

November 16, 2020

Southern Illinois Power Cooperative (SIPC) is posting the Corrective Action Report, the Groundwater Monitoring Report, and the Closure Plan in draft form. While these reports represent the best possible information available at the time of posting, all three reports are under review by the Illinois Environmental Protection Agency and are being or will be updated as necessary.

DRAFT

Emery Pond

Groundwater Monitoring Plan

Marion Power Plant
Southern Illinois Power Cooperative
Marion, Williamson County, Illinois

revised October 29, 2020

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1. Introduction

The following monitoring plan is for the Southern Illinois Power Cooperative [SIPC] Marion Power Plant's [Plant] Emery Pond [Site]. This update is needed due to the development of a Corrective Action Plan [CAP] and Closure Plan for the Site. Figure 1 shows the location of the Plant.

2. Site Hydrogeology

The site is located in the Shawnee Hills section within the Interior Low Plateaus (physiographic) Province (Leighton et al., 1948). Site geology consists of glacially derived deposits of the Illinoian Stage overlying Pennsylvanian Age bedrock. Table 1 list the hydro- and litho-stratigraphic units with their descriptions located within 50 feet of the surface at the Site (Willman et al, 1995 and Berg & Kempton, 1988).

Table 1. Site Geologic/Hydrogeologic Units

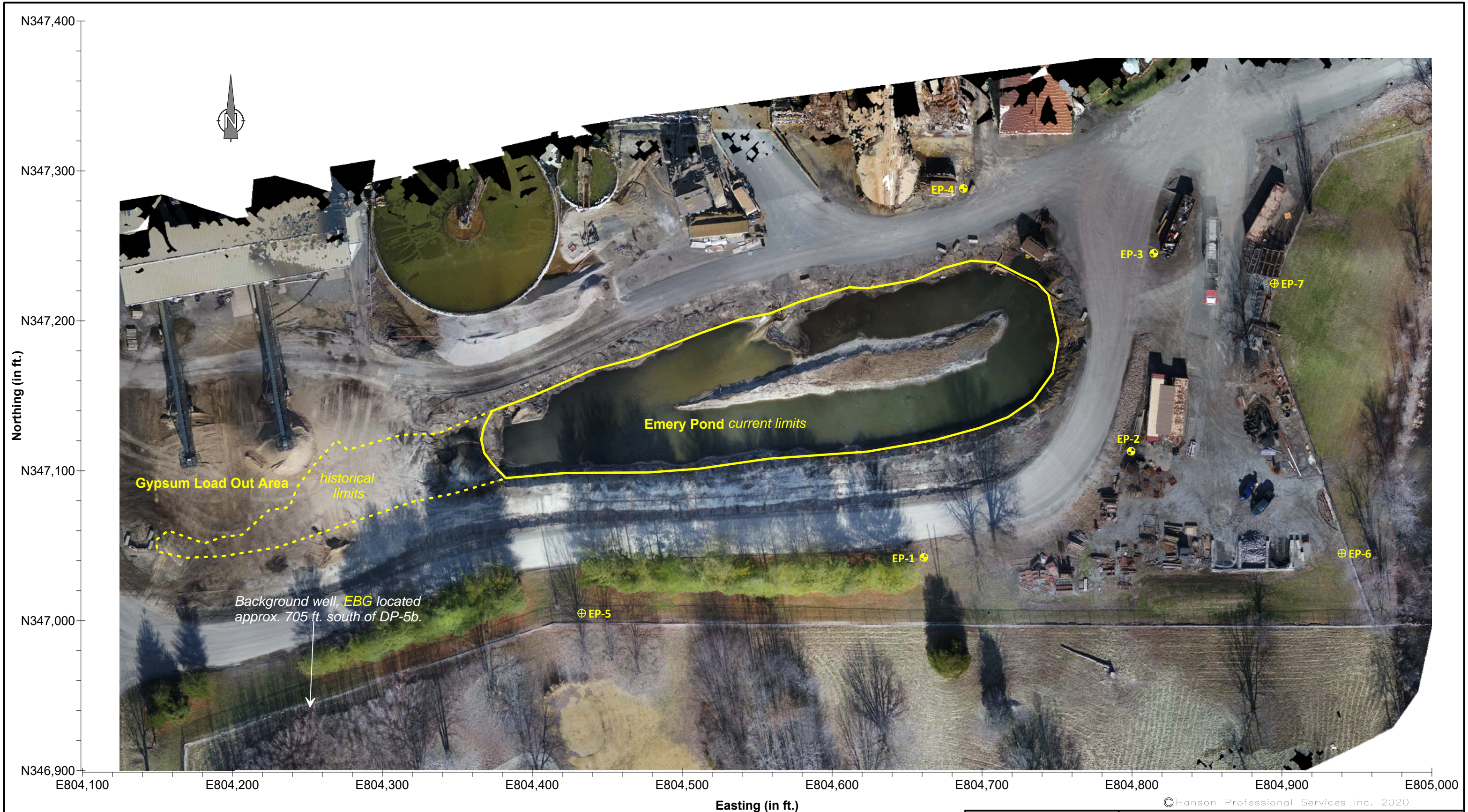
Litho-stratigraphic Unit	Hydro-stratigraphic Unit	Lithologic Description
Peoria/Roxana Silt	Unlithified Unit	light yellow tan to gray, fine sandy silt
Glasford Formation (undifferentiated)		silty/sandy diamictons with thin lenticular bodies of silt, sand, and gravel
Caseyville Formation	Bedrock Unit	primarily sandstone with shales

