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REPORT ON

CORRECTIVE MEASURES ASSESSMENT EAGLE VALLEY GENERATING STATION MARTINSVILLE, INDIANA

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for
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List of Acronyms and Abbreviations

Abbreviation	Definition
Ash Pond System	Ash Ponds A, B and C, and exempt former Ponds D and E
ATC	ATC Group Services LLC
CBR	Closure by Removal
CCR	Coal Combustion Residual
CIP	Closure in Place
CMA	Corrective Measures Assessment
CSM	Conceptual Site Model
EVGS	Eagle Valley Generating Station
ft	Feet
GWPS	Groundwater Protection Standards
GW	Groundwater
Haley & Aldrich	Haley & Aldrich, Inc.
HC	Hydraulic Containment
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
IPL	Indianapolis Power & Light Company
MCL	Maximum Contaminant Level
MNA	Monitored Natural Attenuation
N&E	Nature and Extent
NPDES	National Pollution Discharge Elimination System
RO	Reverse Osmosis
SAP	Sampling and Analysis Plan
Site	Eagle Valley Generating Station
SSI	Statistically Significant Increase
SSL	Statistically Significant Levels
ug/L	Microgram per Liter
USEPA	United States Environmental Protection Agency
WCG	Weaver Consultants Group

1. Introduction

Haley and Aldrich, Inc. (Haley & Aldrich) was retained by Indianapolis Power & Light Company (IPL) to prepare this Corrective Measures Assessment (CMA) for the Coal Combustion Residual (CCR) units, Ash Ponds A, B, and C, and exempt former Ponds D and E (herein referred to as the "Ash Pond System") at the Eagle Valley Generating Station (EVGS or "Site"). IPL has conducted detailed geologic and hydrogeologic investigations under the U.S. Environmental Protection Agency's (USEPA) rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities*. 80 Fed. Reg. 21302 (effective 19 October 2015) and subsequent regulatory revisions (CCR Rule). These investigations have included ongoing groundwater monitoring and Nature and Extent (N&E) investigations associated with §257.95 of the CCR Rule.

This CMA report evaluates potential corrective measures to remediate groundwater for the constituents present in groundwater at statistically signification levels (SSL) above the Groundwater Protection Standards (GWPS). A summary of the historical groundwater monitoring results for the CCR Rule Appendix III and Appendix IV constituents including relevant statistics can be found in the facility's annual groundwater monitoring and corrective action reports located at: http://ccr-eaglevalley.com/Home/default.aspx

1.1 FACILITY DESCRIPTION/BACKGROUND

IPL owns and operates the EVGS, which is located approximately four miles north of Martinsville, Indiana, in Morgan County. The Site is bounded to the north and west by the White River, to the south by farmland and fields, and to the east by various residential homes and wooded areas (**Figure 1-1**).

IPL ceased coal-fired power-generating operations at the Site in April 2016 and now operates a natural gas-fired combined cycle generating station located southwest of the former coal-fired facility. The EVGS had been in operation since 1949 and immediately prior to going offline, had four operating bituminous, coal-fired electric generating units (Units 3, 4, 5, and 6) with a combined nameplate capacity of approximately 300 megawatts.

The Indiana Southern Railroad traverses the Site in the north-south direction and divides the Ash Pond System into the westerly Ponds A, B, & C (regulated units per the CCR Rule) from the eastern subsystem of two ponds (former Ponds D and E). The Ash Pond System illustrated on **Figure 1-2** encompasses approximately 60 acres. Historically, the Ash Pond System treated fly ash and bottom ash waste streams generated by the station's power generating units through sedimentation, flocculation, and neutralization. In addition, the Ash Pond System also treated low volume waste streams and stormwater. Currently, only non-CCR, low volume waste streams, coal pile run-off, and stormwater are being conveyed to the Ash Pond System as part of ongoing decommissioning efforts.

1.2 GROUNDWATER MONITORING

Groundwater monitoring under the CCR Rule occurs through a phased approach to allow for a graduated response (i.e., detection and assessment monitoring as applicable) and evaluation of steps to address groundwater quality associated with a CCR unit. Weaver Consultants Group (WCG) prepared a Groundwater Monitoring Plan as required by the CCR Rule. A revised Groundwater Sampling and Analysis Plan (GW SAP), dated 30 October 2018, was prepared by ATC Group Services LLC (ATC) and submitted to the Indiana Department of Environmental Management (IDEM). The GW SAP presents the design of the groundwater monitoring system, groundwater sampling and analysis procedures, and groundwater statistical analysis methods.

Monitoring wells were installed in September/October 2015 and March 2016 to support compliance with the CCR Rule. Monitoring well MW-10S was initially installed as an upgradient well which was later redesignated as a shallow downgradient well in the revised 2018 GW SAP. The CCR groundwater monitoring network includes seven background wells and 17 downgradient monitoring wells which are located around the perimeter of the Ash Pond System. Monitoring well locations are shown on **Figure 1-3.** Nested monitoring wells were installed in the alluvial deposits (sand and gravel aquifer zone) below the base of the Ash Pond System. Monitoring wells designated MW-XS are screened in the upper part of the saturated zone; wells designated MW-XI are screened in the middle part of the saturated zone; and wells designated MW-XD are screened in the lower part of the saturated zone. Below is a list of the CCR monitoring well network:

Background (Upgradient)			Downgradient		
Shallow	**Intermediate**	**Deep**	**Shallow**	**Intermediate**	**Deep**
MW-4S MW-8S MW-9S	MW-4I MW-9I	MW-4D MW-9D	MW-1S MW-2S MW-3S MW-6S MW-7S MW-10S MW-11S MW-12S	MW-1I MW-2I MW-3I MW-6I MW-11I	MW-1D MW-2D MW-6D MW-11D

Detection monitoring sampling events occurred in 2016 and 2017. The results of the sampling events were then compared to background (upgradient) concentrations using statistical methods to determine whether statistically significant increases (SSI) of constituent concentrations above background concentrations in groundwater had occurred. Results of the detection monitoring statistical analyses completed in January 2018 identified SSI concentrations of Appendix III constituents in downgradient monitoring wells relative to concentrations observed in background wells. There were no alternative sources identified for SSI constituents. Accordingly, the groundwater monitoring program transitioned to an assessment monitoring program.

During the assessment monitoring phase, CCR groundwater monitoring well samples were collected during May and September 2018 and subsequently analyzed for the Appendix III and Appendix IV constituents as required by 40 CFR §257.95(b) and 40 CFR §257.95(d)(1). Concurrent with the second assessment sampling round, and as required by 40 CFR §257.95(h), GWPS were established for the detected Appendix IV constituents. The SSL results indicated that arsenic, lithium, and molybdenum are present in groundwater at SSLs above the GWPS.

1.3 CORRECTIVE MEASURES ASSESSMENT PROCESS

The CMA must include an analysis of the effectiveness of potential corrective measure in meeting all of the requirements and objectives of the remedy per 40 CFR §257.96(c). Each remedy must meet the following threshold criteria as stated in the CCR Rule:

§257.97 Selection of remedy [Threshold Criteria]
(b) Remedies must:

(1) Be protective of human health and the environment;
(2) Attain the groundwater protection standard as specified pursuant to §257.95(h);
(3) Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in appendix IV to this part into the environment;
(4) Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems;
(5) Comply with standards for management of wastes as specified in §257.98(d).

Once these technologies are demonstrated to meet these threshold criteria, they are then compared to one another with respect to the following balancing criteria as stated in the CCR Rule:

§257.97 Selection of remedy [Balancing Criteria]
(c) In selecting a remedy that meets the standards of paragraph (b) of this section, the owner or operator of the CCR unit shall consider the following evaluation factors:

(1) The long- and short-term effectiveness and protectiveness of the potential remedy(s), along with the degree of certainty that the remedy will prove successful based on consideration of the following:

(i) Magnitude of reduction of existing risks;
(ii) Magnitude of residual risks in terms of likelihood of further releases due to CCR remaining following implementation of a remedy;
(iii) The type and degree of long-term management required, including monitoring, operation, and maintenance;
(iv) Short-term risks that might be posed to the community or the environment during implementation of such a remedy, including potential threats to human health and the environment associated with excavation, transportation, and re-disposal of contaminant;
(v) Time until full protection is achieved;
(vi) Potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, re-disposal, or containment;
(vii) Long-term reliability of the engineering and institutional controls; and
(viii) Potential need for replacement of the remedy.

(2) The effectiveness of the remedy in controlling the source to reduce further releases based on consideration of the following factors:

(i) The extent to which containment practices will reduce further releases; and
(ii) The extent to which treatment technologies may be used.

(3) The ease or difficulty of implementing a potential remedy(s) based on consideration of the following types of factors:

(i) Degree of difficulty associated with constructing the technology;
(ii) Expected operational reliability of the technologies;
(iii) Need to coordinate with and obtain necessary approvals and permits from other agencies;
(iv) Availability of necessary equipment and specialists; and
(v) Available capacity and location of needed treatment, storage, and disposal services.

(4) The degree to which community concerns are addressed by a potential remedy(s).

The fourth balancing criterion involves input from the community regarding the proposed remedial alternatives. This criterion will be addressed by presenting the alternatives at a public meeting and soliciting comments. That meeting will be held at least 30 days prior to remedy selection by IPL.

