data collected bi-weekly from July 2023 through May 2024.

ERM developed dissolved phase initial COC distributions to simulate fate and transport over time, with model outputs representing current conditions and projections at 5-year, 15-year, and 30-year intervals (2024, 2029, 2039, and 2054).

Groundwater modeling of the Site indicated that the ISS pilot study had a significant impact on the expected remaining duration of remedial activities. The 2015 Barr model indicated that pumping would be needed for over 100 years for hydraulic containment and achievement of the ROD standards at the Site. The updated model simulations indicate the completion of the ISS pilot columns immediately eliminated the need for operation of the P&T at the Site due to the following findings from the simulations:

- Benzene was not observed to migrate from Ameren property in the updated model simulations.
- Simulated benzene and naphthalene concentrations degrade on Ameren property within 5 years, leaving limited impacts above Part 620 standards, on-site east of pilot study columns.
- B(a)A does not show migration and remains in-place as shown on Figure 7.

In conclusion, this updated modeling indicates that ISS pilot study activities were effective for limiting the migration of COCs from the Site and continued operation of the GWTS is unnecessary for continued protection of the environment. Model results have been confirmed from the end of the pilot study (end of 2023) to date through quarterly groundwater monitoring events from monitoring wells immediately downgradient of the Site.

9. RECOMMENDATIONS

The modeling results, together with Site-specific remedial performance and Site data, support the conclusion that a stable analytical and groundwater environment have been achieved and that the GWTS operation is no longer an integral part of Site remedial needs. Therefore, ERM, on behalf of Ameren, is requesting to cease GWTS operation in order to assess non-pumping conditions of the groundwater aquifer at the Site for the remainder of 2026 through the end of 2028.

During the proposed timeframe that the GWTS will be idled in place, Ameren will continue quarterly groundwater monitoring. Groundwater reports will be prepared and submitted to IEPA, as they have been in the past. Potential downgradient groundwater impacts, if any, will be immediately verified by resampling. Variations in groundwater conditions will be identified and reported to IEPA in Ameren's quarterly groundwater monitoring reports. If groundwater sample results suggest adverse deviation from Ameren's 2025 modeled predictions, Ameren will evaluate alternative controls in consultation with IEPA, which may include GWTS operation. If groundwater conditions remain stable through the end of 2028, ERM proposes to continue idling the GWTS and evaluate next steps with the IEPA during the next Five-Year Review (June 2029).

10. REFERENCES

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ERM

EXTERNAL FIGURES

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Legend **Legend**

- Monitoring Well Location
- Monitoring Well Location (Abandoned)
- Extraction Well Location
- Extraction Well (Abandoned)
- Site Boundary
- Parent Parcel Boundary

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0 30 60 120

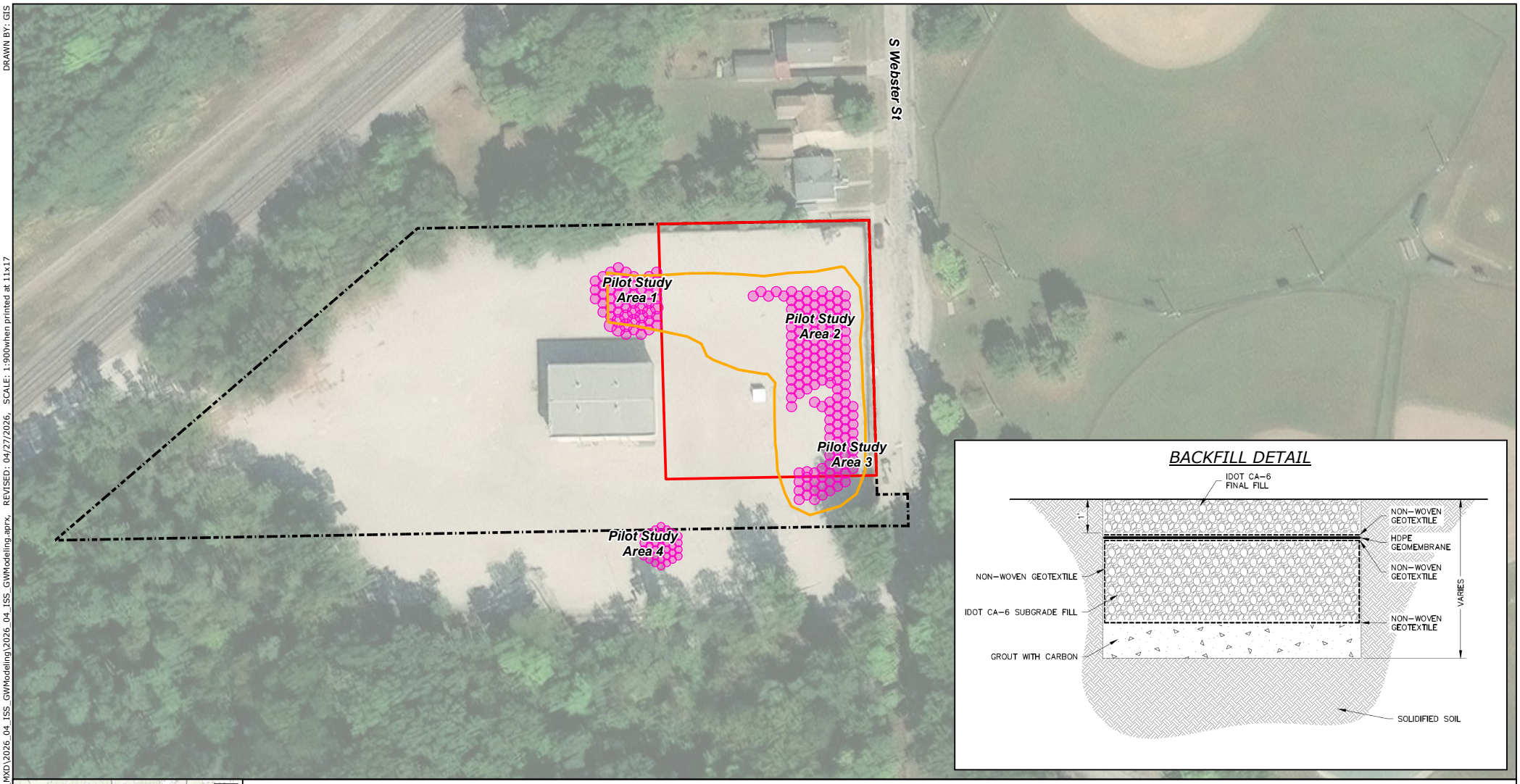
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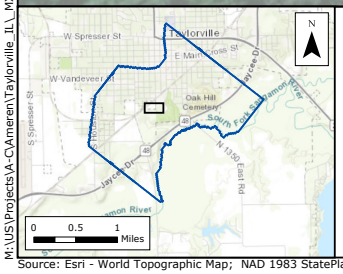
Figure 1
Site Location Map
Ameren Taylorville
Former MGP Site
Ameren Services
Taylorville, Illinois

ERM

Source: Esri - World Topoographic Map; NAD 1983 StatePlane Illinois West FIPS 1202 Feet

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Source: Esri - World Topographic Map; NAD 1983 StatePlane Illinois West FIPS 1202 Feet

Legend

- Active Numerical Flow and Transport Model Domain
- Backfilled Drilling Platform Area
- ISS Area
- Site Boundary
- Parent Parcel Boundary

Notes:
Backfill detail described in Environmental Resources Management, Inc. Site Restoration Report, Ameren Taylorville MGP Site, Taylorville, Illinois. 2026.

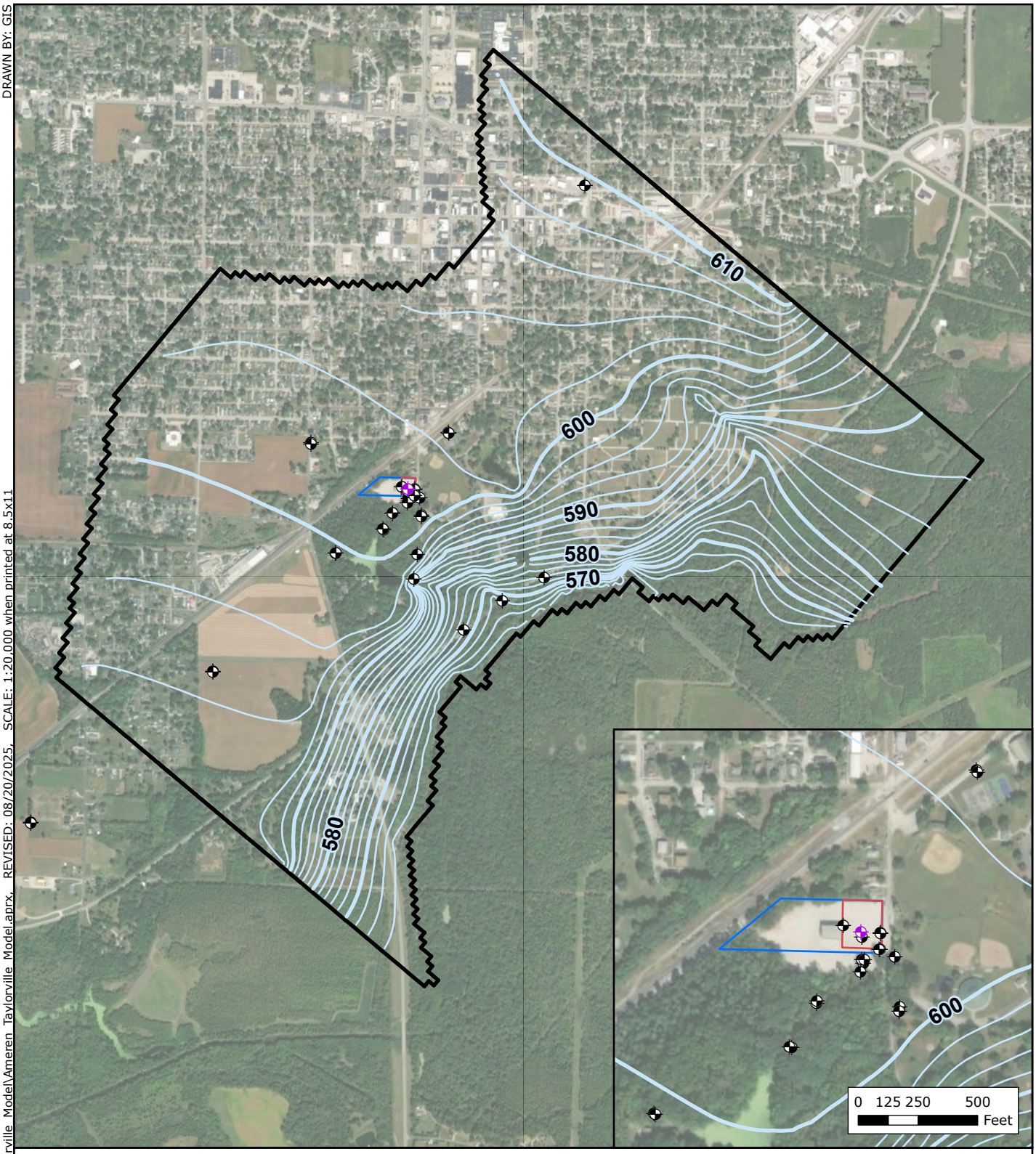
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Figure 2
Backfill Detail at ISS Locations
Ameren Taylorville
Former MGP Site
Ameren Services
Taylorville, Illinois