As identified in the Hydrogeologic Investigation Report (Hanson, 2019a), groundwater at the Site has been classified as Class II: General Resource Groundwater (35 IAC 620.240) in the Unlithified Unit and the upper (approx. 11 ft.) of the Bedrock Unit. This is the strata the current monitoring system is evaluating. This investigation also concluded that there is no aquifer (as defined by the CCR Rule) at the Site. However, after further review and discussions with Illinois EPA, SIPC continues to monitor the shallow groundwater as the uppermost aquifer for compliance with US EPA and proposed Illinois EPA rules.

3. Groundwater Monitoring Network

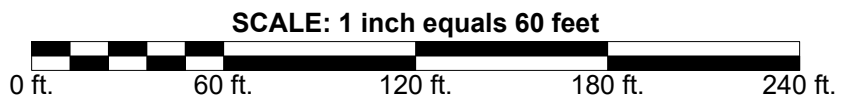
The current groundwater monitoring wells for the Site are all screened at the Unlithified Unit/Bedrock Unit interface. Five (5) monitoring wells were installed at five (5) locations around the facility by Holcomb Foundation Engineering Inc. in early-February 2017 under the direction of AECOM (2018). The wells consisted of 2-inch diameter, schedule 40 PVC pipe with 10-ft long, 0.010-inch slotted well screens. A silica sand (grain size 10/20) filter medium was used to construct the sand pack around each well screen. The depth of the screen and the depth to the top of the filter pack were measured and recorded in the field by the geologist. Bentonite chips were placed on top of the sand pack filling the borehole to 2 to 3 ft. below the ground surface or a minimum thickness of 2 ft.

A steel, lockable, protective outer casing was installed for each well. A concrete monument was constructed around the outer casing with the concrete extending from the ground surface to the top of the bentonite seal. After installation, the locations and elevations of the wells were surveyed using the State Plane horizontal grid and elevation system. All surveying was performed under the direction of an Illinois Licensed Professional Land Surveyor. The monitoring system and individual wells were installed to meet the requirements of 40 CFR 257.90-97. Table 2 lists the current monitoring well, locations and elevations.



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- EXPLANATION**
- Existing Monitoring Well
 - Proposed GMZ Monitoring Well



Groundwater Monitoring Well Location Map	
EMERY POND MARION POWER PLANT WILLIAMSON CO., ILLINOIS	
HANSON NO. 18E0022A	FIGURE NO. 1

Table 2. Current Monitoring Well Network

Well ID	Northing	Easting	Ground Elev.	MP ¹ Elev.	Gradient
EBG	346,358.14	804,168.155	521.74	524.87	Up
EP-1	347,042.31	804,661.17	517.07	519.72	Down
EP-2	347,113.03	804,799.41	511.15	513.79	Down
EP-3	347,245.08	804,814.53	516.24	518.95	Down
EP-4	347,288.30	804,687.53	517.07	519.74	Down

¹Measuring Point

3.1. Groundwater Monitoring Program Standards

3.1.1. Monitoring Well Installation

Hanson proposes to add three (3) additional monitoring wells to evaluate groundwater at the limits of the groundwater management zone (GMZ). Locations are shown on Figure 1 with approximate coordinates and elevations listed in Table 3.

Table 3. GMZ Monitoring Wells

Well ID	Northing	Easting	Ground Elev.	Gradient
EP-5	347,113.00	804,800.00	524.00	Edge of GMZ
EP-6	347,245.00	804,815.00	502.00	Edge of GMZ
EP-7	347,288.00	804,688.00	512.00	Edge of GMZ

The groundwater monitoring wells will be designed and constructed in accordance with:

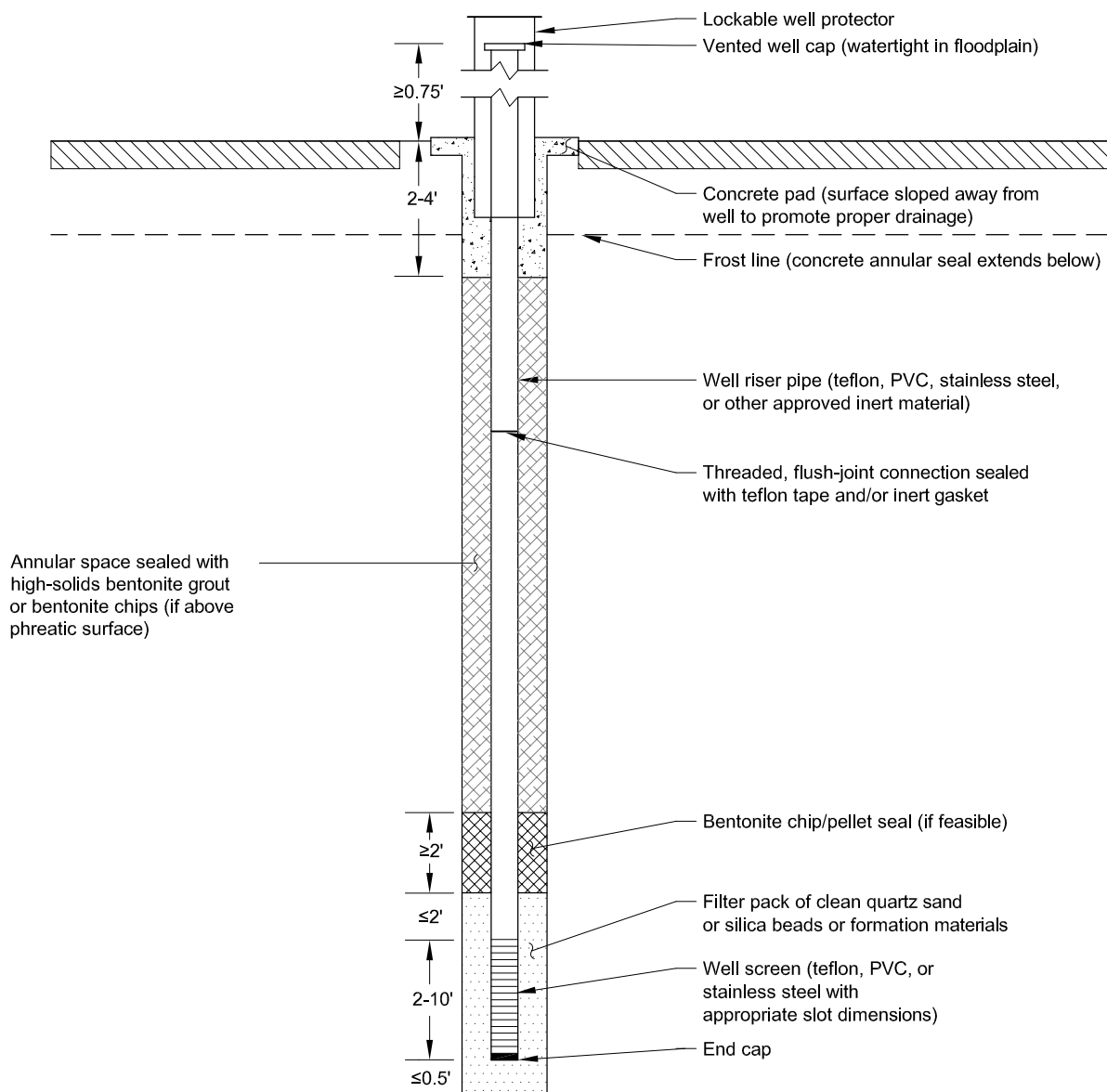
1. Illinois Department of Public Health (IDPH) standards as cited in 77 IAC 920.170; and
2. Chapter 6 – Monitoring Well Design and Construction, RCRA Groundwater Monitoring Technical Enforcement Guidance Document, United States Environmental Protection Agency (U.S. EPA), November 1992.

A typical as-built diagram for groundwater monitoring well construction is provided in Figure 2. New monitoring wells will be constructed to yield groundwater samples that represent the quality of groundwater within the geologic formation(s) monitored at the Site. The monitoring wells should yield sufficient representative quantities of groundwater for the laboratory analyses required.

4. Groundwater Sampling

Hanson (2019a) concluded as part of the Hydrogeologic Investigation that there is no aquifer[†] present beneath the Emery Pond, as that term is defined in both federal and state regulations. However, after further review and discussions with Illinois EPA, SIPC will continue to monitor the shallow groundwater as the uppermost aquifer for compliance with US EPA and proposed Illinois EPA rules.

[†] As defined by 40 CFR 257.53 and 35 IAC 620.110.



After 77 IAC 920.170 and I.E.P.A. Groundwater Monitoring
Network for Non-Hazardous Solid Waste Disposal Facilities
(Final Draft, April 1990)

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GROUNDWATER MONITORING WELL DETAIL

EMERY POND
MARION POWER PLANT
WILLIAMSON COUNTY, ILLINOIS

HANSON NO. 18E0022A

FIGURE 2

Therefore, as discussed with IEPA, SIPC agrees to continue monitoring the groundwater surrounding Emery Pond consistent with the Part 845 proposal and as further described below. Should groundwater monitoring requirements under Part 845 change during the rulemaking proceeding, the parties may agree in writing at that time to modify the groundwater monitoring including, potentially, frequency and the constituent list to be consistent with the final rule.

4.1. Sampling Schedule

Groundwater monitoring at the Emery Pond will be conducted quarterly. Sampling for routine analysis shall be conducted in accordance with the low-flow techniques described in Appendix A. The schedule for quarterly sampling is summarized in Table 4.

Table 4. Groundwater Monitoring Schedule

Sampling Quarter	Sampling Months	Report Due Date	Sampling List
1 st Quarter	January - March	May 31	G1
2 nd Quarter	April - June	August 31	G1
3 rd Quarter	July - September	November 30	G1
4 th Quarter	October - December	February 28	G1

Groundwater monitoring will continue on the schedule outlined in Table 4 until down-gradient water quality has dropped below the relevant standards [40 CFR 257.102(c) and 35 IAC 845.740(b), once approved].