1.4 RISK REDUCTION AND REMEDY

The CCR Rule (§257.97(b)(1) - Selection of Remedy) requires that remedies must be protective of human health and the environment. Further, §257.97(c) of the CCR Rule requires that in selecting a remedy, the owner or operator of the CCR unit must consider specific evaluation factors, including the risk reduction achieved by each of the proposed corrective measures. Each of the following evaluation factors listed here from §257.97(c) and discussed in **Section 5** are those that are directly related to human health and environmental risk:

- (c)(1)(i) Magnitude of reduction of existing risks;
- (c)(1)(ii) Magnitude of residual risks in terms of likelihood of further releases due to CCR remaining following implementation of a remedy;
- (c)(1)(iv) Short-term risks that might be posed to the community or the environment during implementation of such a remedy, including potential threats to human health and the environment associated with excavation, transportation, and re-disposal of contaminant;
- (c)(1)(vi) Potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, re-disposal, or containment;

The following are additional factors related to risk that are factored into the schedule for implementing and completing remedial activities once a remedy is selected (§257.97(d)):

- (d)(4) Potential risks to human health and the environment from exposure to contamination prior to completion of the remedy[1];
- (d)(5)(i) Current and future uses of the aquifer;
- (d)(5)(ii) Proximity and withdrawal rate of users; and
- (d)(5)(iv) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to CCR constituents.

Section 3 presents a summary of the groundwater risk evaluation that provides the basis for evaluating these risk-based evaluation factors in **Section 5**.

1.5 CMA AMENDMENTS

As additional information becomes available in the future, including future groundwater monitoring results or other site-specific or general information, or technological developments, this CMA is subject to change. To the extent material changes to the CMA become necessary, such revised versions of the CMA will be posted to the facility CCR public website.

[1] Factors (d)(4) and (d)(5) are not part of the CMA evaluation process as described in §257.97(d)(4), and §257.97(d)(5)(i)(ii)(iv); rather they are factors the owner or operator must consider as part of the schedule for remedy implementation.

2. Groundwater Conceptual Site Model

To evaluate potential remedy options, the conceptual site model (CSM) was developed and evaluated based on data collected and associated with the Site. The CSM is summarized below.

2.1 SITE SETTING

The EVGS is located north of Martinsville, Morgan County, Indiana, at 4040 Blue Bluff Road. Operations at this facility began in 1949. CCR produced by the EVGS are managed in several surface impoundments. In 2016, IPL decommissioned the coal-fired units at the facility and replaced them with a natural gas-fired generating system. The multi-unit system of impoundments (the Ash Pond System) covers an area of approximately 60 acres. Pond A, Pond B, and Pond C cover the western portion of the multi-unit footprint while Pond D and Pond E make up the eastern portion. The eastern and western CCR management units are separated by a north-south running rail line. Plant process water, including cooling water for the new natural gas-fired plant, is sourced from three high yield groundwater production wells, screened in the alluvial aquifer, and installed at the locations shown on **Figure 1-3**. With the exception of a scheduled temporary shut-down period each year, the plant and production wells run continuously. When operating at capacity, the groundwater average annual withdrawal is approximately 2,683 gallons per minute. Plant wastewater is discharged into the White River through a canal which provides treatment such as thermal dissipation and forms the northern boundary of the multi-unit Ash Pond System.

The EVGS is located on the floodplain of the White River. The White River flows to the south and forms the western boundary of the Site. The White River valley was formed from meltwater from the continental ice sheets and filled with alluvial sediments deposited from meltwater heavily loaded with entrained sediments. The alluvial deposits are primarily comprised of sand and gravel deposits that accumulated in the eroded river valley area on top of the Mississippian age shale bedrock of the Borden Group. The shale bedrock will impede the vertical migration of groundwater and is not considered a significant aquifer.

2.2 GEOLOGY AND HYDROGEOLOGY

Site geologic and hydrogeologic information was obtained from the revised Sampling and Analysis Plan (ATC, October 2018) and from reports by WCG that summarized the installation and testing of the monitoring wells installed around the Ash Pond System in September 2015 and March 2016 as part of the CCR groundwater monitoring network. Based on this information, three types of naturally occurring subsurface materials were encountered beneath the Site. From ground surface to the bedrock, these materials include the following:

- Lean Clay and Silty Clay – The lean clay and silty clay unit is not continuous across the Site but was encountered at thicknesses up to 14-feet (ft). These soils most likely represent over-bank flood plain deposits of the White River. Hydraulic conductivity of this layer was measured in several Shelby tube samples as ranging from 3.28×10^{-8} to 7.12×10^{-6} centimeters per second. Total porosity was measured at up to 44%. Effective porosity would be expected to be considerably lower, as indicated by the low hydraulic conductivity.

- Sand or Sand and Gravel – The thickness of sand or sand/gravel beneath the Ash Pond System averages 75 ft. The sand and gravel unit is horizontally and vertically stratified and was likely deposited in braided outwash channels. Compositionally the sand and gravel unit is dominated by quartz with lesser percentages of rock fragments. The hydraulic conductivity of this unit was measured to range from 3.19×10^{-4} to 9.90×10^{-1} centimeters per second.

- Silty Clay Shale – Where encountered, this unit is typically hard, and foliated gray shale. The thickness of the shale and siltstone of the Borden Group averages about 200-ft according to the Indiana Department of Natural Resources (IDNR) 2002. The hydraulic conductivity of this unit is expected to be low as the formation's typical yield is 1 to 5 gallons per minute to domestic water wells. Considering the sharp contrast between the higher yields of the sand and gravel aquifer and the lower yields of the underlying shale and siltstone, the top of the bedrock represents a lower boundary of the uppermost aquifer.

Groundwater flow directions were evaluated using Site-wide water level measurements collected on multiple occasions in spring 2019 to evaluate how the EVGS production wells influence groundwater flow. The initial round of water level gauging was taken at the end of a two-week shut-down to evaluate equilibrium flow conditions without pumping. Water level measurements obtained on subsequent occasions were collected shortly after the production wells had been in operation to represent current operating conditions. This evaluation showed that in the absence of pumping, groundwater flow will stagnate and eventually begin to flow very slowly to the west, beneath the Ash Pond System towards the White River. During a "pumps off" condition, groundwater from the west edge of the Ash Pond System is expected to take between one and two years to reach the river based on groundwater modeling predictions. In contrast, when the EVGS production wells are operating, the groundwater flow field is reversed with groundwater being captured by the production wells. The productions wells are shown on **Figure 1-3**.

2.3 GROUNDWATER PROTECTION STANDARDS

The GWPS are defined in the CCR Rule at §257.95 Assessment monitoring program:

> (h) The owner or operator of the CCR unit must establish a groundwater protection standard for each constituent in Appendix IV to this part detected in the groundwater. The groundwater protection standard shall be:
>
>> (1) For constituents for which a maximum contaminant level (MCL) has been established under §141.62 and §141.66 of this title, the MCL for that constituent;
>> (2) For constituents for which an MCL has not been established, the background concentration for the constituent established from wells in accordance with §257.91; or
>> (3) For constituents for which the background level is higher than the MCL identified under paragraph (h)(1) of this section, the background concentration.

USEPA published Amendments to the National Minimum Criteria Finalized in 2018 (Phase One, Part One) in the Federal Register on July 30, 2018 (USEPA, 2018b). This included revising the groundwater protection standard for constituents that do not have an established drinking water standard (or MCL) at §257.95 Assessment monitoring program (h)(2):

- Cobalt – 6 ug/L (micrograms per liter)

- Lead – 15 ug/L
- Lithium – 40 ug/L
- Molybdenum – 100 ug/l

Because the GWPS is the higher of the MCL and the background concentration, and background concentrations are specific to each unit, the GWPS are considered to be Site-specific.

ATC completed a statistical evaluation of groundwater sample results that meets the performance standard of §257.93 to develop site-specific GWPS for each Appendix IV constituent pursuant to 40 CFR §257.95(h). Statistically significant levels above the GWPS are limited to molybdenum at 10 monitoring well locations, lithium at 10 monitoring well locations and arsenic at three monitoring well locations. Monitoring well locations with SSLs above the GWPS are illustrated on **Figure 2-1**.

2.4 NATURE AND EXTENT OF GROUNDWATER IMPACTS

As outlined in **Section 1.2** of this CMA, statistically significant levels of arsenic, lithium, and molybdenum were identified in the assessment monitoring results. As a result, IPL initiated an N&E investigation as required by the CCR Rule in 2019 by installing 14 (N&E wells) in five multi-well clusters at strategic locations and depths primarily south and/or east of the Ash Pond System as shown in **Figures 1-3** and **2-1.** The N&E wells are screened similar to the existing CCR monitoring wells (upper, middle, and lower portions of the alluvial aquifer). Future additional N&E well sampling results will be used to supplement and enhance the evaluation of the extent of groundwater impacts.

3. Risk Assessment and Exposure Evaluation

A groundwater risk evaluation has been prepared by Haley & Aldrich, based on currently available information, the purpose of which is to provide the context needed to interpret and meaningfully understand the groundwater monitoring data collected and published for the Ash Pond System under the CCR Rule.

The risk evaluation was initiated by developing a CSM to identify the potential for human or ecological exposure to constituents that may have been released to the environment. Constituents present in the Ash Pond System can be dissolved into infiltrating water (either from precipitation or from groundwater intrusion) and those constituents may move through the subsurface and could then be present in shallow groundwater. Constituents could move with groundwater as it flows, usually in a downgradient/downhill direction.

The new natural gas-fired power plant at EVGS requires cooling water, which is sourced from three high yield groundwater production wells that are screened in the alluvial aquifer. The groundwater flow downgradient of the Ash Pond System is toward the three production wells; groundwater downgradient of the Ash Pond System does not flow toward the White River while the production wells are operating. Untreated cooling water is discharged into the White River, via a National Pollutant Discharge Elimination System (NPDES) permitted outfall, through a canal that forms the northern boundary of the multi-unit Ash Pond System.

There are no on-site potable users of shallow groundwater at EVGS. Water for plant operations (steam generation) is obtained from groundwater and potable water is provided by the municipal water utility. The IDNR Division of Water Well Records database lists 18 wells within a ½ mile radius of the Ash Pond System. Three of these wells are the high yield groundwater production wells, and an additional seven wells are owned by IPL (five of which have reportedly been abandoned). There are no groundwater supply wells between the Ash Pond System and the production wells. There is a cluster of residential water wells located southeast of the Ash Pond System; however, these wells are upgradient of the Ash Pond System, whether or not the production wells are operational.