ERM



Legend

- Extraction Well
- Monitoring Well
- Model Grid Outline
- Site Boundary
- Parent Parcel
- Simulated Water Level Contours (10 ft)
- Simulated Water Level Contours (2 ft)

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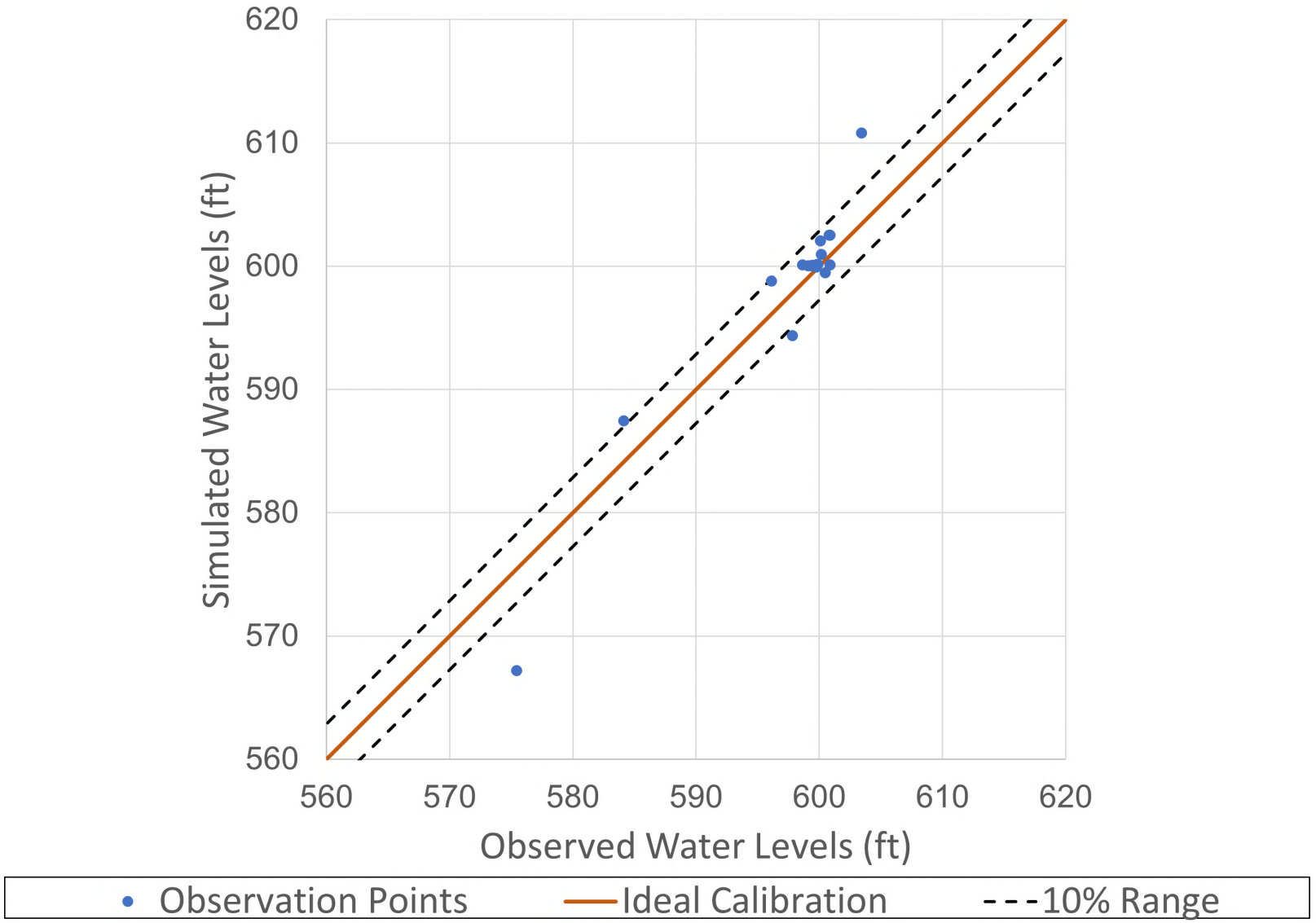
Figure 3
Simulated Groundwater Contours
Ameren Taylorville
Former MGP Ste
Ameren Services
Taylorville, Illinois

ERM

Source: Esri - World Topoographic Map; NAD 1983 UTM Zone 16N

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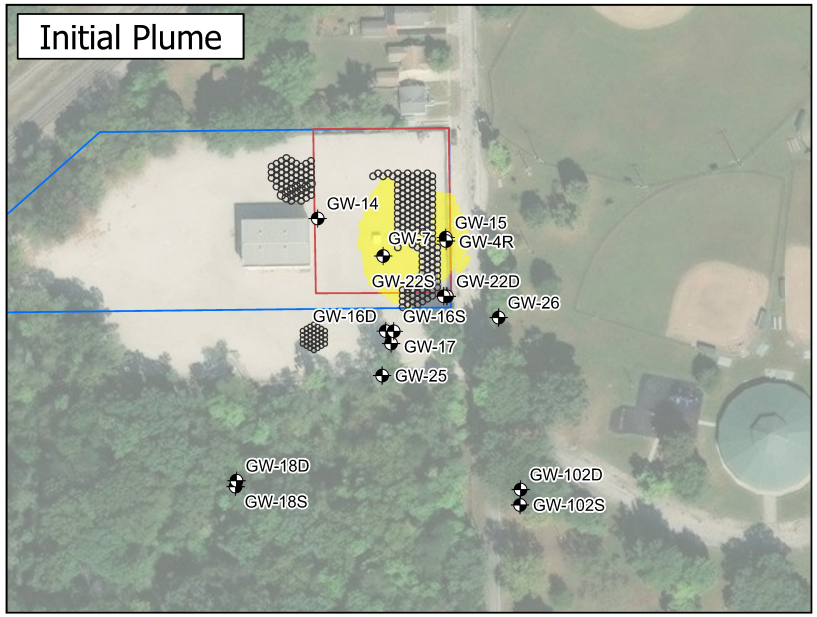


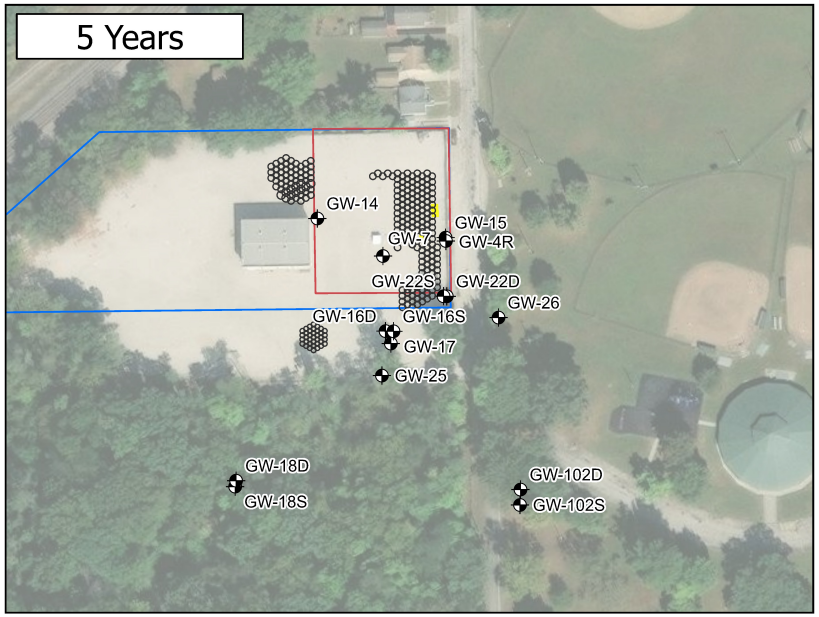
Notes:
Observation points represent January 2024 water levels.