4.2. Parameter Lists

The parameters selected for groundwater monitoring are those parameters found in 40 CFR 257 Appendix III and Appendix IV.[‡]

Table 5. List G1 – Groundwater Monitoring Constituents

Field Parameters	STORET	Indicator Parameters [in ug/L]	STORET
pH [S.U.]	00400	Chloride, total [in mg/L]	00940
Specific Conductance [umohs/cm]	00094	Chromium, total	01034
Temperature [°F]	00011	Cobalt, total	01037
Depth to Water [ft below MP]	72109	Fluoride, total [in mg/L]	00951
Elevation of GW Surface [ft AMSL7]	71993	Lead, total	01051
Indicator Parameters [in ug/L]	STORET	Lithium, total	01132
Antimony, total	01095	Mercury, total	71900
Arsenic, total	01002	Molybdenum, total	01062
Barium, total	01007	Selenium, total	00147
Beryllium, total	01012	Sulfate, total [in mg/L]	00945
Boron, total	01022	Total Dissolved Solids (TDS) [in mg/L]	70300
Cadmium, total	01034	Thallium, total	01059
Calcium, total	00916	Radium 226/228 combined	11503

[‡] The indicator parameters include all the constituents listed at proposed 35 IAC 845.600 plus Calcium.

4.3. Sampling Procedures

The Sampling Protocol included as Appendix A shall be followed for collecting groundwater samples at the Site. If conditions exist at the time of sampling that could influence the results, such as farmers applying herbicides/pesticides on adjacent fields, it may be necessary to postpone sampling until a later date. Under no circumstances will sample collection deviate from the schedule noted in Section 4.1.

5. Analysis of Site Monitoring Samples

5.1. Laboratory Analysis

Laboratory analysis and testing methods will typically be in accordance with U.S. EPA publication Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (U.S. EPA, 2018) or as superseded by future editions. The specific testing method used for analysis shall have Practical Quantitation Limit (PQL) values that can determine if regulatory and/or site groundwater standards are exceeded. For example, 35 IAC Part 724, Appendix I lists three methods and PQLs for Chromium (7190 = 500 ppb; 6010 = 70 ppb; and 7191 = 10 ppb). Since 35 IAC 620.410 sets the standard for Chromium at 100 ppb, the method necessary to meet or exceed this standard would be 6010. Specific testing methods shall be referenced in the Laboratory Analysis Report.

Other references (unless superseded) for testing methods may include:

- a. Test Method: The Determination of Inorganic Anions in Water by Ion (U.S. EPA, 1993),
- b. Test Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater (U.S. EPA, 1982),
- c. Methods for the Determination of Organic Compounds in Drinking Water (U.S. EPA, 1988, and
- d. Standard Methods for Determination of Organic and Inorganic Compounds in Drinking Water (U.S. EPA, 2000).

Quality Assurance/Quality Control (QA/QC) programs will likely vary from laboratory to laboratory but will contain the same general methodologies. The QA/QC programs are implemented: to evaluate the accuracy and precision of analytical data in order to establish the quality of the data; to provide an indication of the need for corrective actions, when comparison with existing regulatory or program criteria or data trends show that activities must be changed or monitored to a different degree; and to determine the effect of corrective actions (U.S. EPA, 2018).

Several methodologies will be used by the laboratory to ensure representative analytical results. Some methodologies that may be used are:

- a. Calibration checks shall be used to enhance instrument reliability. Instrumental calibration curves will be generated in a manner consistent with the instrument and method utilized. Calibration verification shall be conducted on a regular basis;
- b. Laboratory control samples and/or quality control check standards that have been spiked with analyses may be used to monitor the performance of the analytical method;
- c. Matrix spike/matrix spike duplicate analyses are samples in which solutions of specific aliquots are added to a sample matrix prior to sample extraction/digestion and analysis. Samples are

split into duplicates, spiked, and analyzed. Percent recoveries and relative percent differences are calculated for each of the analyses detected;

- d. Replicate samples shall be routinely analyzed to check the precision of the instrumentation and/or methodology employed for all analytical methods; and
- e. Where applicable, method blanks are prepared and analyzed each day or samples are batched to ensure that the system is free of contamination.

The QA/QC program at the laboratory will follow method requirements in the U.S. EPA publication Test Methods for Evaluation Solid Waste, Physical/Chemical Methods (U.S. EPA, 2018) and which may be periodically revised in the future. Other published QA/QC methods may be utilized as part of laboratory policy.

6. Licensed Professional Signature/Seal

The geological work product contained in this document has been prepared under my personal supervision and has been prepared and administered in accordance with the standards of reasonable professional skill and diligence.

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Hanson Professional Services Inc.
1525 South Sixth Street
Springfield, IL 62703-2886
(217) 788-2450
Registration No. 196-000246

Seal:

Expires 31 March 2021

Signature: _____

Date: 29 October 2020

7. References

AECOM, 2018. "2017 Annual Groundwater Monitoring and Corrective Action Report, Coal Combustion Residuals (CCR) Rule, Marion Power Plant, Williamson County, Illinois", AECOM Technical Services, Inc., St. Louis, MO. 31 pp.