To answer the question, "Are the constituent concentrations high enough to potentially exert a toxic effect?" health risk-based screening levels were used for comparison to the data. Of the groundwater data collected, the majority (89%) are below GWPS (i.e., below drinking water standards). There is no direct exposure to groundwater at or downgradient of the Ash Pond System by human or ecological receptors.

This evaluation demonstrates that the impacts of the Ash Pond System are limited. There is no known impact on drinking water (there are no downgradient users of groundwater as drinking water) and there is no evidence of impact to human health or the environment. There is no exposure to CCR-derived constituents detected in groundwater at the EVGS facility. Even for the very few results that may be above screening values for some of the groundwater sampling events, there is no complete drinking water exposure pathway to groundwater. Where there is no exposure, there is no risk.

Therefore, because no adverse human health or environmental risk currently exists, any of the remedies considered in this CMA are all protective of human health and the environment, and implementation of any of the remedial alternatives will not result in a meaningful reduction in risk to groundwater-related exposures or risk.

4. Corrective Measures Alternatives

4.1 CORRECTIVE MEASURES ASSESSMENT GOALS

As noted in §257.96(a), within 90 days of detecting Appendix IV SSLs, "the owner or operator must initiate an assessment of corrective measures to prevent further releases, to remediate any releases and to restore affected area to original conditions." The corrective measures evaluation that is discussed below and subsequent sections provides an analysis of the effectiveness of three potential corrective measures in meeting the requirements and objectives of remedies as described under §257.97 (also shown in **Table I**). Additional remedial alternatives were considered but were determined to not be viable for remediating groundwater at this Site. By meeting these requirements, this assessment also meets the requirements promulgated in §257.96(c) for the balancing criteria (provided in more detail in **Section 1.3**) which includes an evaluation of:

- The performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to any residual contamination;
- The time required to begin and complete the remedy; and
- The institutional requirements, such as state or local permit requirements or other environmental or public health requirements that may substantially affect implementation of the remedy(s).

The criteria listed above are included in the balancing criteria considered during the corrective measures evaluation, described in **Section 5**.

4.2 GROUNDWATER FATE AND TRANSPORT MODELING

Groundwater at the Site was modeled utilizing Groundwater Vista Version 7 for flow and solute transport. The model was constructed, calibrated, and subsequent simulations run to evaluate remedy alternatives for Appendix IV constituents above the GWPS. Site-specific parameters (i.e., groundwater elevations and hydraulic conductivity) were utilized for model preparation. MODFLOW 2005, a finite difference three-dimensional solver, was utilized for groundwater flow estimation. Modeled groundwater elevations were compared to observed values from the on-site well network to achieve a calibration of less than 10% scaled root mean squared of measured water levels. Once groundwater flow was calibrated in the model, solute transport was completed using MT3DMS, a three-dimensional solute transport modeling program. Parameters affecting transport such as advection, diffusion, dispersion, and adsorption are utilized within the MT3DMS package to estimate solute transport within the model domain.

The calibrated flow models were used to simulate the different remediation alternatives and the effects they have on groundwater quality through time. These simulations predict that concentrations of SSL constituents decrease to the GWPS over time in the downgradient monitoring locations for each of the remedial alternatives. The simulation outcomes are incorporated into the Balancing Criterion 1 sub-category discussions **(Section 5.2.1).**

4.3 CORRECTIVE MEASURES ALTERNATIVES

Corrective measures (remedies) are considered complete when groundwater impacted by the Ash Pond System does not exceed the Appendix IV GWPS for three consecutive years of groundwater monitoring pursuant to §257.98(c)(2). In accordance with §257.97(b), for the groundwater remedies to be considered, they must meet, at a minimum, the following threshold criteria (provided in more detail in **Section 1.3**):

1. Be protective of human health and the environment;
2. Attain the GWPS as specified pursuant to §257.95(h);
3. Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in Appendix IV to this part into the environment;
4. Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems; and
5. Comply with standards (regulations) for management of waste as specified in §257.98(d).

Each of the remedial alternatives assembled as part of this CMA meet the requirements of the threshold criteria listed above.

The remedial alternatives presented below contemplate both hybrid[2] close in place (CIP) (Alternatives 1 and 2) and closure by removal (CBR) (Alternative 3) of the Ash Pond System. Both closure methods are expressly authorized under the CCR Rule. The remedial alternatives were also prepared considering the normal existing condition that includes continuous operation of the production well pumps. As supported above in **Section 2.2**, routine/scheduled plant outages (typically a few weeks long or less) will have little effect on groundwater flow direction and is therefore not considered part of the normal existing condition. IPL has prepared a CCR Rule compliant Ash Pond Closure Plan for Ponds A, B, and C that is subject to change based on the selected remedy. IPL is prepared to initiate closure of the units as part of the remedy within the allowable timeframes as stated in §257.101 of the CCR Rule.

4.3.1 Alternative 1 – Hybrid CIP with Capping and Hydraulic Containment through Groundwater Pumping with Ex-Situ Treatment

This remedy for the Ash Pond System would involve the removal of CCR that is in contact with groundwater (during seasonal-high groundwater conditions) and closure in place of the CCR that is present above the water table – thus a "hybrid CIP." CCR in contact with groundwater is limited to a small area (approximately 1.6 acres in size) located in the southwestern corner of the Ash Pond System and along the southern dike of Pond A. CCR in this area below the seasonal high-water table would be over-excavated and used as fill within the Ash Pond System to establish base grade for the cap system. The Ash Pond System would then be closed in place with a geomembrane and soil protective cap system to reduce infiltration of precipitation to groundwater thereby isolating source material. This cap would exceed the permeability performance criteria of 1×10^{-5} centimeters per second required by the CCR Rule and meet the expectations of the IDEM for purposes of CIP. This alternative would isolate the source through installation of a low-permeability cap.

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[2] The term "hybrid" refers to a closure method that includes removal of ash that is in contact with groundwater, and closure in place of the ash that is not in contact with groundwater.

Hybrid CIP can be completed safely, in compliance with applicable federal and state regulations, and be protective of public health and the environment. In general, hybrid CIP consists of removing CCR that is in contact with groundwater, installing a cap/cover designed to significantly reduce infiltration from surface water or rainwater, resist erosion, contain CCR materials, and prevent exposures to CCR. Hybrid CIP would require relocating CCR below the seasonal high-water table in Pond A, mounding of the CCRs within the Ash Pond System, or importation of borrow soil, in order to create a surface with adequate slope to construct a cap and prevent the mounding and ponding of stormwater. This would require extensive excavation and transferring of the material within the Ash Pond System. Excavation and construction safety during closure is a concern due to heavy equipment (e.g., bulldozers, excavators, front-end loaders, and off-road trucks) and dump truck operation within the active Site.

Arsenic, lithium, and molybdenum detected at the boundary of the unit at concentrations above the GWPS would be addressed with hydraulic containment[3] (HC) through groundwater pumping of the existing production wells associated with the Eagle Valley Combined Cycle Gas Turbine Natural Gas Plant to hydraulically control the migration of those constituents downgradient. Production well effluent would be treated ex-situ, likely with an ion exchange or a reverse osmosis (RO) treatment system. The treatment system would have ongoing operation and maintenance and would generate a secondary waste stream – including but not limited to the regeneration/replacement of the ion exchange media or accumulation of reject water from the RO system. Verification that the effluent could be discharged under the current NPDES permit or application for and approval of a NPDES permit modification may be required.

Following the installation of the low-permeability cap and the ex-situ treatment system, IPL would implement post-closure care activities that include operation of the production well system, long-term groundwater sampling to monitor HC system performance, and cap system maintenance. Once concentrations of arsenic, lithium, and molybdenum decrease to the GWPS, operation of the HC system could cease if groundwater from the production wells is no longer being used as process water. IPL would maintain the groundwater monitoring system and continue to monitor the groundwater pursuant to §§257.90 through 257.98.

4.3.2 Alternative 2 – Hybrid CIP with Capping and Hydraulic Containment through Groundwater Pumping with No Treatment

Using this alternative, the Ash Pond System would be closed in-place as described in **Section 4.3.1** to reduce infiltration of surface water to groundwater. Arsenic, lithium, and molybdenum detected at the boundary of the unit at concentrations above the GWPS would be addressed with HC through groundwater pumping of the existing production wells to hydraulically control the migration of those constituents downgradient. Production well water would be utilized by the plant as currently operated. Effluent wastewater is discharged directly to the discharge canal water under an NPDES permit. Under this alternative no treatment would be used prior to discharge. Verification that the effluent could be discharged under the current NPDES permit or application for and approval of an NPDES permit modification may be required.

Following the installation of the low-permeability cap, IPL would implement post-closure care activities that includes but is not limited to the continued operation of the Eagle Valley production well system (excluding routine plant outages), long-term groundwater sampling to monitor hydraulic control system

[3] The production wells at the facility demonstrate hydraulic capture under normal operating conditions.

performance, and cap system maintenance. Once concentrations of arsenic, lithium, and molybdenum decrease to the GWPS, operation of the production well system would cease if no longer in use by the plant. IPL would maintain the groundwater monitoring system and continue to monitor the groundwater pursuant to §§257.90 through 257.98.

4.3.3 Alternative 3 – Closure by Removal with Monitored Natural Attenuation

This alternative evaluates the removal of CCR from the Ash Pond System followed by natural attenuation of arsenic, lithium, and molybdenum in groundwater.