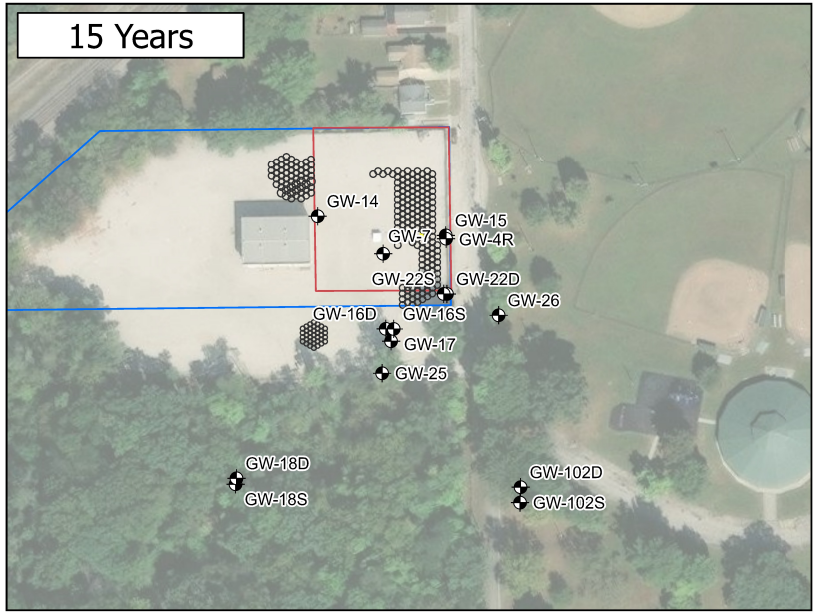
Figure 4
Model Verification Scatter Plot
Ameren Taylorville
Former MGP Site
Ameren Services
Taylorville, Illinois

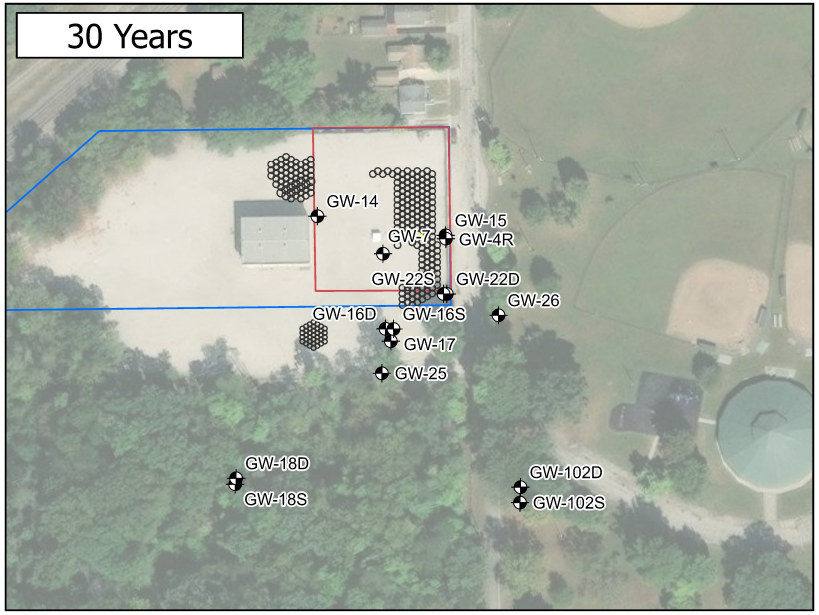
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Legend

- Monitoring Well
- Benzene Plume Extent (5 ug/L)
- ISS Columns
- Site Boundary
- Parent Parcel

Notes:
ug/L = micrograms per liter

IEPA Part 620 Groundwater Standards for Benzene = 5 ug/L

Plume extent represents combination of maximum concentrations in all model layers

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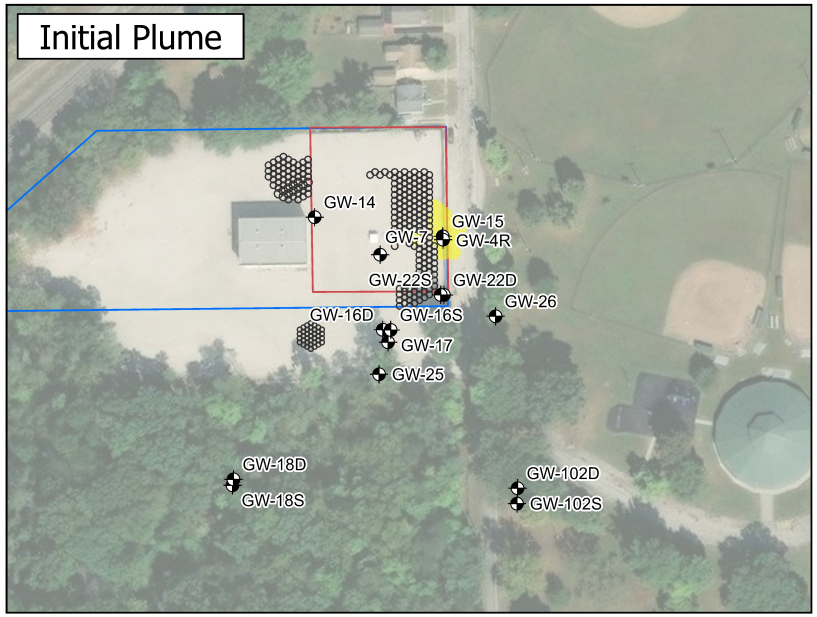
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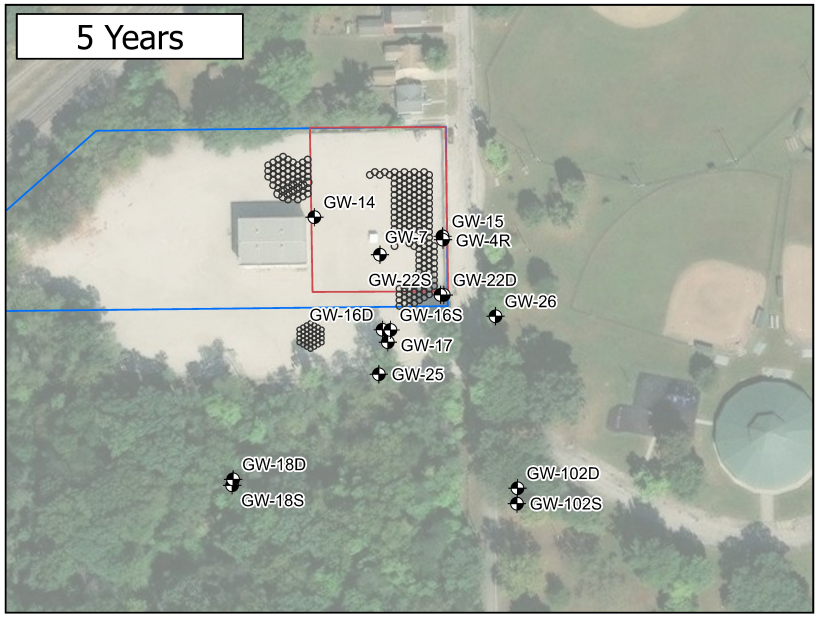
Figure 5
Pilot Study ISS Application without Groundwater Pumping: Benzene
Ameren Taylorville
Former MGP Site
Ameren Services
Taylorville, Illinois

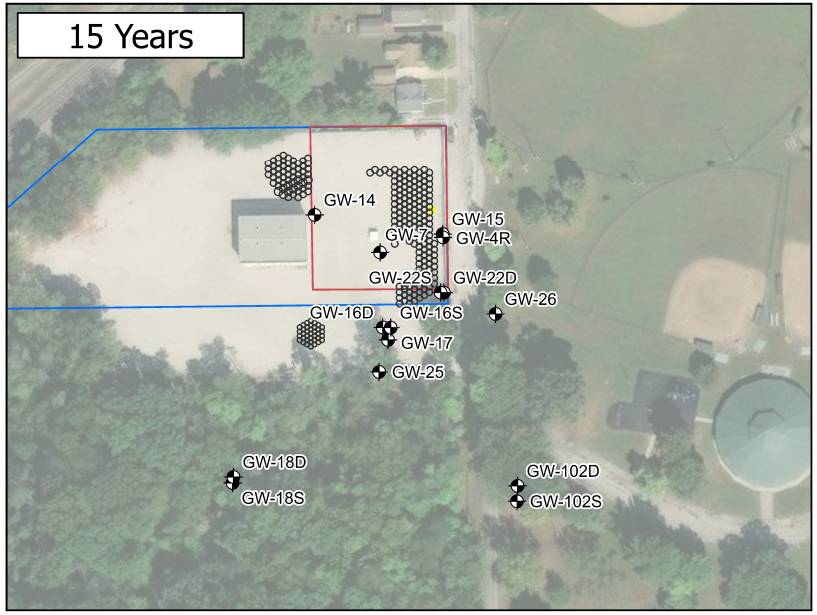
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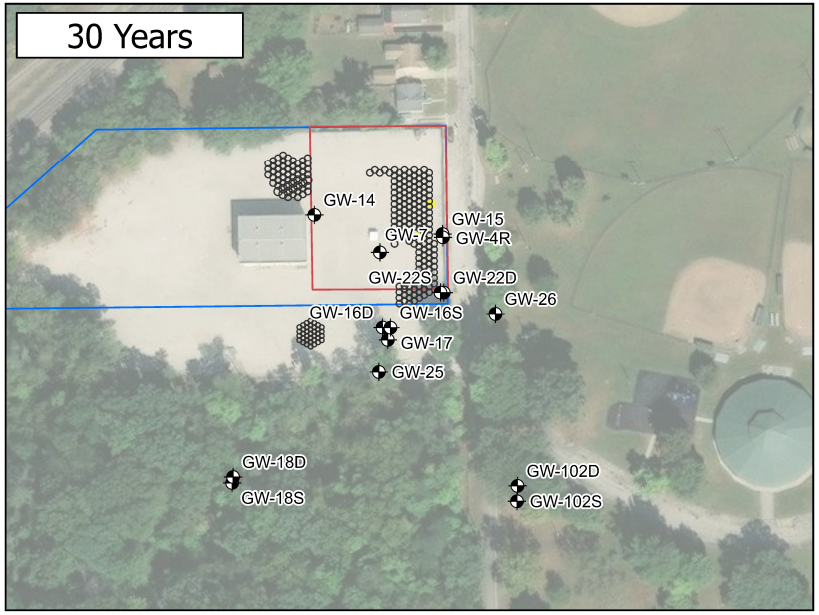
Source: Esri - World Topoographic Map; NAD 1983 2011 StatePlane Illinois West FIPS 1202 Ft US

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Legend

- Monitoring Well
- Naphthalene Plume Extent (77 ug/L)
- ISS Columns
- Site Boundary
- Parent Parcel

Notes:
ug/L = micrograms per liter

IEPA Part 620 Groundwater Standards for Naphthalene = 77 ug/L

Plume extent represents combination of maximum concentrations in all model layers