Gilbert, R.O. 1987. Statistical Methods for Environmental Pollution Monitoring, John Wiley and Sons, Inc., New York, 239 pp.

Hanson, 2019a. "Emery Pond - Hydrogeologic Investigation Report", March 29, 2019. Hanson Professional Services Inc., Springfield, IL. 24 pp + 5 App.

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U.S. EPA, 1982a. Test Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, EPA 600/4-82-057, U.S. Environmental Protection Agency, Washington D.C., 160 pp.

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- U.S. EPA, 1992. RCRA Groundwater Monitoring Technical Enforcement Guidance Document. U.S. Environmental Protection Agency, Office of Solid Waste, Washington D.C., 236 pp.
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- U.S. EPA, 2000. Methods for Determination of Organic and Inorganic Compounds in Drinking Water; Volume 1. EPA 815/R-00/014, U.S. Environmental Protection Agency, National Exposure Research Laboratory, Cincinnati, OH.
- U.S. EPA, 2018. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA/530/SW-846, 3rd Edition (Revision 0); November 1986; Final Updates I (1993), II (1995), IIA (1994), IIB (1995), III (1997), IIIA (1999), IIIB (2005), IV (2008), V (2015), and VIB (2018).

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Appendix A

Sampling Protocol



A.1. Sampling Protocol

The following procedures shall be used in sample collection at the Site. This sampling protocol shall apply to the routine quarterly, semi-annual, or annual sampling events. A sample collector's worksheet, comparable to the one located in Exhibit A-1, may be used for noting relevant information in regard to each well.

If conditions at the time of sampling could influence the results, sampling should be postponed until a later date. However, under no circumstances will sample collection deviate from the schedule in Section 0.

A.2. Preparation

Prior to the site visit, the sampling team should prepare equipment necessary for the trip. Several days before, sample bottles/containers should be ordered from the laboratory that will conduct the analyses. Coolers and/or ice chests should be delivered with the sample containers, early enough that the sampling team can inspect the containers and determine if the correct number and type of containers are present. The sampling team should also note if the sample containers come from the laboratory pre-preserved, or if preservative vials are included with the sample containers. Trip blanks should be included by the laboratory for each sample cooler.

Equipment needed for the sampling trip should be collected, inspected, and verified to be in operating condition. Sample meters should have an adequate supply of fresh buffer and standard solutions. An ample supply of de-ionized or distilled water should be available for decontamination of equipment while on-site. At a minimum, the following equipment should be included in a sampling kit that will be taken on the sampling trip:

- Gloves (nitrile, polyethylene, or equivalent);
- Decontamination (DeCon) water (de-ionized and/or distilled);
- Depth to water meter (capable of reading in 0.01 ft. increments);
- Thermometer or thermocouple (in degrees Fahrenheit [°F] with $\pm 1^\circ$ accuracy);
- Specific conductance meter (in micro Siemens per centimeter [$\mu\text{S}/\text{cm}$] accurate to $\pm 0.5\%$);
- pH meter (in 0.1 Standard Units [SU] with ± 0.2 SU accuracy);
- at least one of;
 - ◆ dissolved oxygen meter (in milligrams per liter [mg/L] with ± 0.5 mg/L accuracy);
 - ◆ redox potential meter (in milli-volts [mV] with ± 50 mV accuracy);
 - ◆ turbidity meter (in nephelometric turbidity units [NTU] with ± 0.1 NTU accuracy);
- Buffer solutions and standard for sample meters;
- Ice and/or cold packs;
- A supply of clean, disposable containers for field parameter testing;
- Bubble pack or foam insets to protect sample containers;
- At least one factory packaged, clean, disposable bailer and new, clean rope;
- Forms (chain of custody, purging forms, sampling forms, etc.);
- Spare batteries for sample equipment;
- A site map showing (at a minimum) sampling locations, landmarks, and topographic features; and
- Instructions for locating a set of keys for site entry and monitoring point access. (Keys should be with the sampling kit, or obtained once on-site.)

The site owner, operator, or manager should be notified at least 24 hours before the sampling team arrives at the Site. If not part of the sampling kit, arrangements should be made to obtain the keys for the monitoring devices, and inquiries should be made as to the conditions at the Site (access, weather, operations that may affect sampling, etc.).

When the sample team arrives at the Site, the team should check in with site personnel, obtain the monitoring device keys (if necessary), and receive a conditions update.

A.3. Water Levels

Water levels shall be taken in each well prior to purging and/or sampling. Water levels should be taken as close together as practical, to prevent any time distortion of the water surface data. The following steps shall be followed to obtain accurate water level readings:

1. Note the general condition of the well on the worksheet. This shall include, but is not limited to the condition of the casing, the lock, evidence of tampering, condition of the pad, and any standing water.
2. Remove the lock and open the well. Note the condition of the interior of the casing and the condition of the well cap and riser. Open the cap, taking care not to allow dirt or foreign material into the well.
3. The technician shall rinse the probe and cable of the water level meter with DeCon water.
4. Slowly lower the probe into the well until the meter indicates the water surface has been reached.
5. Note the depth to water (to the nearest 0.01 ft) and the time on the worksheet.
6. Lower the probe to the bottom of well. (If a dedicated pump is installed in the well, skip this step). Note the well depth on the worksheet. The depth of wells with dedicated pumps will be measured at least once every 5 years, or whenever the pump is removed for service.
7. Slowly remove the probe from the well. Rinse the probe and line with DeCon water.
8. Replace cap. Close and lock the well. Proceed to the next well, and repeat.