There are several potential community impacts and safety concerns associated with the CBR and off-site disposal option. Removal activities would likely require dewatering and temporary staging/stockpiling of material for drying prior to transportation, which may affect productivity and extend the timeframe to complete removal. During periods of rain and inclement weather, the removal schedule would be negatively impacted. Excavation and construction safety during the removal duration is another concern due to heavy equipment (e.g., bulldozers, excavators, front-end loaders, and off-road trucks) and dump truck operation within the active Site. Transport of CCR to an off-site commercial landfill can create safety concerns and traffic congestion due to truck haul routes through a mix of commercial or residential areas. With transportation over public roadways, there are increased exposures to transportation-related incidents. Fossil fuel consumption and vehicle emissions from transporting the CCR to a regional landfill are also significant in order to complete the off-site CBR alternative.

Groundwater would be addressed through monitored natural attenuation (MNA) which is a viable remedial technology that can reduce concentrations of arsenic, lithium, and molybdenum in groundwater at the boundary of the Ash Pond System. Upon completion of CBR, the concentrations of Appendix IV constituents above GWPS in groundwater would decline and attenuate. Upon completion of CBR, IPL would also implement post-closure groundwater monitoring until such time that groundwater conditions no longer exceed GWPS. IPL would maintain the groundwater monitoring system and continue to monitor the groundwater pursuant to §§257.90 through 257.98.

5. Comparison of Corrective Measures Alternatives

The purpose of this section is to evaluate and compare the three corrective measures alternatives using the balancing criteria described in §257.97(c).

5.1 EVALUATION CRITERIA

In accordance with §257.97, remedial alternatives[4] that satisfy the threshold criteria are then compared to four balancing (evaluation) criteria. The balancing criteria allow a comparative analysis for each corrective measure, thereby informing the final corrective measure selection. The four balancing criteria include the following (provided in more detail in **Section 1.3**):

1. The long- and short-term effectiveness and protectiveness of the potential remedy(s), along with the degree of certainty that the remedy will prove successful;
2. The effectiveness of the remedy in controlling the source to reduce further releases;
3. The ease or difficulty of implementing a potential remedy(s); and
4. The degree to which community concerns are addressed by a potential remedy(s).

The degree to which community concerns are addressed by the potential remedies will be considered following a public meeting to discuss the results of the corrective measures assessment with interested and affected parties and will be held at least 30 days prior to remedy selection in accordance with §257.96(e).

5.2 COMPARISON OF ALTERNATIVES

This section compares the alternatives to each other based on evaluation of the balancing criteria listed above. Each of the balancing criteria consists of several sub criteria listed in the CCR Rule (provided in detail in **Section 1.3**) which have been considered in this assessment. The goal of this analysis is to evaluate the alternatives based on whether each is technologically feasible, relevant, and readily implementable, provides adequate protection to human health and the environment, and minimizes impacts to the community as compared to other alternatives.

A color-coded graphic which is part of a comprehensive visual comparison tool (see **Table II**) is presented within each subsection below. These graphics provide a visual snapshot of the favorability of each alternative compared to the other alternatives, where green represents "most favorable," yellow represents "less favorable," and red represents "least favorable."

5.2.1 Balancing Criterion 1 – The Long- and Short-Term Effectiveness and Protectiveness of the Potential Remedy, along with the Degree of Certainty that the Remedy Will Prove Successful

This balancing criterion takes into consideration the following sub criteria relative to the long-term and short-term effectiveness of the remedy, along with the anticipated success of the remedy.

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[4]The terms "corrective measures alternatives" and "remedial alternatives" are used interchangeably within this report to represent potential remedies for satisfying the requirements of §257.97 of the CCR Rule.

5.2.1.1 Magnitude of reduction of existing risks

As summarized by the risk evaluation in **Section 3**, the Ash Pond System at EVGS does not pose a risk to human health or the environment. Therefore, the remedial alternatives considered are not necessary to reduce an assumed risk posed by the Appendix IV constituents, arsenic, lithium, and molybdenum, in groundwater because no such adverse risk exists. However, other types of impacts may be posed by the various remedial alternatives considered herein.

Alternatives 1 and 2, which include closure in place with continued operation of the pumping well system, are considered favorable because CCR remains in place without the need for material handling, dewatering, and transportation to an off-site landfill. Alternative 3 is considered less favorable with respect to this criterion due to the risks associated with material handling, dewatering, and transportation to the off-site landfill throughout the duration of the long-term construction project.

	Alternative 1 Hybrid CIP with Cap and HC with Ex-Situ Treatment	**Alternative 2** Hybrid CIP with Cap and HC with No Treatment	**Alternative 3** CBR with MNA
Category 1 - Subcriteria i) Magnitude of reduction of risks			

5.2.1.2 Magnitude of residual risks in terms of likelihood of further releases due to CCR remaining following implementation of a remedy

Following implementation of a remedy, all alternatives will initially achieve an equal magnitude of residual risks in terms of likelihood of further releases due to CCR remaining because full implementation of all the remedies will result in meeting the GWPS as a threshold criterion. However, for Alternatives 1 and 2 that include CIP, the uncertainty associated with CCR materials remaining in the environment represents a slightly higher potential risk, therefore these alternatives are considered less favorable with respect to this criterion. Alternative 3 is considered favorable since CCR materials are removed from the Site as part of the Ash Pond System closure.

	Alternative 1 Hybrid CIP with Cap and HC with Ex-Situ Treatment	**Alternative 2** Hybrid CIP with Cap and HC with No Treatment	**Alternative 3** CBR with MNA
Category 1 - Subcriteria ii) Magnitude of residual risk in terms of likelihood of further release			

5.2.1.3 The type and degree of long-term management required, including monitoring, operation, and maintenance

Alternatives 2 (CIP with HC and no treatment) and 3 (CBR with MNA) are the most favorable alternatives with respect to this criterion because they require the least amount of long-term management and involve no mechanical systems as part of the remedy, other than continued operation of the existing production wells. Alternative 1 (CIP with HC and treatment) is less favorable since this alternative include operation of the ex-situ treatment system until the GWPS is achieved.

	Alternative 1 Hybrid CIP with Cap and HC with Ex-Situ Treatment	**Alternative 2** Hybrid CIP with Cap and HC with No Treatment	**Alternative 3** CBR with MNA
Category 1 - Subcriteria iii) Type and degree of long-term management required			

5.2.1.4 *Short-term risks that might be posed to the community or the environment during implementation of such a remedy*

Community impacts include general impacts to the community due to increased truck traffic on public roads during construction of the remedies, along with truck emissions and noise. Because Alternative 3 includes transportation of the CCR material over public roadways or waterways for off-site disposal, this alternative is considered the least favorable. Alternatives 1 and 2 are generally limited to the transportation of capping materials onto the site as part of the remedy and are considered the most favorable relative to short-term risk to the community or environment.

	Alternative 1 Hybrid CIP with Cap and HC with Ex-Situ Treatment	**Alternative 2** Hybrid CIP with Cap and HC with No Treatment	**Alternative 3** CBR with MNA
Category 1 - Subcriteria iv) Short-term risk to community or environment during implementation			

5.2.1.5 *Time until full protection is achieved*

As previously stated, there is currently no unacceptable exposure to groundwater impacted by arsenic, lithium, and molybdenum associated with the Ash Pond System; therefore, protection is already achieved. The timeframes to achieve GWPS were evaluated using a predictive model as described in **Section 4.2**. Based upon predictive modeling the timeframes to achieve GWPS are equally favorable for Alternatives 1 and 2 which include CIP and continued operation of the production wells and Alternative 3 which includes CBR followed by a period of MNA to achieve GWPS. The timeframes to achieve the GWPS are similar for each of the three alternatives.

	Alternative 1 Hybrid CIP with Cap and HC with Ex-Situ Treatment	**Alternative 2** Hybrid CIP with Cap and HC with No Treatment	**Alternative 3** CBR with MNA
Category 1 - Subcriteria v) Time until full protection is achieved			

5.2.1.6 *Potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, re-disposal, or containment*

Alternative 2 (CIP with HC and no treatment) has the lowest potential for exposure to humans and environmental receptors and is considered most favorable with respect to this criterion since the CCR will be isolated by a low permeability cap and no additional waste streams will be generated. Alternative 1 (CIP with HC and ex-situ treatment) is considered less favorable since this scenario includes O&M of an ex-situ treatment system and generation of the secondary waste stream. Alternative 3 (CBR with MNA), which includes excavation, transportation, and disposal of CCR material has the highest potential risk for exposure to humans and environmental receptors due to construction and transportation and is therefore considered least favorable with respect to this criterion.

	Alternative 1 Hybrid CIP with Cap and HC with Ex-Situ Treatment	**Alternative 2** Hybrid CIP with Cap and HC with No Treatment	**Alternative 3** CBR with MNA
Category 1 - Subcriteria vi) Potential for exposure of humans and environmental receptors to remaining wastes			

5.2.1.7 *Long-term reliability of the engineering and institutional controls*

Alternative 3 (CBR with MNA) is expected to have high long-term reliability and is considered most favorable with respect to this criterion. Alternative 2, which incorporates CIP, is also considered reliable even though it requires the long-term maintenance of the cap and cover system along with continued operation of the existing production wells. Alternative 1, which includes ex-situ treatment in addition to continued operation of the existing production wells, would have high long-term reliability, but will require bench scale testing and rely on a treatment system to operate and maintain and is therefore considered less reliable.

	Alternative 1 Hybrid CIP with Cap and HC with Ex-Situ Treatment	**Alternative 2** Hybrid CIP with Cap and HC with No Treatment	**Alternative 3** CBR with MNA
Category 1 - Subcriteria vii) Long-term reliability of engineering and institutional controls			

5.2.1.8 *Potential need for replacement of the remedy*

While Alternatives 1 and 2 rely on mechanical systems as part of the remedy, the production wells that provide HC are currently operating and are shown to be effective at controlling the plume extent. Therefore, the need to replace the remedy under both alternatives is unlikely. Alternative 3, which incorporates CBR with MNA, also has a low likelihood of requiring replacement because source removal is permanent and natural processes will remedy groundwater.