N

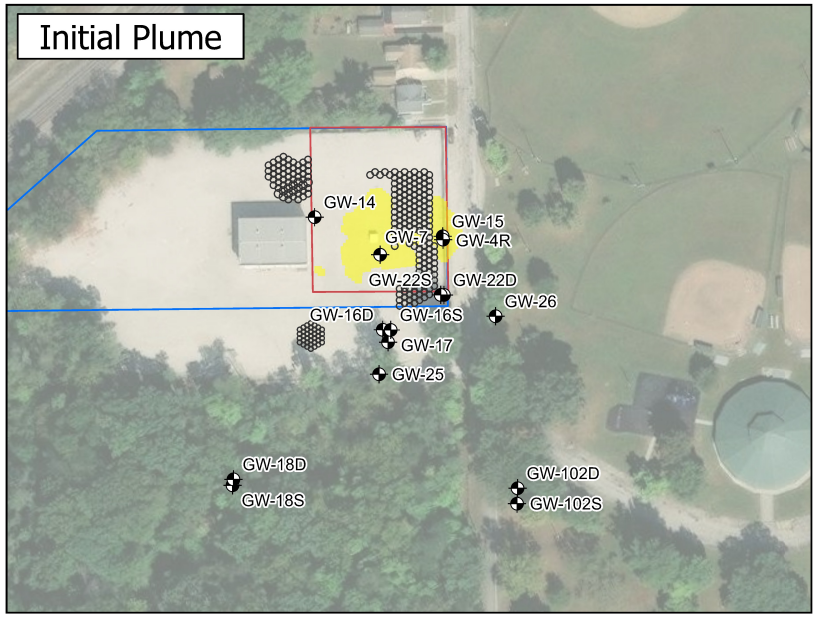
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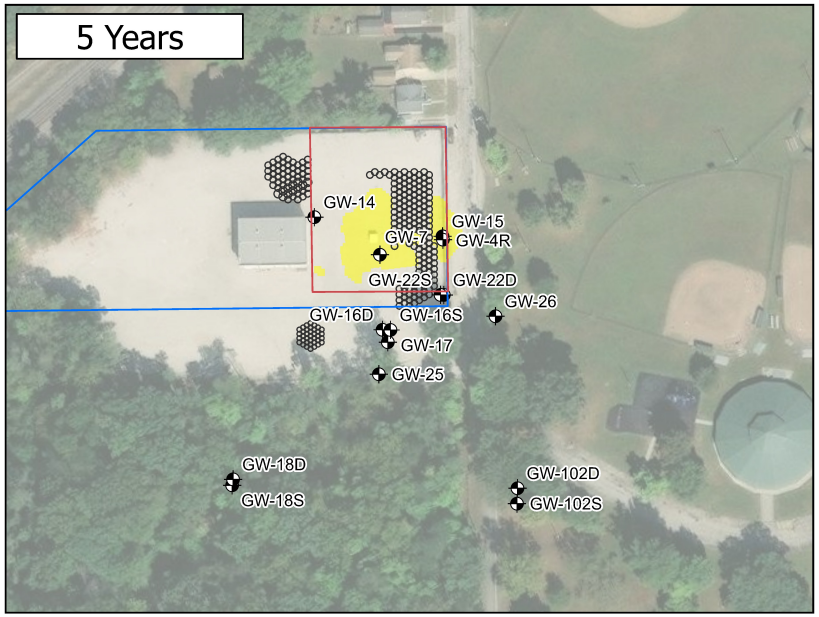
Figure 6
Pilot Study ISS Application without Groundwater Pumping: Naphthalene
Ameren Taylorville
Former MGP Site
Ameren Services
Taylorville, Illinois

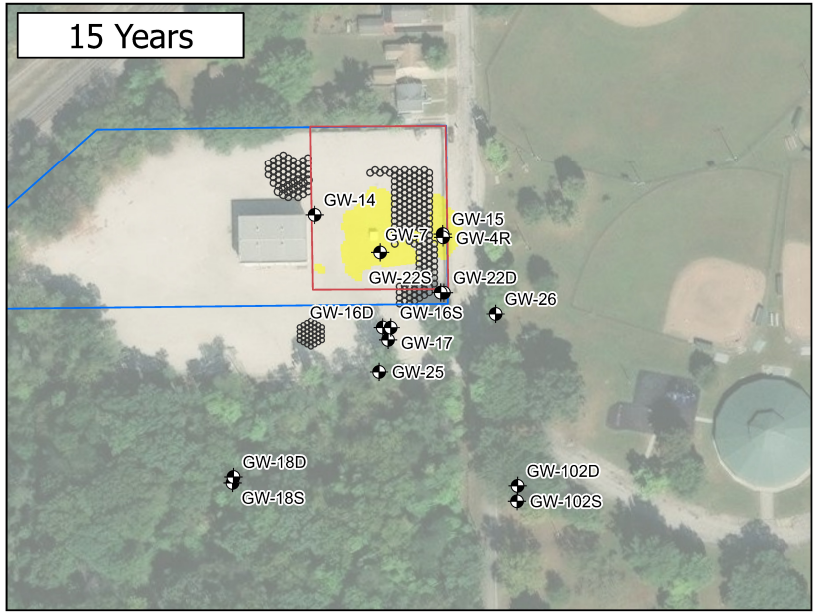
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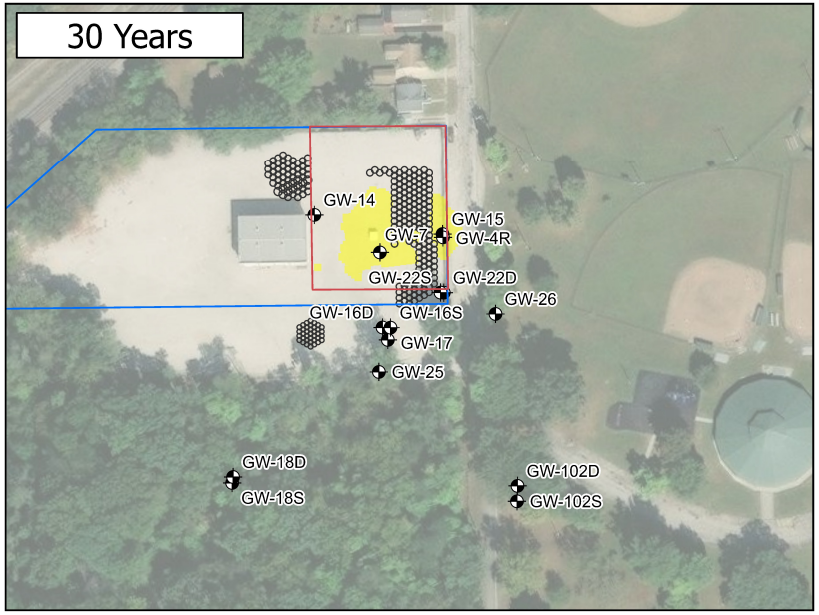
Source: Esri - World Topoographic Map; NAD 1983 2011 StatePlane Illinois West FIPS 1202 Ft US

C:\Users\Stacey.Law\OneDrive-ERM\Documents\Ameren_Taylorville\00_GIS\Ameren_Taylorville_GWModel_2025.aprx, REVISED: 04/27/2026, SCALE: 1:1,932 when printed at 8.5x11 DRAWN BY: GIS









Legend

- Monitoring Well
- Benzo(a)anthracene Plume Extent (0.25 ug/L)
- ISS Columns
- Site Boundary
- Parent Parcel

Notes:
ug/L = micrograms per liter

IEPA Part 620 Groundwater Standards for Benzo(a)anthracene = 0.25 ug/L

Plume extent represents combination of maximum concentrations in all model layers

N

0 50 100 200 Feet

Figure 7
Pilot Study ISS Application without Groundwater Pumping: Benzo(a)anthracene
Ameren Taylorville
Former MGP Site
Ameren Services
Taylorville, Illinois

ERM

Source: Esri - World Topoographic Map; NAD 1983 2011 StatePlane Illinois West FIPS 1202 Ft US

APPENDIX A IEPA 12 MARCH 2026 RESPONSE LETTER TO GROUNDWATER FLOW AND TRANSPORT MODELING ASSESSMENT OF REMEDIATION STATUS

Illinois Environmental Protection Agency

2520 West Iles Avenue • P.O. Box 19276 • Springfield, Illinois • 62794-9276 • 217-782-3397

JB Pritzker, Governor **James Jennings**, Acting Director

March 12, 2026

Mr. Brian Martin
Senior Manager, Environmental Services
1901 Chouteau Avenue
PO Box 66149, Mail Code 602
St. Louis, MO 63166-6149

RE: 0218160007 – Christian County
Ameren CIPS Taylorville
Superfund/Technical Reports

Response to Groundwater Flow and Transport Modeling Assessment of Remediation Status

Dear Mr. Martin:

Illinois Environmental Protection Agency (Illinois EPA) has reviewed the *Groundwater Flow and Transport Modeling Assessment of Remediation Status*, for the Ameren CIPS Taylorville Superfund Site in Taylorville, IL. The Report is dated October 28, 2025 and was received electronically by Illinois EPA on the same date. Illinois EPA offers the following comments:

General Comment:

1. Section 7, Conclusions (Page 8): This section states the Pump and Treat (P&T) system will be kept in a standby state during the monitoring period so pumping can be resumed if needed based on downgradient sampling. Please define "resumed if needed" in more detail. Please state as part of the text what criteria will need to be met to trigger reactivation of the P&T system.

Model Specific Comments:

2. Hydrogeologic zones are not adequately characterized by the model, as all zones have the same value of specific storage (SS) and specific yield (SY), which is of specific concern in the In-situ stabilization (ISS) area. Please update the MODFLOW parameters to accurately reflect site conditions using field, lab or literature derived values where applicable. Data gathered as part of the 2023 Remedial Delineation Investigation would be appropriate.

3. Groundwater elevations within the area of ISS are unrealistic and contain a potentiometric surface above land surface elevation. This appears to be an artifact of how recharge is applied, as the inflow of recharge to ISS cells exceeds the rate of removal through saturated flow. Recharge to these cells should be reduced or removed to more accurately match site conditions and render a realistic potentiometric surface. Data from the 2017-2019 shutdown of the pump and treat system may be used.

4. Snapshots of plume extent do not provide sufficient information on the effectiveness of the chosen remedy. Additional metrics, such as predicted concentration over time at monitoring wells, must be provided.

5. The resolution of input parameters and model temporal discretization in the model is not sufficiently justified. An investigation of seasonal groundwater elevation and precipitation must show that individual or seasonal increases in precipitation will not impact the effectiveness of the chosen remedy. If this investigation shows that an updated conceptual site model is required, then the groundwater model must be updated.