A.4. Purging of Well – Pump Method

After all water level measurements have been taken, the monitoring wells shall be purged to provide a representative sample. Each groundwater monitoring well shall be purged by using a dedicated pump. The pump construction shall consist of inert materials consistent with the monitoring well construction (e.g., stainless steel pump bodies installed in stainless steel wells).

Purging shall be conducted utilizing a “low-flow” or minimal drawdown technique. Flow rates for this technique will typically fall below 0.5 liters/minutes, with an overall goal of not reducing the water level in the monitoring well by more than 0.3 ft during purging. Water levels should be checked frequently to ensure that the drawdown in the well does not exceed the 0.3-ft limits. Every 3 minutes to 5 minutes, readings shall be taken on the following water quality indicators to determine if a representative water sample is available.

- pH (in SU),
- Specific Conductance (in $\mu\text{mhos/cm}$ or $\mu\text{S/cm}$),
- Temperature (in $^{\circ}\text{F}$),
- And, it is suggested, at least one of the following:
 - ♦ Redox Potential (in mV);
 - ♦ Dissolved Oxygen (in mg/L); and/or
 - ♦ Turbidity (in NTU).

The water quality indicators will be considered stabilized when the following tolerances are reached after three consecutive readings:

- | | |
|---|---|
| • pH ± 0.05 SU | • Redox Potential ± 10 percent |
| • Specific Conductance ± 3 percent | • Dissolved Oxygen ± 10 percent |
| • Temperature $\pm 0.5^{\circ}\text{F}$ | • Turbidity ± 10 percent |

Slow recovering wells require special consideration. If a well is dry, or is purged below the bottom of the pump intake, the well will be allowed to recharge for 12 to 18 hours. Missing samples shall be collected the following day until all sample containers have been filled or the well becomes dry. This procedure shall be repeated until all sample containers have been filled. Notes shall be kept on the worksheet with regard to water levels, times, volume of water removed, and any other parameters considered to be relevant.

A.5. Purging of Well – Bailer Method

Purging and sample collection with a bailer shall be performed in the event of a non-functioning pump or from a well that does not have a dedicated pump installed. A sample shall be collected utilizing a factory packaged, clean, disposable bailer with an appropriate length of new, clean rope attached.

Calculate the number of bailer volumes of water needed to remove one (1) well volume of water.

Well Volume Calculations (2-inch well):

Schedule 40 PVC has a inside diameter of 2.067 inches.

$$\therefore ((2.067 \text{ inches}/12 \text{ inches/ft})/2)^2 \cdot \pi \cdot 1 \text{ ft of water} = 0.0233 \text{ ft}^3/\text{ft of water}.$$

$$0.0233 \text{ ft}^3/\text{ft} \cdot 7.48 \text{ gallons/ft}^3 = 0.174 \text{ gallon/ft}$$

Schedule 5 Stainless Steel (304 or 316) has an inside diameter of 2.245 inches.

$$\therefore ((2.245 \text{ inches}/12 \text{ inches/ft})/2)^2 \cdot \pi \cdot 1 \text{ ft of water} = 0.0275 \text{ ft}^3/\text{ft of water}.$$

$$0.0275 \text{ ft}^3/\text{ft} \cdot 7.48 \text{ gallons/ft}^3 = 0.206 \text{ gallon/ft}$$

Volume of well (in gallons) = well type gallon/ft • (DTB - DTW);

where DTB \equiv depth to bottom of well (from measuring point), and

DTW \equiv depth to water (from measuring point)

Bailer Volumes: Disposable bailer volumes will vary by type and manufacturer. Volume information should be obtained before going to the site. For comparison, a 3 ft stainless steel bailer has a volume of approximately 1220 cc or 0.322 gallon and a 5 ft PVC bailer has a volume of approximately 1085 cc or 0.287 gallon.

1. Open well, being careful that no potential contaminant enters the well.
2. Remove one (1) bailer volume of water from the well. Test pH, specific conductance and temperature. Note values on worksheet. (Turbidity, redox potential and dissolved oxygen will vary considerably due to the agitation a bailer will cause in the well. Testing for these parameters is not recommended with this method.)
3. Remove one-half ($\frac{1}{2}$) gallon of water from the well. Test pH, specific conductance and temperature. Note values on worksheet.
4. Remove $\frac{1}{2}$ to 1 gallon of water. Test pH, specific conductance and temperature. Record data on worksheet.
5. Repeat Number 4 until pH, specific conductance and temperature stabilize or three (3) well volumes of water have been removed.
6. If the well becomes dry, or there is insufficient water to obtain all necessary samples, the well will be allowed to recharge for 24 hours. Samples shall be collected until all sample containers are filled or the well becomes dry. Notes shall be kept on the worksheet regarding water levels, times, volume of water removed, and any other parameters considered by the technician to be relevant.
7. If there is sufficient water volume in the well to obtain all samples, sample collection shall begin at this time.