	Alternative 1 Hybrid CIP with Cap and HC with Ex-Situ Treatment	Alternative 2 Hybrid CIP with Cap and HC with No Treatment	Alternative 3 CBR with MNA
Category 1 - Subcriteria viii) Potential need for replacement of the remedy			

5.2.1.9 Long- and short-term effectiveness and protectiveness criterion summary

The following graphic provides a summary of the long- and short-term effectiveness and protectiveness of the potential remedy, along with the degree of certainty that the remedy will prove successful. Alternative 2 (CIP with HC with no treatment) is considered the most favorable since this scenario includes continued use of the existing production wells to provide hydraulic containment, which has been demonstrated to be effective. Alternative 1 (CIP with HC and treatment) is considered less favorable since this alternative, while effective, would produce a secondary waste stream that would need to be handled and disposed, which creates a potential for exposure. Alternative 3 (CBR with MNA) is considered the least favorable since this scenario, while effective longer-term, would not provide protection during the construction period and would create both a potential for exposure and adverse community impacts, relative to the other alternatives.

	Alternative 1 Hybrid CIP with Cap and HC with Ex-Situ Treatment	Alternative 2 Hybrid CIP with Cap and HC with No Treatment	Alternative 3 CBR with MNA
CATEGORY 1 Long- and Short-Term Effectiveness, Protectiveness, and Certainty of Success			

5.2.2 Balancing Criterion 2 – The Effectiveness of the Remedy in Controlling the Source to Reduce Further Releases

This balancing criterion takes into consideration the ability of the remedy to control a future release, and the extensiveness of treatment technologies that will be required.

5.2.2.1 The extent to which containment practices will reduce further releases

Alternatives 1 and 2 are considered favorable in this sub-category because source material remains in place, but the existing production wells provide reliable HC and will continue to operate. Under the two closure in place alternatives, capping will be effective at isolating the source material. Containment practices in Alternatives 1 and 2 are proven and are known to successfully contain releases. While Alternative 3 (CBR with MNA) is considered highly effective at reducing further releases in the future because this alternative includes source removal, there is a potential for a further release during the removal construction period, which will be a large-scale project.

	Alternative 1 Hybrid CIP with Cap and HC with Ex-Situ Treatment	Alternative 2 Hybrid CIP with Cap and HC with No Treatment	Alternative 3 CBR with MNA
Category 2 - Subcriteria i) Extent to which containment practices will reduce further releases			

5.2.2.2 The extent to which treatment technologies may be used

For Alternative 3, no additional groundwater treatment technologies, other than natural attenuation will be used and is considered favorable with respect to this criterion. Alternative 2 is also considered favorable since the production wells are currently operating and provide HC and are considered an existing technology. Alternative 1 will include an ex-situ treatment system treating thousands of gallons per minute of effluent and is considered least favorable. The ex-situ treatment system will create a secondary waste stream, such as concentrated reject water (from RO) requiring off-site disposal, or depleted resin (from ion exchange), requiring regeneration or off-site disposal.

	Alternative 1 Hybrid CIP with Cap and HC with Ex-Situ Treatment	Alternative 2 Hybrid CIP with Cap and HC with No Treatment	Alternative 3 CBR with MNA
Category 2 - Subcriteria ii) Extent to which treatment technologies may be used			

5.2.2.3 Effectiveness of the remedy in controlling the source to reduce further releases summary

The graphic below provides a summary of the effectiveness of the remedial alternatives to control the source to reduce further releases. Alternative 2 (CIP with HC and no treatment) is considered the most favorable since the remedy relies on the existing production wells to control the source of release, which has been demonstrated to be effective. Alternative 3 (CBR with MNA) is considered less favorable since this scenario adds an ex-situ treatment system (additional treatment technology with long-term O&M) which is not included with Alternative 2. Alternative 1 (CIP with HC and treatment) is considered the least favorable since this scenario will successfully control the source longer-term, but further releases may occur during the large-scale construction period.

	Alternative 1 Hybrid CIP with Cap and HC with Ex-Situ Treatment	Alternative 2 Hybrid CIP with Cap and HC with No Treatment	Alternative 3 CBR with MNA
CATEGORY 2 Effectiveness in controlling the source to reduce further releases			

5.2.3 Balancing Criterion 3 – The Ease or Difficulty of Implementing a Potential Remedy

This balancing criterion takes into consideration technical and logistical challenges required to implement a remedy, including practical considerations such as equipment availability and disposal facility capacity.

5.2.3.1 Degree of difficulty associated with constructing the technology

Alternative 2 (CIP with HC and no treatment) is considered most favorable since the concepts and technologies are proven and capping can be implemented in a reasonable timeframe. The production wells are currently operating, providing HC. Alternative 1 (CIP with HC and treatment) is considered less favorable since this alternative includes the installation of an ex-situ treatment system. Alternative 3 (CBR with MNA) will involve a large-scale construction project to remove CCR from the Ash Pond System and is therefore considered the least favorable.

	Alternative 1 Hybrid CIP with Cap and HC with Ex-Situ Treatment	**Alternative 2** Hybrid CIP with Cap and HC with No Treatment	**Alternative 3** CBR with MNA
Category 3 - Subcriteria i) Degree of difficulty associated with constructing the technology			

5.2.3.2 Expected operational reliability of the technologies

Alternatives 2 (CIP with HC and no treatment) and 3 (CBR with MNA) are considered the most favorable from an operational perspective. Under Alternative 2, the production wells are currently operating and are proven reliable. Under Alternative 3, removal of the source followed by MNA has a proven track record and only requires long-term monitoring following implementation. While Alternative 1 (CIP with HC and treatment) also includes HC and is expected to be reliable, this alternative will utilize additional groundwater treatment technologies which will require treatability studies and operations and maintenance and therefore Alternative 1 is considered less favorable when compared to the other two alternatives.

	Alternative 1 Hybrid CIP with Cap and HC with Ex-Situ Treatment	**Alternative 2** Hybrid CIP with Cap and HC with No Treatment	**Alternative 3** CBR with MNA
Category 3 - Subcriteria ii) Expected operational reliability of the technologies			

5.2.3.3 Need to coordinate with and obtain necessary approvals and permits from other agencies

Alternative 2 (CIP with HC and no treatment) is the most favorable since the implementation of the remedy is straightforward and only includes capping and continued operation of the production wells to address groundwater. Alternative 1 will require additional permitting and approvals for treatability testing, field scale pilot testing, groundwater discharge, groundwater treatment, and/or disposal of secondary waste streams and is considered less favorable. Alternative 3 (CBR with MNA) is considered least favorable since highly complex permits may be necessary to obtain waterway, floodway, and waste management approvals and permits will be required for removal of the Ash Pond System.

	Alternative 1 Hybrid CIP with Cap and HC with Ex-Situ Treatment	**Alternative 2** Hybrid CIP with Cap and HC with No Treatment	**Alternative 3** CBR with MNA
Category 3 - Subcriteria iii) Need to coordinate with and obtain necessary approvals and permits from other agencies			

5.2.3.4 Availability of necessary equipment and specialists

Alternatives 1 and 2, which include capping and HC, are considered favorable since equipment for completion is expected to be readily available and specialists will not be needed. Alternative 3 (CBR with MNA) is considered less favorable since the construction project is large scale and will require a variety of equipment.

	Alternative 1 Hybrid CIP with Cap and HC with Ex-Situ Treatment	**Alternative 2** Hybrid CIP with Cap and HC with No Treatment	**Alternative 3** CBR with MNA
Category 3 - Subcriteria iv) Availability of necessary equipment and specialists			

5.2.3.5 Available capacity and location of needed treatment, storage, and disposal services

Alternative 2 (CIP with HC and no treatment) is considered the most favorable since treatment, storage, and disposal will not be needed. The production wells will continue to operate. Alternative 3, which includes closure by removal, requires adequate capacity, storage, and disposal services. Due to the relatively large size of the Ash Pond System and anticipated need for off-site disposal, this alternative is considered the least favorable. For Alternative 1 which includes HC with groundwater treatment, the ex-situ treatment system may generate a concentrated waste stream which would require off-site transportation and disposal that Alternative 2 would not require and is therefore considered less favorable.

	Alternative 1 Hybrid CIP with Cap and HC with Ex-Situ Treatment	**Alternative 2** Hybrid CIP with Cap and HC with No Treatment	**Alternative 3** CBR with MNA
Category 3 - Subcriteria v) Available capacity and location of needed treatment, storage, and disposal services			

5.2.3.6 Ease or difficulty of implementation summary

The graphic below provides a summary of the ease or difficulty that will be needed to implement each alternative. Alternative 2 (CIP with HC and no treatment) is considered the most favorable because implementation is straightforward, equipment for completion is readily available, and specialists will not be needed, while the Alternative 1 which includes an ex-situ treatment system is considered less favorable since it requires pilot testing, installation of a groundwater treatment system that requires long term O&M, along with disposal of secondary waste streams. Due to the large-scale construction for removal and need for off-site disposal requirements along with highly complex permits that may be necessary to obtain waterway, floodway approvals Alternative 3 (CBR with MNA) is considered the least favorable.

	Alternative 1 Hybrid CIP with Cap and HC with Ex-Situ Treatment	**Alternative 2** Hybrid CIP with Cap and HC with No Treatment	**Alternative 3** CBR with MNA
CATEGORY 3 Ease of implementation			

6. Summary

This Corrective Measures Assessment has evaluated the following alternatives:

- Alternative 1: Hybrid CIP with capping and HC through groundwater pumping with ex-situ treatment;
- Alternative 2: Hybrid CIP with capping and HC through groundwater pumping with no treatment; and
- Alternative 3: CBR with MNA.