If you have any questions, then please contact me at Greggory.miller@illinois.gov or at (217) 782-9869.

Sincerely,

Greggory Miller
Project Manager
Federal Site Remediation Section
Bureau of Land

GSM:SMD:CAF:ATL:P:\Projects\Sites\CIPS Taylorville\20260312_Pilot_Study_Report_Response.docx

APPENDIX B ERM 10 APRIL 2026 RESPONSE TO IEPA COMMENT LETTER

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Greggory Miller
Illinois Environmental Protection Agency
Federal Site Remediation Section
2520 West Iles Avenue
PO Box 19276
Springfield, Illinois 62794-9276

DATE
10 April 2026

SUBJECT
Response to IEPA Letter dated 12 March 2026

0218160007 – Christian County

Ameren CIPS Taylorville

Superfund/Technical Reports

REFERENCE
0724126

Dear Mr. Miller:

Environmental Resources Management, Inc. (ERM), on behalf of Ameren Services (Ameren), respectfully submits the following responses to the Illinois Environmental Protection Agency's (IEPA) 12 March 2026 comments in their review of the Groundwater Flow and Transport Modeling Assessment of Remediation Status (ERM 2025a) associated with the above reference site. These responses reflect the discussion that ERM and Ameren had with IEPA on 20 March 2026 regarding IEPA's comments.

As discussed in the referenced submittal, updated modeling showed that the 2023 in-situ stabilization / solidification (ISS) activities were effective for limiting constituents of concern (COCs) migration from the Site, and that continued operation of the groundwater treatment system (GWTS) would not provide additional environmental benefits.

IEPA reviewed numerical groundwater flow and transport files that were developed to evaluate the long-term effectiveness of ISS conditions and potential for advective COC transport following completion of ISS activities. As presented in the responses, the ISS remedy was effective in mitigating COC mobility, thereby substantially reducing the potential for off-Site advective migration. Under current Site conditions, continued operation of the GWTS is no longer necessary as a Site remedial component to maintain protection of the environment.

The enclosed responses summarize how modeling results, together with Site-specific remedial performance and Site data, support the conclusion that a stable analytical and groundwater environment have been achieved and that GWTS operation is no longer an integral part of Site remedial needs. We appreciate IEPA's ongoing coordination and review and remain available to address any questions or provide additional clarification, as needed.

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Responses to IEPA Comments

IEPA Comment #1 – Section 7, Conclusions (Page 8)

This section states the Pump and Treat (P&T) system will be kept in a standby state during the monitoring period so pumping can be resumed if needed based on downgradient sampling. Please define "resumed if needed" in more detail. Please state as part of the text what criteria will need to be met to trigger reactivation of the P&T system.

ERM Response

Ameren does not anticipate long term increases in Site COC concentrations in downgradient wells because of idling the GWTS. This is based on Ameren's 2025 modeling and Ameren's experience during the 2017-2019 GWTS shutdown. During the proposed timeframe that the GWTS will be idled, Ameren will continue quarterly groundwater monitoring. Groundwater reports will be prepared and submitted to IEPA, as they have been in the past. Potential changes in downgradient groundwater impacts, if any, will be immediately verified by resampling. Variations in groundwater conditions will be identified and reported to IEPA in Ameren's quarterly groundwater monitoring reports. If groundwater sample results suggest adverse deviation from Ameren's 2025 modeled predictions, Ameren will evaluate alternative controls in consultation with IEPA, which may include GWTS operation.

IEPA Comment #2

Hydrogeologic zones are not adequately characterized by the model as all zones have the same value of specific storage (SS) and specific yield (SY), which is of specific concern in the In-situ stabilization (ISS) area. Please update the MODFLOW parameters to accurately reflect site conditions using field, lab or literature derived values where applicable. Data gathered as part of the 2023 Remedial Delineation investigation would be appropriate.

ERM Response

ERM acknowledges IEPA's comment regarding the use of uniform SS and SY values across hydrogeologic zones, including within ISS model cells.

Laboratory testing and field observations collected during ISS implementation, documented as part of the Pilot Study Report (ERM 2025b), confirm that ISS-treated soils exhibit substantially reduced permeability relative to surrounding native materials. These conditions were appropriately represented in the groundwater flow and transport model through the assignment of very low hydraulic conductivity values applied to ISS model cells, resulting in minimal groundwater flux through the treated zone. Under such conditions, advective groundwater flow and transport of modeled COCs, within the ISS, is negligible and dominated by imposed low-permeability flow regime rather than by storage parameters. Furthermore, within a numerical groundwater flow and transport modeling framework, SS represents elastic aquifer deformation and SY represents gravity drainage, both of which are transient groundwater responses. In contrast, the

groundwater flow field in which COC transport is evaluated as part of this groundwater flow and transport analysis is under steady-state conditions, such that storage parameters do not materially influence simulated long-term groundwater flow or transport results.

Given the low hydraulic conductivity assigned to ISS model cells, further adjustment of SS and SY values within ISS model cells would not result in meaningful changes to simulated groundwater velocities, flow paths, or downgradient COC transport projections. ERM appreciates the discussion of this comment during our meeting with IEPA on 20 March 2026. During the meeting, it was agreed that the suggested revisions to the model would not materially change the modeled outcome and therefore the suggested revisions were not necessary.

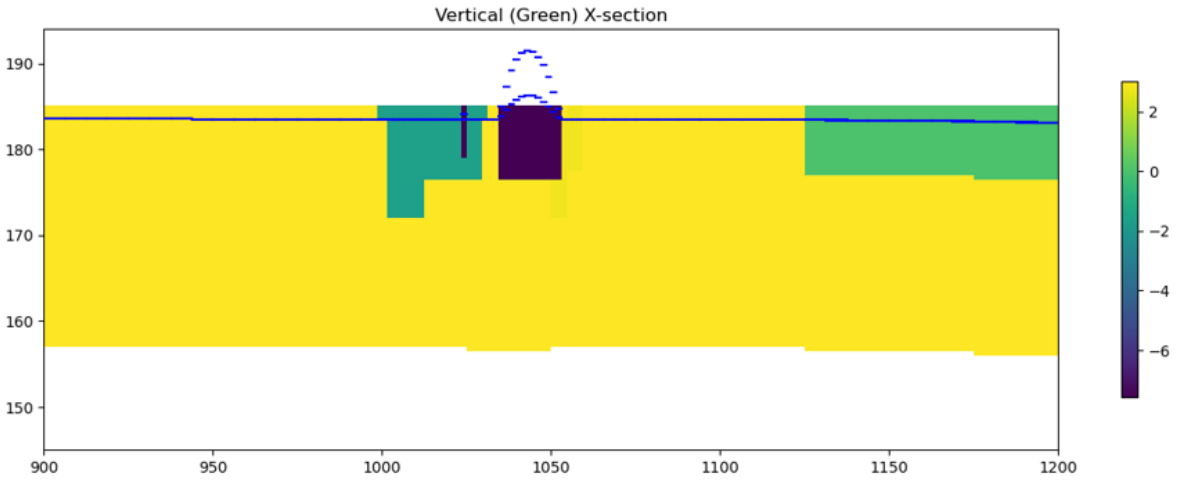
IEPA Comment #3

Groundwater elevations within the area of ISS are unrealistic and contain a potentiometric surface above land surface elevation. This appears to be an artifact of how recharge is applied, as the inflow of recharge to ISS cells exceeds the rate of removal through saturated flow. Recharge to these cells should be reduced or removed to more accurately match site conditions and render a realistic potentiometric surface. Data from the 2017-2019 shutdown of the pump and treat system may be used.

ERM Response

ERM acknowledges IEPA's observation regarding elevated simulated groundwater elevations at ISS model cells as shown below in an excerpt from IEPA's model review Figure 1. The elevated potentiometric surface is recognized as a numerical artifact associated with the application of recharge to very low-permeability ISS model cells. As agreed during our discussion on 20 March 2026 with IEPA, ERM's modeling approach is conservative and the presence of this piezometric head artifact in the model does not invalidate model conclusions. However, ERM can adjust this parameter in the final model to support completeness of the final model.

FIGURE 1. SIMULATED GROUNDWATER ELEVATIONS AT ISS MODEL CELLS



Source: Excerpt from IEPA's model review

Note: Figure shows model vertical cross section. Hydraulic conductivity is in log space colored corresponding to the right-hand scale bar. Groundwater elevation is shown in blue for model layers 1 and 2 where the two lines correspond to the potentiometric surface of the model layers.

IEPA Comment #4

Snapshots of plume extent do not provide sufficient information on the effectiveness of the chosen remedy. Additional metrics, such as predicted concentration over time at monitoring wells, must be provided.

ERM Response

As discussed during the 20 March 2026 meeting, ERM intends to use field-derived data from continued quarterly monitoring during the demonstration period as the best indicator of the effectiveness of ISS.As presented, groundwater flow and transport modeling results indicate that modeled plumes within and downgradient of ISS model cells either contract or remain stable over time. Model results quantify a reduction in simulated benzene mass of approximately 93.7 percent within five years following ISS implementation. Naphthalene concentrations decrease by approximately 45 percent, with limited localized migration simulated along the southeastern margin of ISS model cells. Both benzene and naphthalene are predicted to be below the applicable IEPA Part 620 Groundwater Quality Standards within five years post-ISS. Benzo[a]anthracene (BaA) is not predicted to decrease appreciably in mass due to its relatively immobile and stable nature; however, modeled transport indicates minimal to no downgradient migration. These results are illustrated in Figures 2 through 4 and are further detailed in the Groundwater Flow and Transport Modeling Assessment of Remediation Status Report (ERM 2025a).

In response to IEPA's request for evaluation of concentrations over time, ERM considers field-derived groundwater monitoring data to be the most appropriate and protective indicator of remedy performance. Groundwater monitoring results collected from downgradient ISS performance monitoring locations (Figure 5) provide a reliable and representative measure of Site conditions in conjunction with model-predicted concentrations. Time-series groundwater data from these wells demonstrate that COCs remain below IEPA Part 620 Groundwater Quality Standards following ISS implementation, with no increasing trends or evidence of plume expansion. This data satisfies the objective of demonstrating remedial effectiveness at compliance locations over time (Figure 6).

