Addendum No. 1
Assessment of Corrective Measures
Existing Surface Impoundments

Burlington Generating Station
Burlington, Iowa

Prepared for:

Alliant Energy

SCS ENGINEERS

25219168.00 | November 24, 2020

2830 Dairy Drive
Madison, WI 53718-6751
608-224-2830

Table of Contents

Section Page

Executive Summary iii
1.0 Introduction and Purpose 1
1.1 Assessment of Corrective Measures Process 1
1.2 Site Information and Map 2
2.0 Background 2
2.1 Regional Geologic Information 2
2.2 Site Geologic Information 3
2.3 CCR Rule Monitoring System 3
3.0 Nature and Extent of Groundwater Impacts 4
3.1 Potential Sources 4
3.2 Groundwater Assessment 5
3.2.1 Groundwater Depth and Flow Direction 5
3.2.2 Groundwater Protection Standard Exceedances Identified 5
3.2.3 Expanding the Groundwater Monitoring Network 6
3.2.4 MNA Data Collection and Evaluation 6
3.3 Conceptual Site Model 8
3.3.1 Nature of Constituents Above GPS 8
3.3.2 Potential Receptors and Pathways 8
4.0 Potential Corrective Measures 11
4.1 Identification of Corrective Measures 11
4.1.1 Source Control 11
4.1.2 Containment 12
4.1.3 Restoration 14
5.0 Corrective Measure Alternatives 15
5.1 Alternative 1 – No Action 15
5.2 Alternative 2 – Close and Cap in Place with MNA 15
5.3 Alternative 3 – Consolidate On-Site and Cap with MNA 16
5.4 Alternative 4 – Excavate and Dispose On-Site with MNA 16
5.5 Alternative 5 – Excavate and Dispose in Off-Site Landfill with MNA 16
5.6 Alternative 6 – Consolidate and Cap with Chemical Amendment 17
5.7 Alternative 7 – Consolidate and Cap with Groundwater Collection 17
5.8 Alternative 8 – Consolidate and Cap with Barrier Wall 17
6.0 Evaluation of Corrective Measure Alternatives 18
6.1 Alternative 1 – No Action 18
6.2 Alternative 2 – Close and Cap in Place with MNA 19
6.3 Alternative 3 – Consolidate On-Site and Cap with MNA 20
6.4 Alternative 4 – Excavate and Dispose On-Site with MNA 21
6.5 Alternative 5 – Excavate and Dispose in Off-Site Landfill with MNA 23
6.6 Alternative 6 – Consolidate and Cap with Chemical Amendment 25
6.7 Alternative 7 – Consolidate and Cap with Groundwater Collection 26

6.8 Alternative 8 – Consolidate and Cap with Barrier Wall 28
7.0 **Summary of Assessment** **30**
8.0 **References** **30**

Tables

Table 1. Groundwater Elevation Summary
Table 2. CCR Rule Groundwater Samples Summary
Table 3. Groundwater Analytical Results Summary – CCR Program – Assessment Monitoring
Table 4. Groundwater Field Parameters – CCR Program – Assessment Monitoring
Table 5. Preliminary Evaluation of Corrective Measure Alternatives

Figures

Figure 1. Site Location Map
Figure 2. Site Plan and Monitoring Well Locations
Figure 3. Potentiometric Surface Map – April 2019
Figure 4. High Potentiometric Surface Map – June 2020
Figure 5. Low Potentiometric Surface Map – September 2020
Figure 6. Geologic Cross Section

Appendices

Appendix A Regional Geologic and Hydrogeologic Information
Appendix B Boring Logs
Appendix C Hydrogeochemical Conceptual Model and Preliminary Summary of Groundwater Contaminant Attenuation
Appendix D Mann-Kendall Trend Test