In accordance with §257.97(b), each of these alternatives has been evaluated in the context of the following threshold criteria:

- Be protective of human health and the environment;
- Attain the GWPS as specified pursuant to §257.95(h);
- Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in Appendix IV to this part into the environment;
- Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems; and
- Comply with standards for management of wastes as specified in §257.98(d).

In addition, in accordance with §257.96(c), each of the alternatives has been confirmed to meet the following balancing criteria:

- The long- and short-term effectiveness and protectiveness of the potential remedy(s), along with the degree of certainty that the remedy will prove successful;
- The effectiveness of the remedy in controlling the source to reduce further releases;
- The ease or difficulty of implementing a potential remedy(s); and
- The degree to which community concerns are addressed by a potential remedy(s).

This Corrective Measures Assessment, and the input received during the public meeting, and any additional information, including N&E investigative work results will be used to select a remedy (corrective measure) for implementation at the Site in accordance with the CCR Rule. §257.97(a) requires that a semi-annual report be prepared to document progress toward remedy selection and design. Once a remedy is selected, a final remedy selection report must be prepared to document details of the selected remedy and how the selected remedy meets §257.97(b) requirements. The final selected remedy report will also be certified by a professional engineer and posted to the EVGS CCR website.

References

1. ATC. 2019. 2018 CCR Annual Groundwater Monitoring and Corrective Action Report, IPL Ash Pond System Monitoring Program, Eagle Valley Generating Station, Indianapolis, Indiana.

2. ATC. 2018. Revised Groundwater Sampling and Analysis Plan, IPL Ash Pond System Monitoring Program, Eagle Valley Generating Station, Indianapolis, Indiana.

3. ATC. 2018. 2017 CCR Annual Groundwater Monitoring and Corrective Action Report, IPL Ash Pond System Monitoring Program, Eagle Valley Generating Station, Indianapolis, Indiana.

4. Sargent & Lundy. 2019. Addendum to Ash Pond System Closure & Post Closure Plan. IPL Eagle Valley Generating Station.

5. Sargent & Lundy. 2016. Ash Pond System Closure & Post Closure Plan. IPL Eagle Valley Generating Station.

6. USEPA. 2015. Frequent Questions about the 2015 Coal Ash Disposal Rule. https://www.epa.gov/coalash/frequent-questions-about-2015-coal-ash-disposal-rule

7. USEPA. 2015a. Final Rule: Disposal of Coal Combustion Residuals (CCRs) for Electric Utilities. 80 CFR 21301-21501. U.S. Environmental Protection Agency, Washington, D.C. Available at: https://www.govinfo.gov/content/pkg/FR-2015-04-17/pdf/2015-00257.pdf

8. USEPA. 2015b. Use of Monitored Natural Attenuation for Inorganic Contaminants in Groundwater at Superfund Sites.

9. USEPA. 2018a. USEPA Regional Screening Levels. November 2018, values for tap water. U.S. Environmental Protection Agency. Available at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

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TABLES

TABLE I
REMEDIAL ALTERNATIVE ROADMAP
CORRECTIVE MEASURES ASSESSMENT
ASH POND SYSTEM
EAGLE VALLEY GENERATING STATION - MARTINSVILLE, INDIANA

Alternative Number	Remedial Alternative Description	Pond Closure Description	Groundwater Remedy Components		
			A. Groundwater Remedy Approach	B. Groundwater Treatment Method	C. Post-Closure Actions
1	**Hybrid CIP with Capping and Hydraulic Containment through Groundwater Pumping with Ex-Situ Treatment**	**CIP with Synthetic Cap**	**Hydraulic Containment** Mitigate off-site migration of groundwater with CCR constituents above GWPS using existing groundwater production wells associated with the Combined Cycle Gas Turbine Natural Gas Plant	**Ex-Situ Treatment** Treatment system (ion exchange or reverse osmosis) to remove CCR constituents from groundwater and discharge under applicable permits	**Pump & Treat Long-Term** Continue to operate pumping well system to maintain reduction of CCR constituents in groundwater
2	**Hybrid CIP with Capping and Hydraulic Containment through Groundwater Pumping with No Treatment**	**CIP with Synthetic Cap**	**Hydraulic Containment** Mitigate off-site migration of groundwater with CCR constituents above GWPS using existing groundwater production wells associated with the Combined Cycle Gas Turbine Natural Gas Plant	**No Active Treatment** No active treatment technologies for groundwater to address CCR constituents	**Pump Long-Term** Continue to operate pumping well system to contain CCR constituents in groundwater
3	**Closure by Removal (CBR) with MNA**	**CBR**	**Natural Attenuation with Monitoring** Mitigate off-site migration of groundwater with CCR constituents above GWPS through process of natural attenuation	**No Active Treatment** No active treatment technologies for groundwater to address CCR constituents	**MNA** Long-term groundwater monitoring to confirm reduction of CCR constituents

Note: Hybrid CIP includes removal/replacement of 1.5+/- acre area of ash below GW table and backfill with clean fill as described in current proposed Closure Plan.

TABLE II

SUMMARY OF CORRECTIVE MEASURES

CORRECTIVE MEASURES ASSESSMENT

ASH POND SYSTEM

EAGLE VALLEY GENERATING STATION - MARTINSVILLE, INDIANA

THRESHOLD CRITERIA

Alternative Number	Remedial Alternative Description	Be protective of human health and the environment	Attain the groundwater protective standard	Control the source of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of Appendix IV constituents into the environment	Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems	Management of waste to comply with all applicable RCRA requirements
1	Hybrid CIP with Capping and Hydraulic Containment through Groundwater Pumping with Ex-Situ Treatment	✓	✓	✓	✓	✓
2	Hybrid CIP with Capping and Hydraulic Containment through Groundwater Pumping with No Treatment	✓	✓	✓	✓	✓
3	Closure by Removal (CBR) with MNA	✓	✓	✓	✓	✓

BALANCING CRITERIA

Alternative Number	Remedial Alternative Description	CATEGORY 1 Long- and Short-Term Effectiveness, Protectiveness, and Certainty of Success that the remedy will prove successful	Sub-Category 1 – 1: *Magnitude of reduction of existing risks*	Sub-Category 1 – 2: *Magnitude of residual risks in terms of likelihood of further releases due to CCR remaining following implementation of a remedy*	Sub-Category 1 – 3: *Type and degree of long-term management required including monitoring, operation and maintenance*	Sub-Category 1 – 4: *Short-term risk to community or environment during implementation of remedy*	Sub-Category 1 – 5: *Time until full protection is achieved*	Sub-Category 1 – 6: *Potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, re-disposal, or containment*	Sub-Category 1 – 7: *Long-term reliability of engineering and institutional controls*	Sub-Category 1 – 8: *Potential need for replacement of the remedy*
1	Hybrid CIP with Capping and Hydraulic Containment through Groundwater Pumping with Ex-Situ Treatment	Yellow	Green	Yellow	Yellow	Green	Green	Yellow	Yellow	Green
2	Hybrid CIP with Capping and Hydraulic Containment through Groundwater Pumping with No Treatment	Green	Green	Yellow	Green	Green	Green	Green	Green	Green
3	Closure by Removal (CBR) with MNA	Red	Yellow	Green	Green	Red	Green	Red	Green	Green

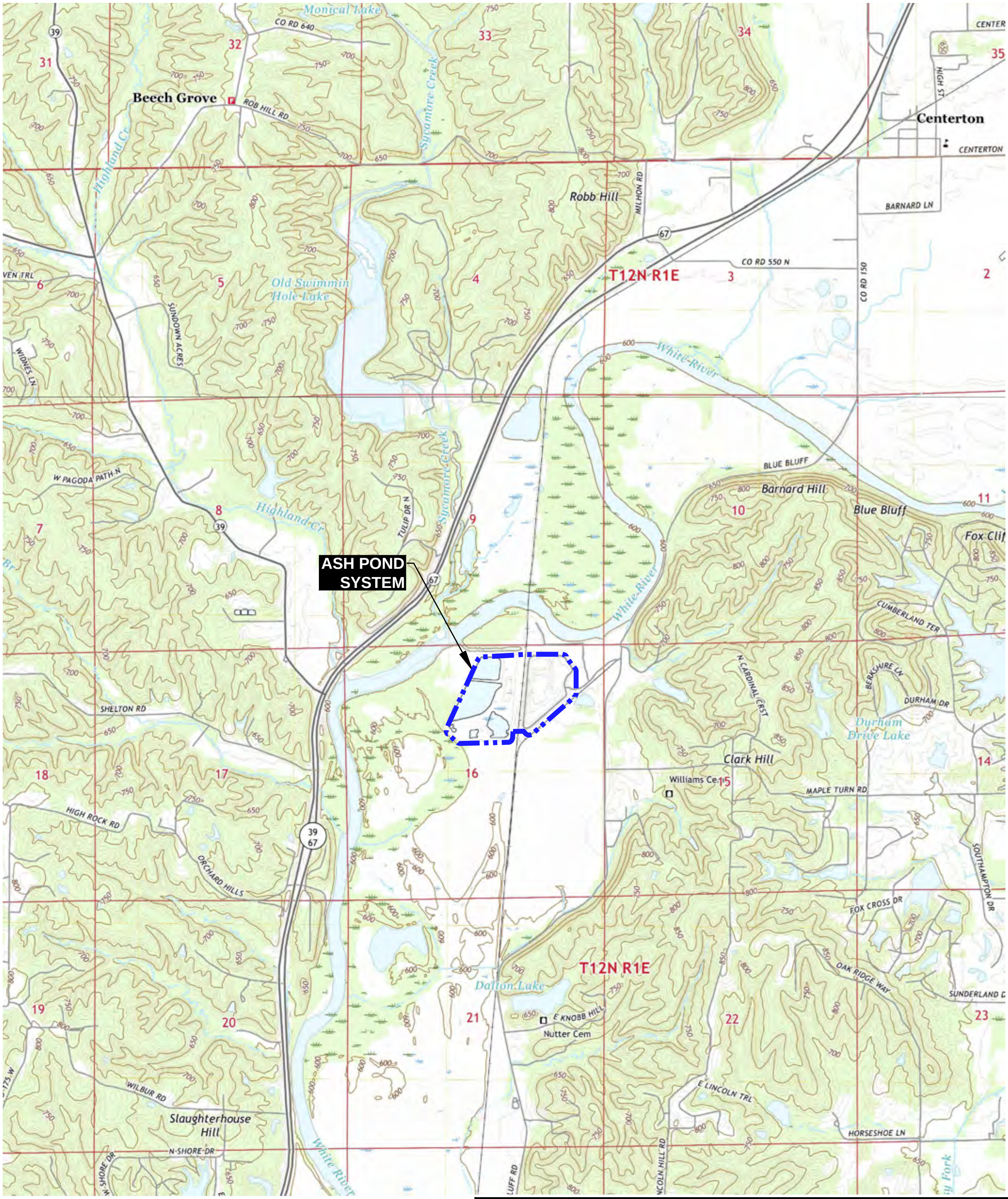
Alternative Number	Remedial Alternative Description	CATEGORY 2 Effectiveness in controlling the source to reduce further releases	Sub-Cat. 2 – 1: *Extent to which containment practices will reduce further releases*	Sub-Cat. 2 – 2: *Extent to which treatment technologies may be used*	CATEGORY 3 The ease or difficulty of implementation	Sub-Category 3 – 1: *Degree of difficulty associated with constructing the technology*	Sub-Category 3 – 2: *Expected operational reliability of the technologies*	Sub-Category 3 – 3: *Need to coordinate with and obtain necessary approvals and permits from other agencies*	Sub-Category 3 – 4: *Availability of necessary equipment and specialists*	Sub-Category 3 – 5: *Available capacity and location of needed treatment, storage, and disposal services*
1	Hybrid CIP with Capping and Hydraulic Containment through Groundwater Pumping with Ex-Situ Treatment	Red	Green	Red	Yellow	Yellow	Yellow	Yellow	Green	Yellow
2	Hybrid CIP with Capping and Hydraulic Containment through Groundwater Pumping with No Treatment	Green	Green	Green	Green	Green	Green	Green	Green	Green
3	Closure by Removal (CBR) with MNA	Yellow	Yellow	Green	Red	Red	Green	Red	Yellow	Red