In addition, groundwater monitoring conducted following post-ISS remedy further demonstrates that potential advective transport pathways have been effectively mitigated. This is evidenced by results from downgradient groundwater monitoring well GW-25, where the absence of detectable off-Site impacts confirms that COC migration is controlled and that the remedy remains protective of the environment (Figure 6).

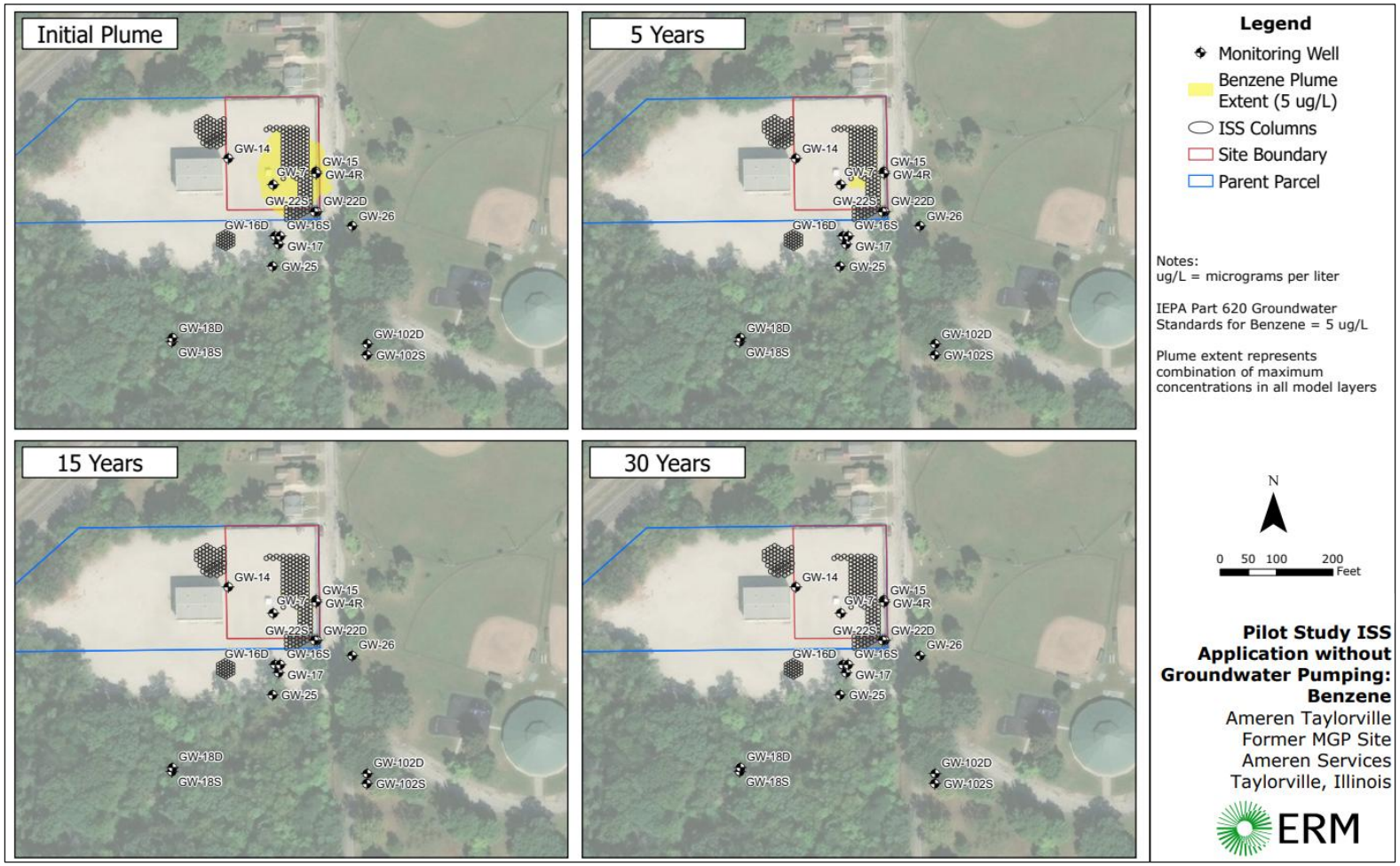
Based on the consistency between modeled plume behavior and observed groundwater concentration trends from quarterly monitoring, as well as the absence of downgradient impacts during the GWTS shutdown period from 2017-2019, ERM believes the planned quarterly groundwater monitoring during the demonstration period would be a representative and more direct measure of ISS effectiveness.

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FIGURE 2. SIMULATED BENZENE TRANSPORT REPORTED IN GROUNDWATER FLOW AND TRANSPORT MODELING ASSESSMENT OF REMEDIATION STATUS REPORT (ERM 2025A).



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FIGURE 3. SIMULATED NAPTHALENE TRANSPORT REPORTED IN GROUNDWATER FLOW AND TRANSPORT MODELING ASSESSMENT OF REMEDIATION STATUS REPORT (ERM 2025A).



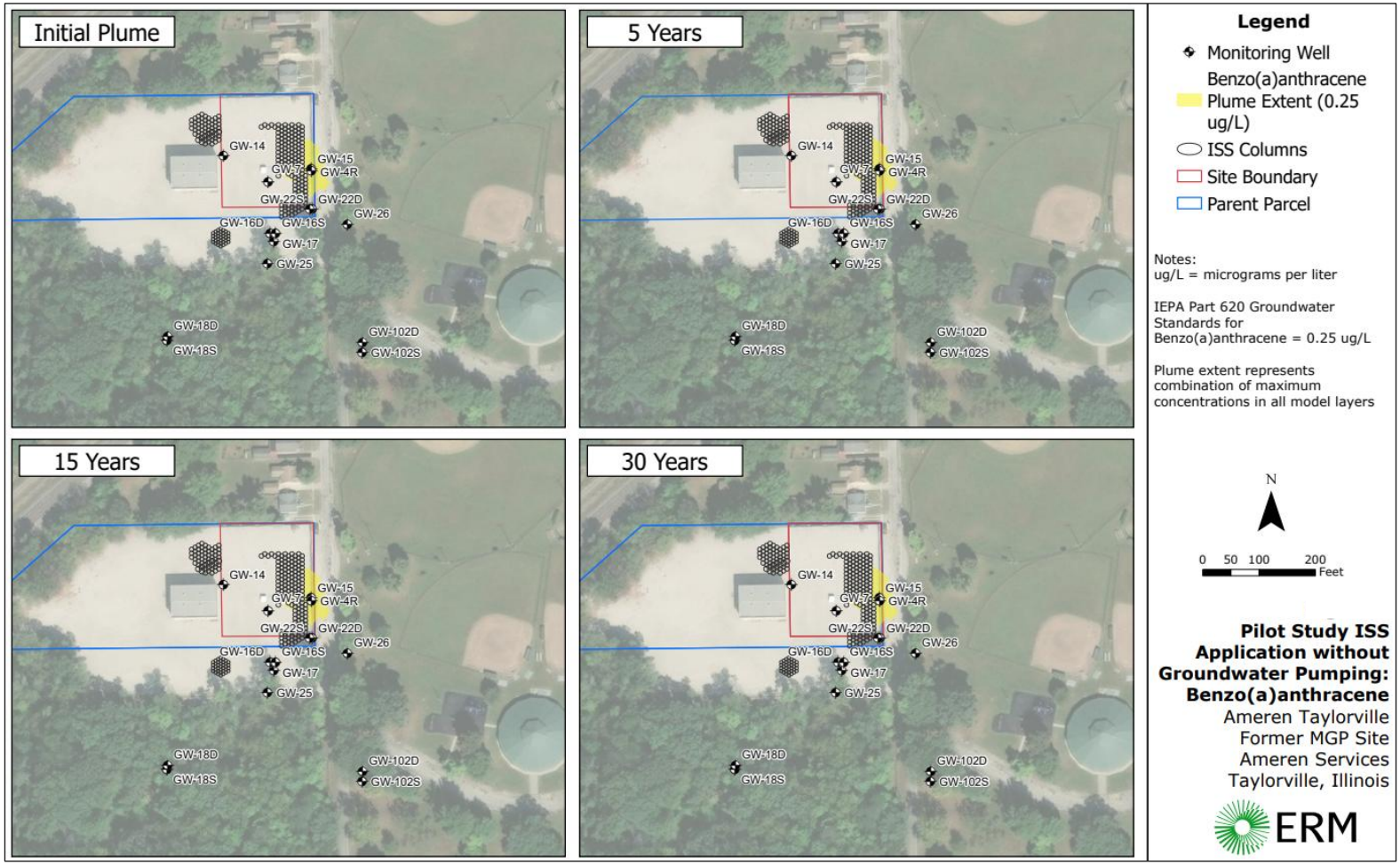
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FIGURE 4. SIMULATED BENZO(A)ANTHRACENE TRANSPORT REPORTED IN GROUNDWATER FLOW AND TRANSPORT MODELING ASSESSMENT OF REMEDIATION STATUS REPORT (ERM 2025A).