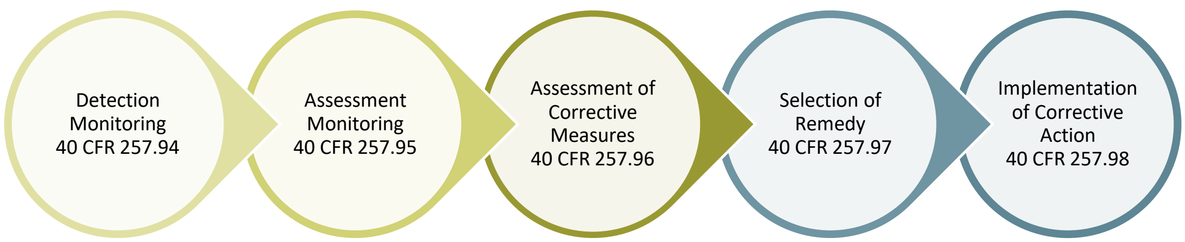
I:\25219168.00\Deliverables\ACM Addendum\201124_BGS_ACM Addendum 1.docx

EXECUTIVE SUMMARY

Interstate Power and Light Company (IPL), an Alliant Energy company, operates four ash ponds at the Burlington Generating Station (BGS). The ponds are used to manage coal combustion residuals (CCR) and wastewater from the power plant, which burns coal and natural gas to generate electricity.

IPL samples and tests the groundwater in the area of the ash ponds to comply with U.S. Environmental Protection Agency (USEPA) standards for the Disposal of CCR from Electric Utilities, or the "CCR Rule" (Rule). Groundwater samples from some of the wells installed to monitor the ash ponds contained two metals, lithium and molybdenum, at levels higher than the Groundwater Protection Standards (GPS) defined in the Rule. These metals occur naturally, and both can be present in coal and CCR.

IPL prepared an Assessment of Corrective Measures (ACM) Report in September 2019 in response to the groundwater sampling results at the BGS facility. The ACM process is one step in a series of steps defined in the Rule and shown below.



To prepare the ACM, IPL worked to understand the following:

- Types of soil and rock deposits in the area of the BGS facility.
- Depth of groundwater.
- Direction that groundwater is moving.
- Potential sources of the lithium and molybdenum in groundwater.
- The area where lithium and molybdenum levels are higher than the USEPA standards.
- The people, plants, and animals that may be affected by levels of lithium and molybdenum in groundwater that are above the GPS.

Because the time allowed by the Rule to prepare the ACM was limited, IPL has continued work to improve the understanding of the items listed above. Addendum No. 1 has been prepared to update the ACM for BGS based on the information now available.

IPL has identified and evaluated additional Corrective Measures to bring the levels of lithium and molybdenum in groundwater below USEPA standards. In addition to stopping the discharge of CCR and BGS wastewater to the ponds, these corrective measures include:

- Cap CCR in Place with Monitored Natural Attenuation (MNA)
- Consolidate CCR and Cap with MNA
- Excavate and Dispose CCR On-Site with MNA
- Excavate and Dispose CCR in Off-site Landfill with MNA

- Consolidate and Cap with Chemical Amendment
- Consolidate and Cap with Groundwater Collection
- Consolidate and Cap with Barrier Wall

IPL has also included a “No Action” alternative for comparison purposes only. This alternative will not be selected as a remedy.

Addendum No. 1 includes an updated evaluation that includes all eight options using factors identified in the Rule.

IPL will provide semiannual updates on its progress in evaluating Corrective Measures to address the groundwater impacts at BGS.

IPL held a public meeting on October 14, 2020, to discuss the contents of the September 2019 ACM. Before a remedy is selected, IPL will hold a public meeting with interested and affected parties to discuss this addendum.

For more information on Alliant Energy, view our Corporate Responsibility Report at https://poweringwhatsnext.alliantenergy.com/crr/.