COLOR LEGEND

- Green: **Most favorable when compared to other alternatives**
- Yellow: **Less favorable when compared to other alternatives**
- Red: **Least favorable when compared to other alternatives**

1. For context, this a relative comparison of remedial options for this site. Site conditions, weather, and site-specific considerations are made in this table. This is not a comparison to all options at all sites.

FIGURES



MAP SOURCE: USGS
QUADRANGELS: MARTINSVILLE, IN 2019
MOORESVILLE WEST, IN 2019

HALEY ALDRICH

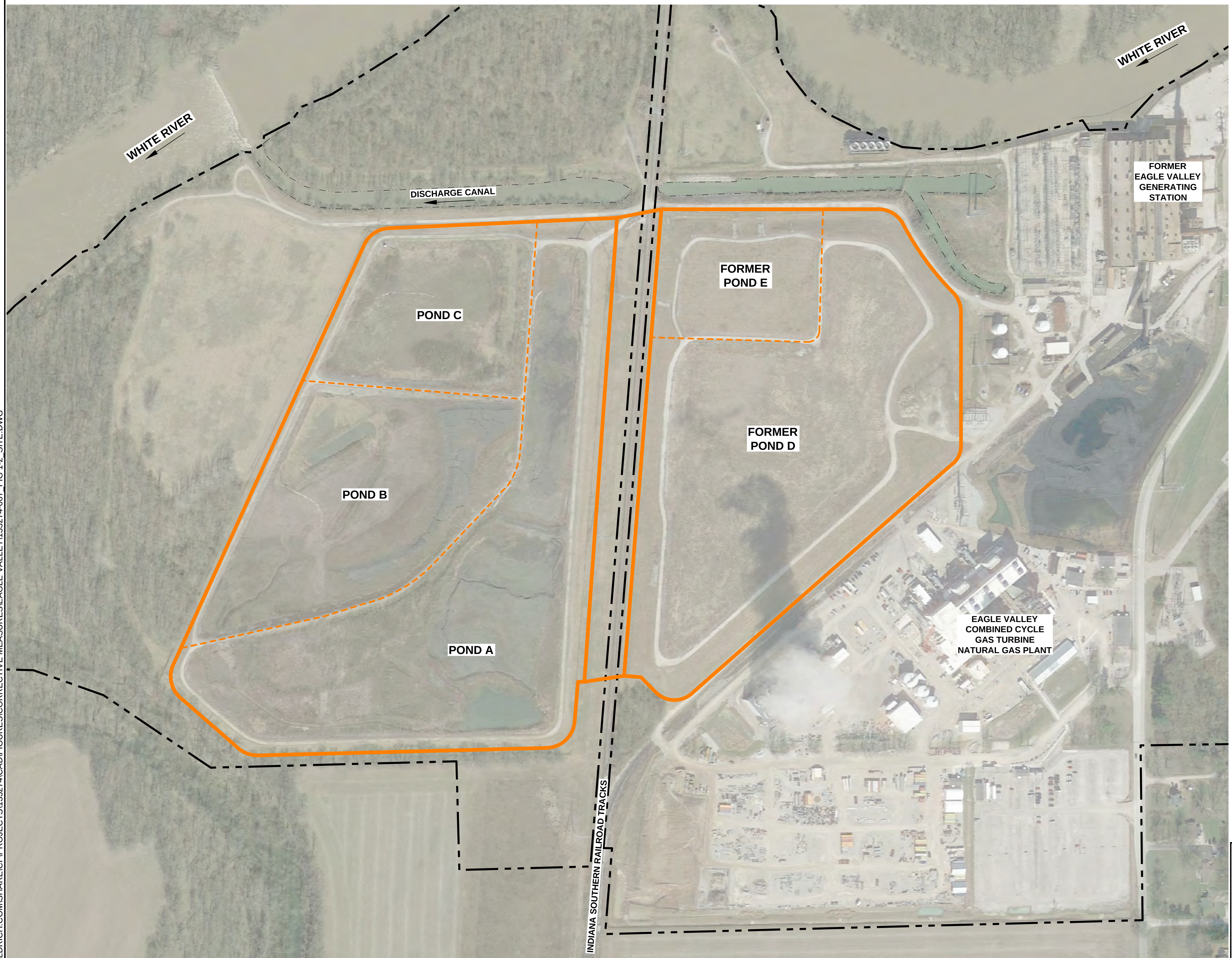
CORRECTIVE MEASURES ASSESSMENT
ASH POND SYSTEM
EAGLE VALLEY GENERATING STATION
MARTINSVILLE, INDIANA

SITE LOCATION MAP

APPROXIMATE SCALE: 1IN = 3000 FT
OCTOBER 2019

FIGURE 1-1

VARI, KATALIN Printed: 9/30/2019 5:10 PM Layout: FIGURE 1-1
\\HALEYALDRICH.COM\SHARE\CF\PROJECTS\133274\CAD\FIGURES\CORRECTIVE MEASURES\EAGLE VALLEY\133274-007_FIG 1-1_SLM.DWG