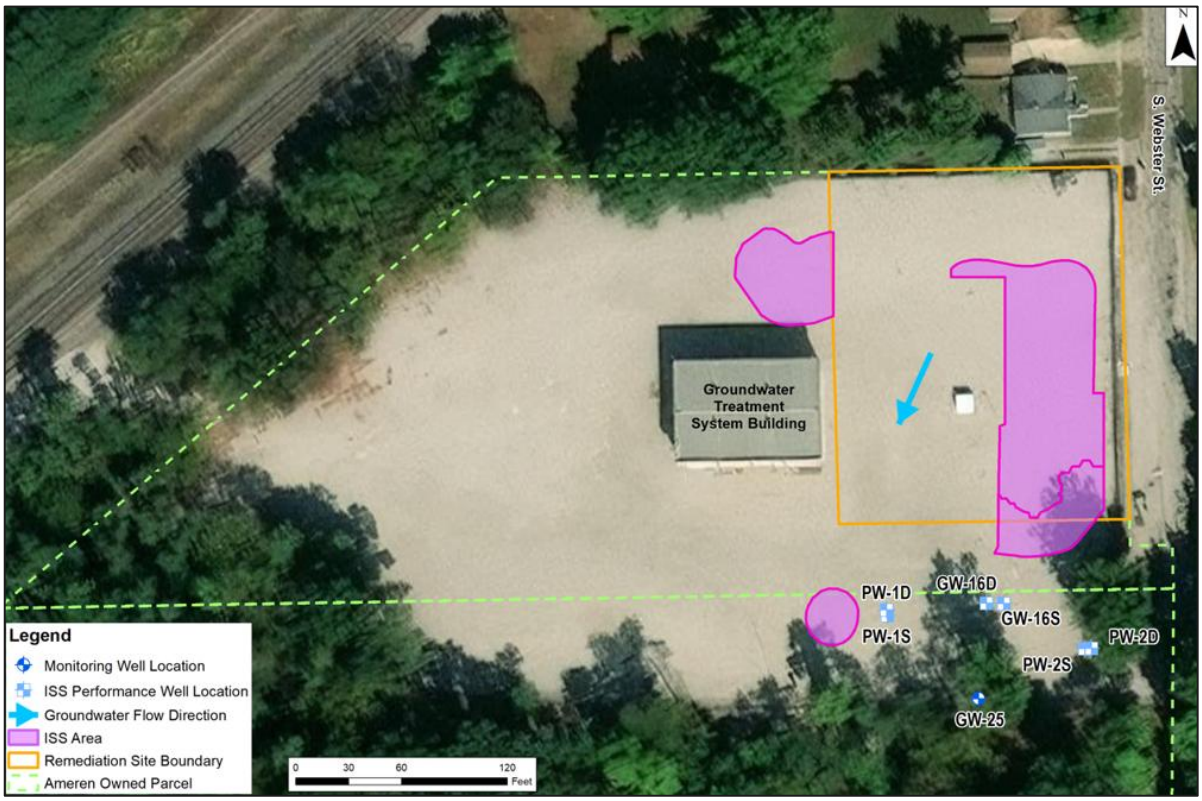
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FIGURE 5. ISS PERFORMANCE MONITORING AND SITE MONITORING LOCATIONS



Note: Groundwater flow direction under non-remedial pumping conditions.

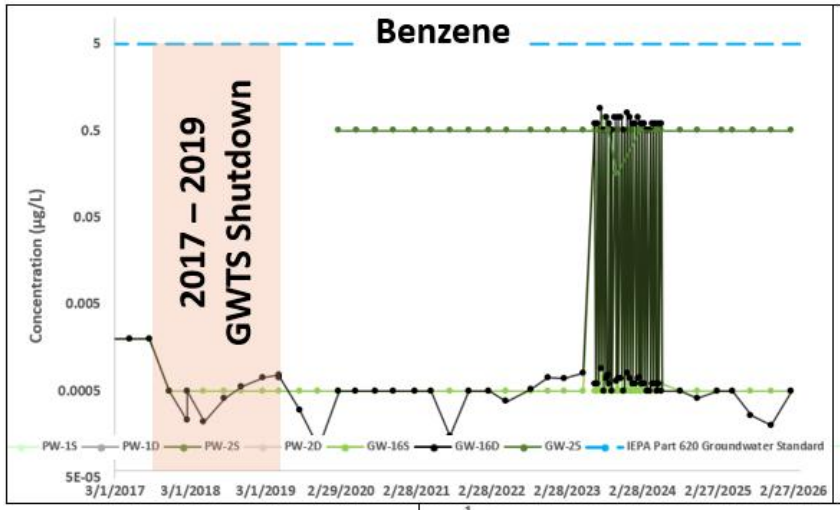
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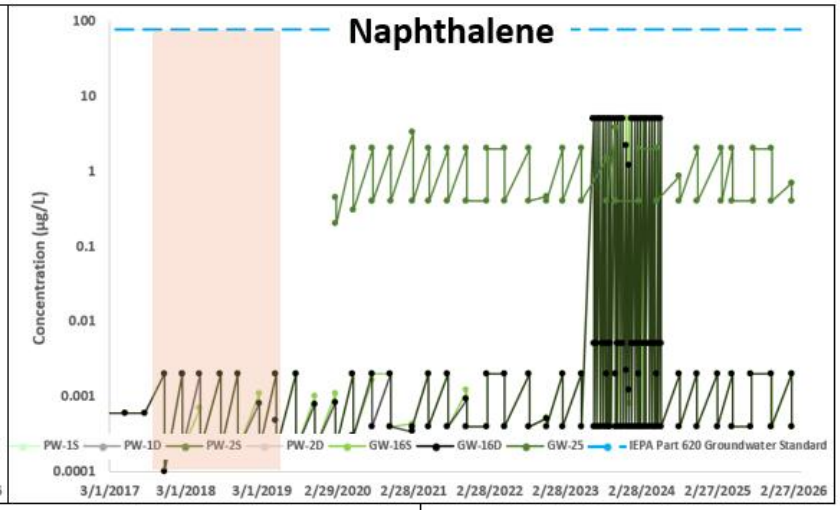
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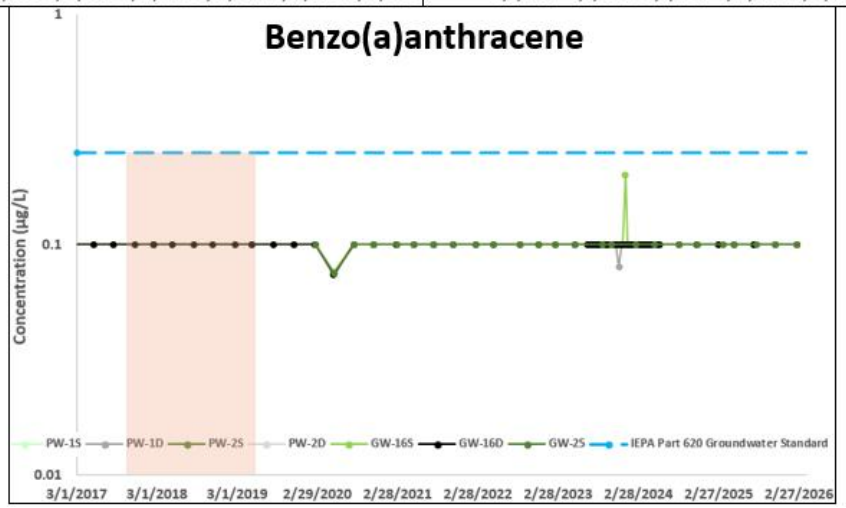
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FIGURE 6. ANALYTICAL SITE MONITORING DATA AT ISS PERFORMANCE AND SITE MONITORING LOCATIONS







Note:

Fluctuations in groundwater sample results were observed and are shown for the ISS Performance Monitoring period (August 2023 – February 2024). These fluctuations were anticipated from the ISS installation activities and were communicated in the Performance Monitoring plan.

Laboratory reporting limits and/or sample result concentrations were less than IEPA Part 620 Groundwater Standards during the performance monitoring period and have since reduced to their previous lower values.

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IEPA Comment #5

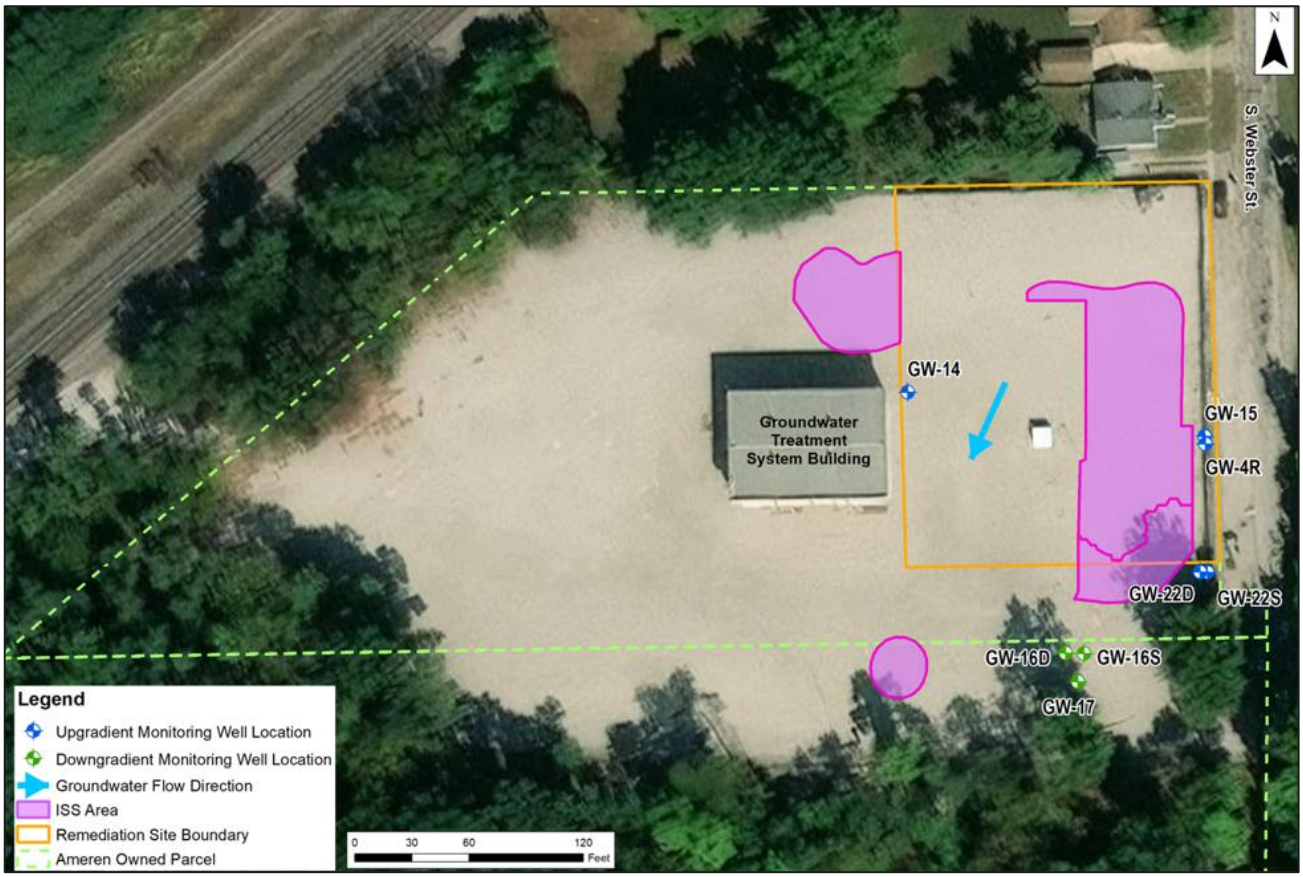
The resolution of input parameters and model temporal discretization in the model is not sufficiently justified. An investigation of seasonal groundwater elevation and precipitation must show that individual or seasonal increases in precipitation will not impact the effectiveness of the chosen remedy. If this investigation shows that an updated conceptual site model is required, then the groundwater model must be updated.