A.6. Sample Collection Order

Samples shall be collected starting at the monitoring well with the least likelihood for contamination. Sampling shall proceed from the well with the lowest potential for contamination to the well with the highest potential for contamination.

A.7. Field Measurements

A.7.1. General

Upon arrival at each groundwater monitoring well, the technician shall note on the sampler's worksheet or in a field notebook the date, time, ambient air temperature, general weather conditions, and individuals present, including sample team members and any observers. (Note: At a minimum, any observers shall need the same personal protective gear as the members of the sample team.)

Establish a "clean area" near the monitoring well where the sample containers and equipment can be stored while not in use. Every effort should be made to keep the sampling equipment and containers from contacting the ground surface. If necessary, a disposable, plastic tarp can be used as a ground cover to prevent potential contamination of the sample containers and equipment. Typically, the back of the field vehicle will be used as the "clean area".

Any non-dedicated sampling equipment (meter probes, thermometers, etc.) shall be washed in a commercial, laboratory cleaner (Alconox®, Liqui-nox®, or equivalent), and thoroughly rinsed in DeCon water before each use. Calibration shall be performed at each new monitoring location after the initial decontamination. After use, each device shall be powered down (if necessary) decontaminated, and stored in its manufacturer-approved container.

A.7.2. Temperature

Obtain a water sample from the well. Place the sample aliquot in a disposable container, insert the thermometer (or electronic probe), wait until the readings have stabilized, and record the temperature on the worksheet. Temperature for a glass thermometer should be noted to the nearest degree Fahrenheit (1°F). For electronic thermometers (thermocouples), temperature should be noted to the nearest tenth degree Fahrenheit (0.1°F). The thermometer or probe shall be cleaned and rinsed with DeCon water after use.

A.7.3. pH

Confirm calibration of the instrument by comparing with an appropriate buffer solution. Adjust for temperature compensation (if meter is not self-compensating). Rinse probe with DeCon water. Obtain a sample from the well and place the probe in sample aliquot. Note the pH and record on the sample worksheet. Note pH readings to the nearest tenth unit (0.1).

A.7.4. Specific Conductance

Confirm calibration of the instrument by comparing against an appropriate buffer solution. Adjust for temperature compensation (if meter is not self-compensating). Rinse the probe with DeCon water. Obtain a sample from the well and place the probe in sample aliquot. Note the specific conductance and record on the sample worksheet. Specific conductance should be noted to the nearest micromhos per centimeter ($\mu\text{mhos/cm}$) or microSiemens per centimeter ($\mu\text{S/cm}$).

A.8. Sample Collection Procedures

Jars and vials may ship pre-labeled from the laboratory, identifying the analysis and preservative for each type of sample. Dependent upon circumstances, sample containers may be prepared by non-laboratory personnel. If so, this should be noted on the sample worksheet or in the field notebook.

A technician shall remove a sample container from the cooler, affix a label, and in indelible, waterproof ink write the well number and/or sample I.D., the facility name, the sample collection date and time, the type of sample in the container, and the sample collector's name. A technician shall organize the containers in the following sampling order:

- a. Metals and Minerals (totals)
- b. Anions (totals)
- c. Cyanides (totals)
- d. Alkalinity

Not all samples will necessarily be required on each sampling trip, and those constituents not sampled should be skipped. The order should remain consistent.

A.8.1. VOCs

The first sample collected shall be for VOC's. Sample water shall carefully be added to the sample vials. It is extremely important that there is no air in the sample, or that the sample is agitated during transfer to the vial. The vial cap shall be rinsed with sample water, and then placed on the vial and

sealed. To ensure no air is in the sample vial, invert the vial and observe any air bubbles that may accumulate in the bottom of the vial. If there are any air bubbles, discard the sample, and obtain another sample. Fill all VOC vials in the same manner. Place the vials inverted in the cooler, and continue.

A.8.2. SVOCs

Fill the large sample bottle for base neutral and acid extractable organic compounds to the shoulder of the bottle. Rinse the cap with sample water, seal the bottle, and place it in the cooler.

A.8.3. Unfiltered samples

Continue to fill all the other sample bottles for unfiltered parameters in a manner comparable to the SVOCs subsection above.

A.8.4. Filtered

Dissolved parameters include dissolved metals and minerals, total dissolved solids (TDS), and nitrogen. Samples may be filtered using a 0.45-micron filter attached to the pump line. Other filter apparatus may be utilized as long as Illinois EPA guidelines are followed. Filters should be replaced no less frequently than at each new well, and may need to be replaced more often if flow is restricted due to particulate matter in the sample water. Bottles should be filled in a manner consistent with the SVOCs subsection above.

A.9. Special Handling

Some of the samples require additional handling or preservation techniques.

1. VOC samples must be free of air. See Subsection A.8.1.
2. Metals and minerals (total and dissolved) shall be acidified to a pH of less than two by addition of nitric acid (HNO_3).
3. Oils & grease, phenolics, TOC, and ammonia samples must be acidified by the addition of sulfuric acid (H_2SO_4).
4. Cyanides samples must be preserved in an alkaline environment by addition of Sodium Hydroxide (NaOH).