LEGEND

- APPROXIMATE LIMITS OF PROPERTY
- APPROXIMATE LIMITS OF ASH POND SYSTEM
- APPROXIMATE BOUNDARY OF ASH POND

NOTES

1. AERIAL IMAGE FROM GOOGLE EARTH, DATED 03/02/2018.
2. ALL BOUNDARIES AND LOCATIONS ARE APPROXIMATE.

N

0 360 720

SCALE IN FEET

HALEY ALDRICH

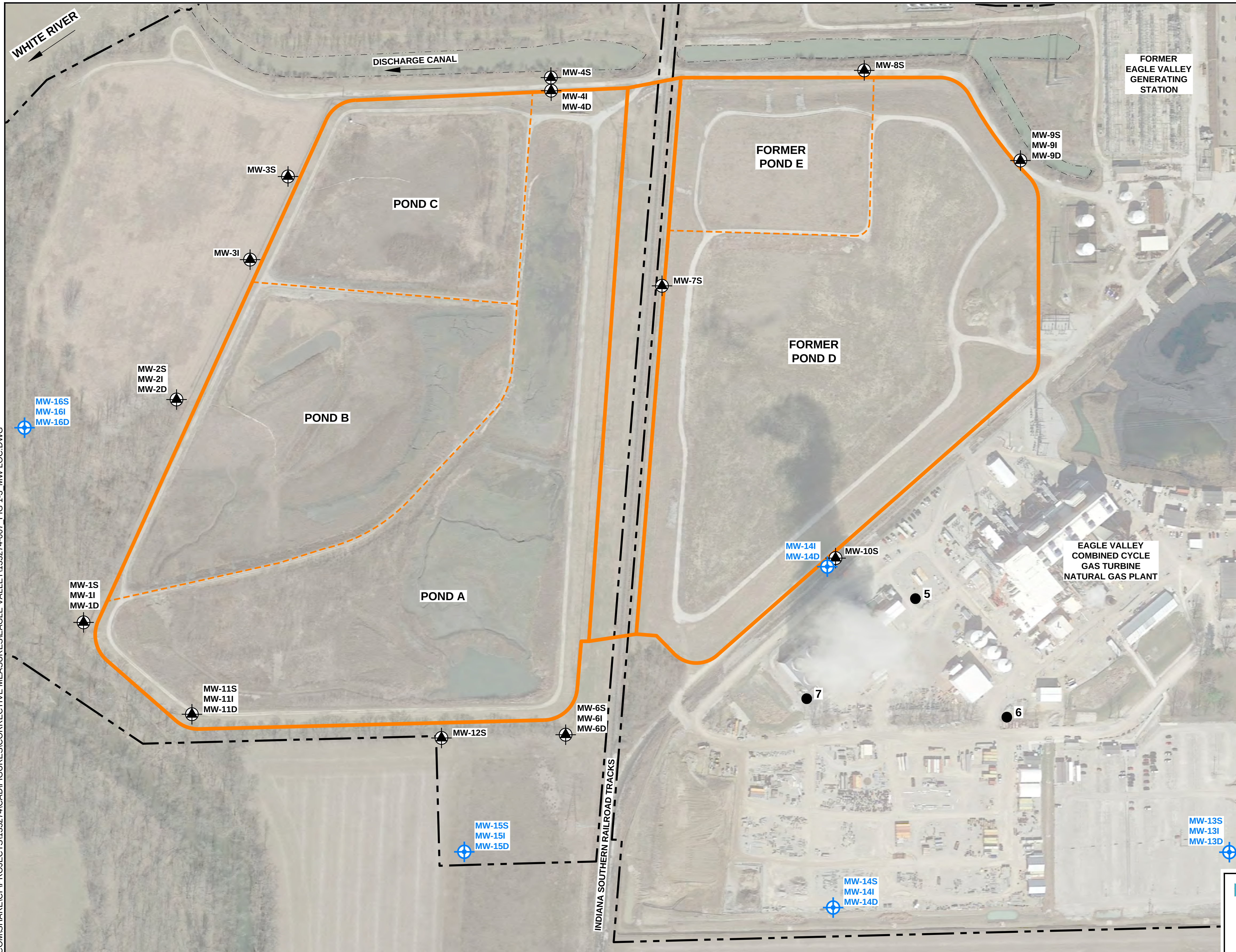
CORRECTIVE MEASURES ASSESSMENT
ASH POND SYSTEM
EAGLE VALLEY GENERATING STATION
MARTINSVILLE, INDIANA

SITE FEATURES

SCALE: AS SHOWN
OCTOBER 2019

FIGURE 1-2

VARI, KATALIN Saved: 10/1/2019 2:39 PM Layout: FIGURE 1-2
\\HALEYALDRICH.COM\SHARE\CF\PROJECTS\133274\CAD\FIGURES\CORRECTIVE MEASURES\EAGLE VALLEY\133274-007_FIG 1-2_SITE.DWG



LEGEND

- APPROXIMATE LIMITS OF PROPERTY
- APPROXIMATE LIMITS OF ASH POND SYSTEM
- APPROXIMATE BOUNDARY OF ASH POND
- MW-3 CCR MONITORING WELL
- MW-15 NATURE AND EXTENT MONITORING WELL
- 5 PRODUCTION WELL

NOTES

1. AERIAL IMAGE FROM GOOGLE EARTH, DATED 03/02/2018.
2. ALL BOUNDARIES AND LOCATIONS ARE APPROXIMATE.
3. MONITORING WELL LOCATIONS OBTAINED FROM FIGURE 2 2018 CCR ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT (ATC, JANUARY 2019).
4. WELL DESIGNATION:
   - S = SHALLOW WELL
   - I = INTERMEDIATE WELL
   - D = DEEP WELL
5. CCR = COAL COMBUSTION RESIDUALS

N

0 300 600
SCALE IN FEET

HALEY ALDRICH

CORRECTIVE MEASURES ASSESSMENT
ASH POND SYSTEM
EAGLE VALLEY GENERATING STATION
MARTINSVILLE, INDIANA

CCR AND N&E MONITORING WELL LOCATIONS

SCALE: AS SHOWN
OCTOBER 2019

FIGURE 1-3

VARI, KATALIN
\\HALEYALDRICH.COM\SHARE\CF\PROJECTS\133274\CAD\FIGURES\CORRECTIVE MEASURES\EAGLE VALLEY\133274-007_FIG 1-3_MW LOC.DWG
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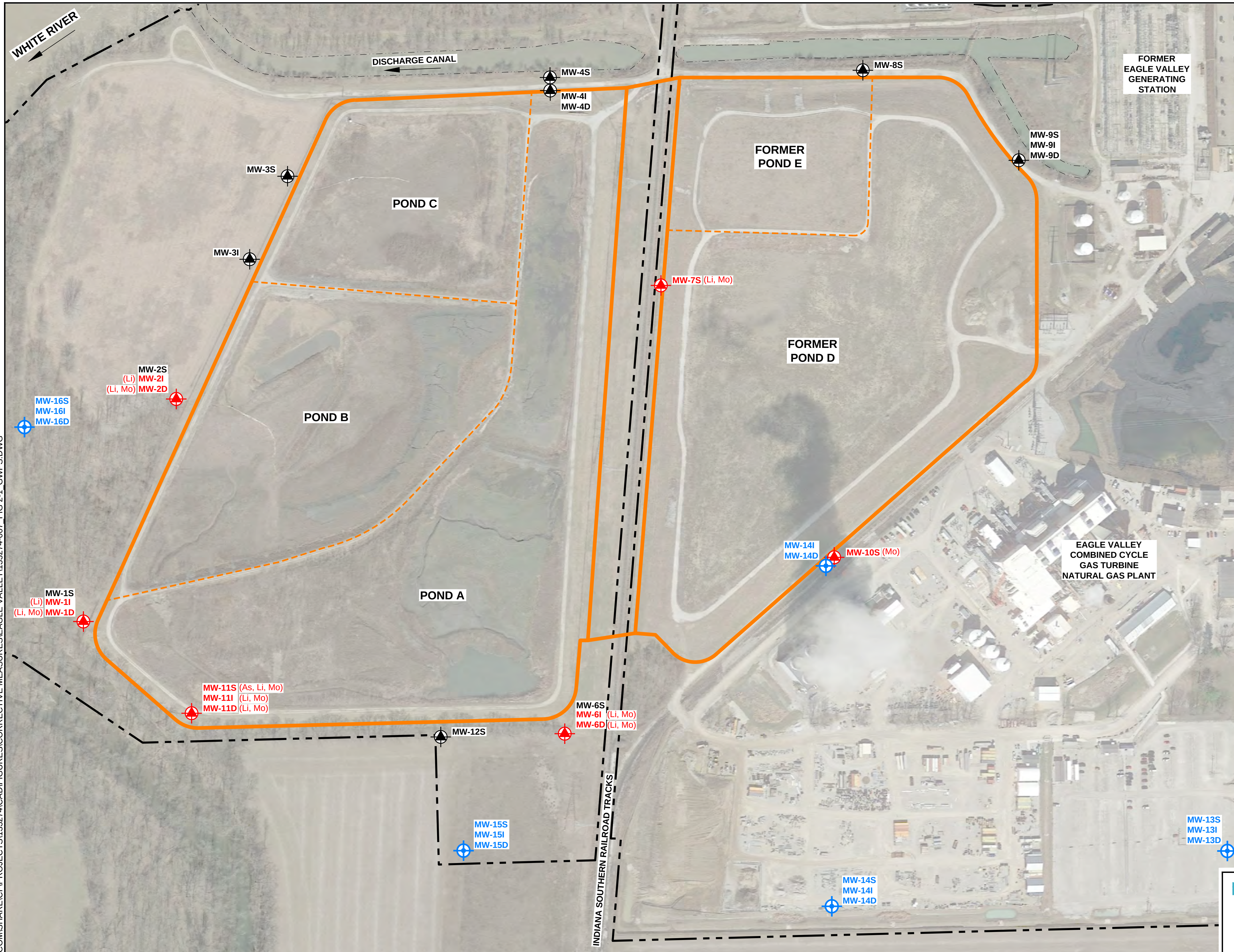
Layout: FIGURE 1-3



LEGEND

- APPROXIMATE LIMITS OF PROPERTY
- APPROXIMATE LIMITS OF ASH POND SYSTEM
- APPROXIMATE BOUNDARY OF ASH POND
- MW-3 — CCR MONITORING WELL WITH NO SSL
- MW-15 — NATURE AND EXTENT MONITORING WELL
- MW-7 — CCR MONITORING WELL WITH REPORTED SSL
  - As = ARSENIC
  - Li = LITHIUM
  - Mo = MOLYBDENUM

NOTES

1. AERIAL IMAGE FROM GOOGLE EARTH, DATED 03/02/2018.
2. ALL BOUNDARIES AND LOCATIONS ARE APPROXIMATE.
3. MONITORING WELL LOCATIONS OBTAINED FROM FIGURE 2 2018 CCR ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT (ATC, JANUARY 2019).
4. WELL DESIGNATION:
   - S = SHALLOW WELL
   - I = INTERMEDIATE WELL
   - D = DEEP WELL
5. CCR = COAL COMBUSTION RESIDUALS
6. SSL = STATISTICALLY SIGNIFICANT LEVEL
7. SSLs HAVE NOT BEEN DEVELOPED FOR MONITORING WELL LOCATIONS MW-10I AND MW-10D.

N

0 300 600
SCALE IN FEET

HALEY ALDRICH

CORRECTIVE MEASURES ASSESSMENT
ASH POND SYSTEM
EAGLE VALLEY GENERATING STATION
MARTINSVILLE, INDIANA

CCR MONITORING WELL LOCATIONS WITH STATISTICALLY SIGNIFICANT LEVELS ABOVE GROUNDWATER PROTECTION STANDARDS

SCALE: AS SHOWN
OCTOBER 2019

FIGURE 2-1

VARI, KATALIN \\HALEYALDRICH.COM\SHARE\CF\PROJECTS\133274\CAD\FIGURES\CORRECTIVE MEASURES\EAGLE VALLEY\133274-007_FIG 2-1_GWPS.DWG
Saved: 10/10/2019 12:27 PM Layout: FIGURE 2-1