ERM Response

ERM acknowledges IEPA's comment regarding model parameter resolution, temporal discretization, and the potential influence of seasonal precipitation on groundwater elevations and remedial effectiveness. An evaluation of Site groundwater elevation data collected from groundwater monitoring wells over a ten-year period (Figure 7) indicates that groundwater level fluctuations are minimal. Elevations vary seasonally, as expected, in response to climatic forces such as precipitation, evapotranspiration, and recharge, with observed annual fluctuations averaging approximately two to three feet over the period of record in most wells (Figure 8). As discussed during our 20 March 2026 meeting, ongoing groundwater monitoring has shown seasonal fluctuations of potentiometric surface to be minimal, and ongoing groundwater monitoring during the demonstration period will address potential seasonal variations.

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FIGURE 7. SITE MONITORING WELLS



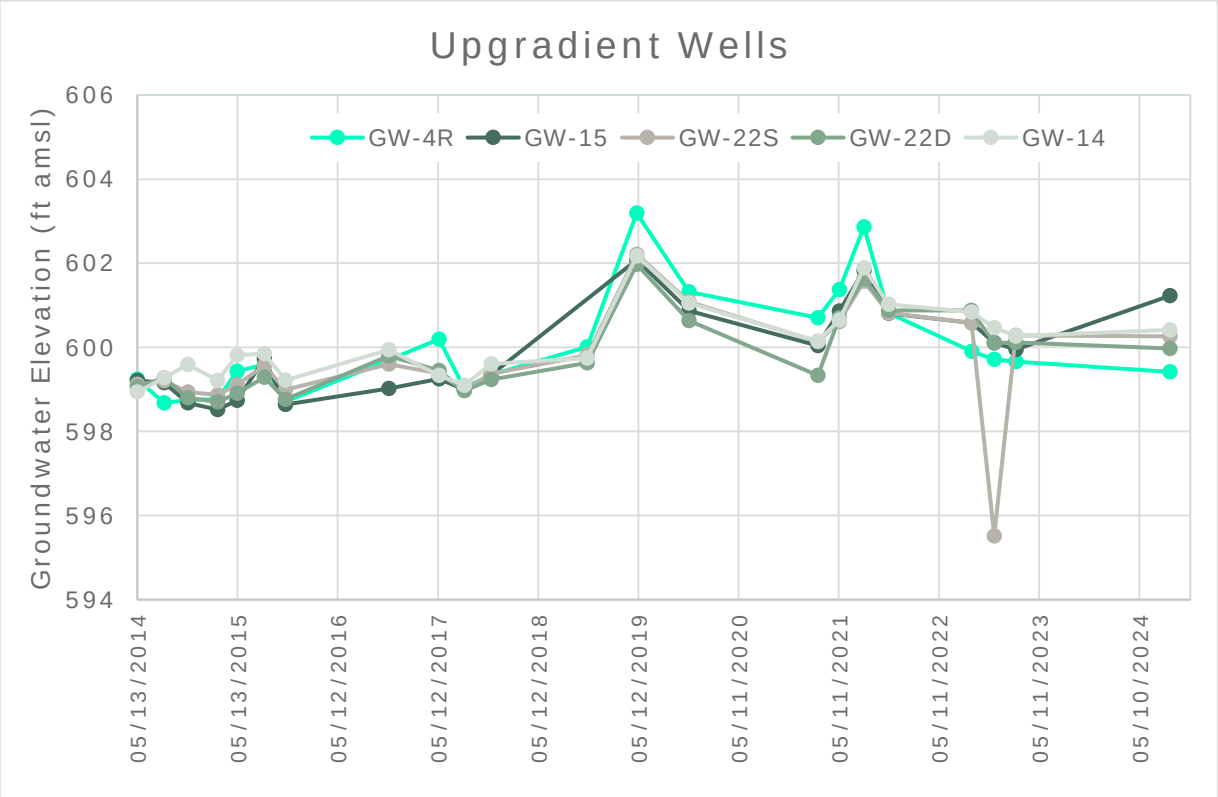
Note: Groundwater flow direction under non-remedial pumping conditions.

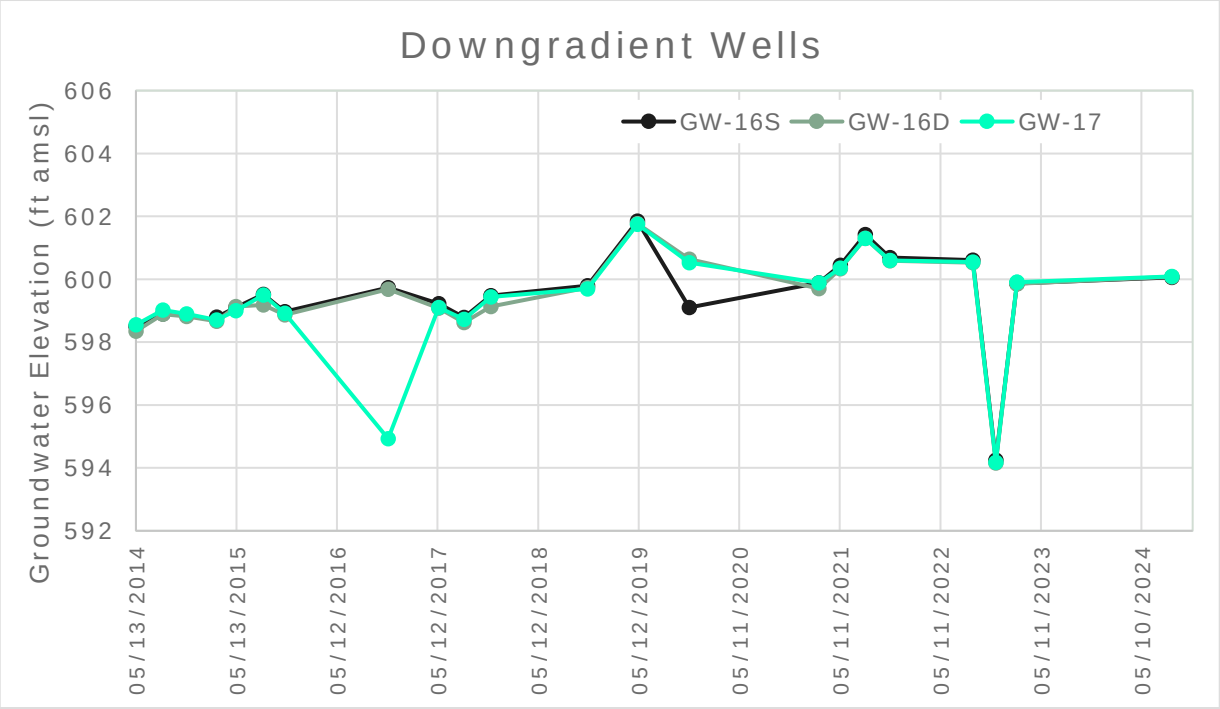
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FIGURE 8. SITE MONITORING WELL HYDROGRAPHS





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In summary, evaluation of groundwater elevation data indicates that Site groundwater level variability is limited and does not adversely affect ISS performance. Observed groundwater elevation trends demonstrate that storm events or seasonal increases in precipitation do not produce sustained or anomalous groundwater level increases or hydraulic conditions that would compromise ISS performance – groundwater level amplitude confirm that ISS effectiveness is maintained under both average and seasonal groundwater conditions.

Indeed, the quarterly groundwater analytical data confirms that fluctuations in water levels are not impactful to water quality, which is what is predicted by the model.

The existing groundwater flow model adequately represents Site groundwater dynamics by capturing both regional and Site-specific groundwater flow patterns providing a representative basis for evaluating long-term conditions. Evaluated seasonal groundwater elevation data do not indicate a change in groundwater flow behavior or chemistry; therefore, ERM believes that an update to the conceptual site model related to these inputs is not beneficial. Accordingly, resulting revisions to the groundwater flow model for these inputs would not materially change the understanding of Site conditions or the conclusions regarding remedial effectiveness.

Closing Remarks

ERM, on behalf of Ameren, appreciates IEPA's review of the Groundwater Flow and Transport Modeling Assessment of Remediation Status and corresponding numerical groundwater flow and transport model files, and IEPA's comments and concerns have been carefully considered and addressed in this response. While ERM's technical assessment indicates that additional numerical modeling refinements would not materially change the conclusions regarding groundwater flow or COC transport behavior, we recognize the importance of ensuring IEPA's full confidence in the technical basis supporting site closure and the transition to the next phase of remedial management.

As discussed, the current remedial strategy is driven by empirical groundwater monitoring data, which provide the most reliable and Site-representative indicator of post-ISS performance and show no adverse groundwater trends. The results of the modeling conducted by ERM support the data measured in the field. Continued monitoring will remain in place to verify that groundwater conditions remain stable and protective following the cessation of routine GWTS operation.

ERM looks forward to continued coordination with IEPA and appreciates the Agency's engagement throughout this process. We remain committed to a transparent, data-driven approach that supports regulatory confidence while allowing the Site to advance without unnecessary continued operation of active groundwater extraction.

Should you have any questions please feel free to contact ERM at (314) 733-4490.

Respectfully,

Dan Wilkens, P.G.
Partner

Michael LeFrancois, P.G.
Principal Hydrogeologist

REFERENCES

ERM, 2025a. Groundwater Flow and Transport Modeling Assessment of Remediation Status. Ameren Former MGP Site, Taylorville, Illinois. October 2025.

ERM, 2025b. Pilot Study Report. Ameren Former MGP Site, Taylorville, Illinois. October 2025.

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