A.10. Sample Preservation Techniques

The preservation techniques utilized in the groundwater samples will typically adhere to those listed in Handbook for Sampling and Sample Preservation of Water and Wastewater, (U.S. EPA, 1982) and/or Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (U.S. EPA, 2018).

A.11. Transportation of Samples

Samples shall be transported or shipped to the laboratory in insulated shipping containers, ice chests, or coolers. The shipping containers should be sturdy, and if samples are contained in glass bottles, bottle dividers and/or bubble wrap should be used to prevent breakage. All samples for organic analysis and numerous other parameters will be packed in ice or a packaged refrigerant as necessary

for proper preservation. Samples should be packed such that the temperature of the samples is maintained as close to 4°C (degrees Celsius) or 39°F as possible from the time the samples are collected to the time the samples are received by the laboratory. The samples should be shipped/delivered to the laboratory as soon as practical, preferably within 24 hours of sample collection. If the samples are shipped to the laboratory, the shipping containers will have a custody seal placed over the lid to identify if the container has been tampered with during transit. Custody seals will not be necessary if the containers are transported directly to the laboratory by the sampling crew.

All shipped or delivered samples shall be accompanied by a chain-of-custody record. The sampler shall retain a copy of the record and forward the original with the samples to the analytical laboratory. Once the laboratory has received the samples, a representative from the laboratory is to complete the record, retain the original and return a copy with the chemical analysis reports to the sampler. The chain-of-custody shall contain information such as the facility name, the wells sampled, time and date of sampling, members of the sampling party, type of samples (i.e. water, soil, leachate, etc.), number of sample bottles, requested analysis, overnight courier, etc. A sample chain-of-custody record is provided in Exhibit A-2.

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Exhibit A-1
Groundwater Sampling Worksheet



GROUNDWATER SAMPLING WORKSHEET



BACKGROUND INFORMATION:

Site: _____

Well ID: _____

Project: _____

Well Condition: _____

Well Information: Well pipe diameter: _____ Well material: _____
Constructed depth: _____ ft. from m.p. Screen length: _____ feet

Initial Depth to Water: _____ ft. from m.p. Date: _____ Time: _____

Sample Depth to Water: _____ ft. from m.p. Date: _____ Time: _____

Water Volume: Btm of well: _____ ft. from m.p. Well volume $[0.164 \times (CD-DTW)]$: _____ gal.

SAMPLE COLLECTION:

Lab Sample ID: _____

Personnel: Technician 1: _____

Technician 2: _____

Company: _____

Location: _____

Weather: Ambient Air Temperature: _____ °F. Approx. Wind Direction & Speed: _____

Well purge: Stable DTW: _____ ft. MP Pump rate: _____ ml/min Volume removed: _____ ml

Fill cycle time: () _____ sec. Discharge cycle time: () _____ sec.

STABILIZATION TEST:

Reading	Time	Temp. (in °C)	pH (in std .units)	Conductance (in μ mhos/cm)	Dis. O ₂ (in mg/L)	RedOx Pot. (in mV)	Turbidity (in NTU)
1 (start)							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							

SAMPLE APPEARANCE:

Clarity:	Clear	Hazy	Sl. Turbid	Turbid	V. Turbid	Opaque
Color:	Clear	Yellow	Brown	Rust	White	Gray
Odor	Sulfurous	Petroleum	Musty	Solvent		None

SAMPLE DATA:

General Information	Sample Types Collected			
Well or Sample ID:	Alkalinity (CO ₃ /HCO ₃)	Cyanide (total)	Pesticides	
Date Collected:	Ammonia (dissolved)	Fecal Coliform	Phenolics	
Time Collected:	Ammonia (total)	Herbicides	Radio Nuclides	
	Anions (dissolved)	Metals (dissolved)	SVOC's	
	Anions (total)	Metals (total)	TOC	
Date Sent to Lab:	BOD/TDS	Oils & Grease	TOX	
Time Sent to Lab:	COD	PCB's	VOC's	

EXPENDABLES:

Bladder	Filter (lg)	Filter (md)	Filter (sm)	Bailer	Lock	Tubing/Rope
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NOTES: _____

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Exhibit A-2
Example Chain-of-Custody Record



CHAIN OF CUSTODY RECORD



CLIENT INFORMATION:

Client: _____
 Address: _____

Contact Name: _____
 Telephone No.: _____
 Fax No.: _____
 Project ID/PO: _____

SAMPLE INFORMATION:

Sampler (please print): _____			Sampler (signature): _____					Type	Matrix	Number of Containers	Analyses Desired										Remarks
Sample Description	Date Collected	Time Collected	Grab	Composite	Water	Soil	Other														

Relinquished by (signature): _____

Date/ Time _____

Received by (signature): _____

Date/ Time _____

Samples received:

Relinquished by (signature): _____

Date/ Time _____

Received by (signature): _____

Date/ Time _____

Chilled (☐ 4°C)
 in proper container
 within holding time

Y or N
 Y or N
 Y or N