1.0 INTRODUCTION AND PURPOSE

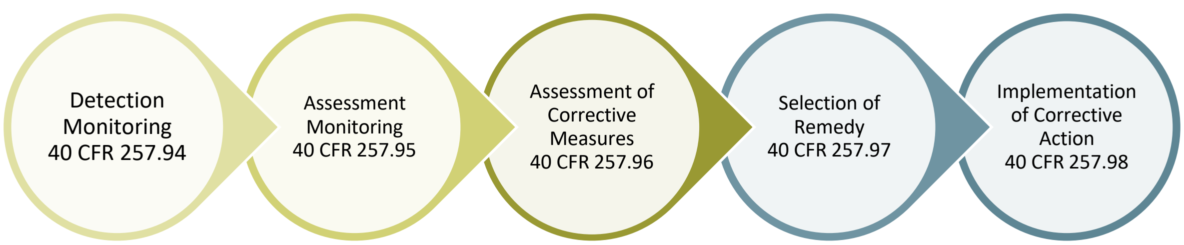
An Assessment of Corrective Measures (ACM) at the Interstate Power and Light Company (IPL) Burlington Generating Station (BGS) was prepared to comply with U.S. Environmental Protection Agency (USEPA) regulations regarding the Disposal of Coal Combustion Residuals (CCR) from Electric Utilities [40 CFR 257.50-107], or the "CCR Rule"(Rule). Specifically, the ACM was initiated and this report was prepared to fulfill the requirements of 40 CFR 257.96, including:

- Prevention of further releases
- Remediation of release
- Restoration of affected areas

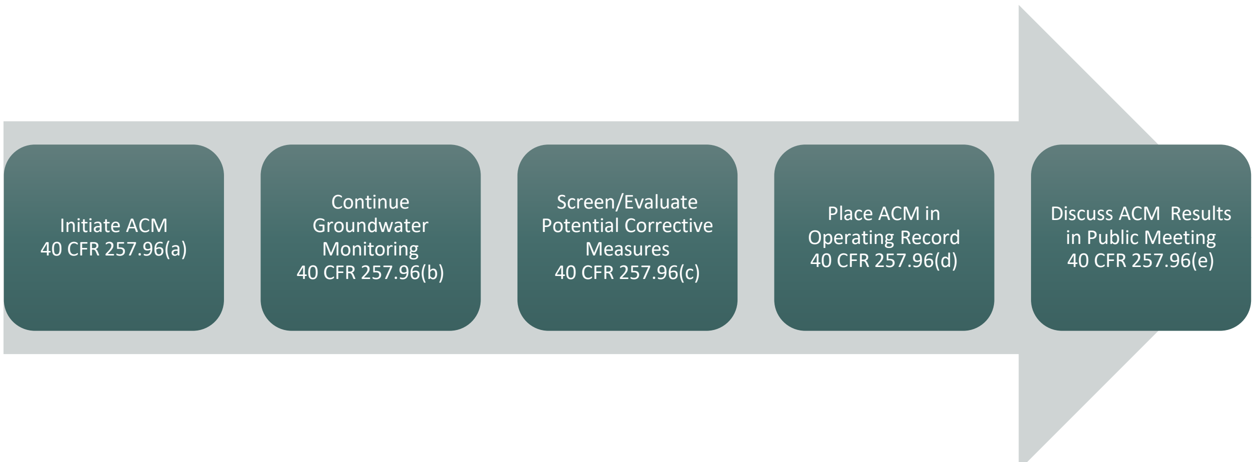
An ACM Report was issued in September 2019 to summarize the remedial alternatives for addressing the Groundwater Protection Standard (GPS) exceedances observed in the October 2018 sampling event, and identified in the Notification of Groundwater Protection Standard Exceedance dated April 15, 2019. The September 2019 ACM identified additional information needed to inform the selection of a corrective measure (remedy) for BGS according to 40 CFR 257.97. Since the ACM was issued, IPL has worked to obtain the needed information and prepared Addendum No. 1 to update the ACM for BGS and discuss additional remedy alternatives.

1.1 ASSESSMENT OF CORRECTIVE MEASURES PROCESS

As discussed above, Addendum No. 1 was prepared to update the ACM Report developed in response to GPS exceedances observed in groundwater samples collected at the BGS facility. The ACM process is one step in a series of steps defined in the CCR Rule and depicted in the graphic below. To date, IPL has implemented a detection monitoring program per 40 CFR 257.94 and completed assessment monitoring at BGS per 40 CFR 257.95. The September 2019 ACM was required based on the groundwater monitoring results obtained through October 2018. With the ACM completed and now updated with new information, IPL is required to select a remedy according to 40 CFR 257.97. The remedy selection process must be completed as soon as feasible and, once selected, IPL is required to start the corrective action process within 90 days.



The process for developing the ACM is defined in 40 CFR 257.96 and is shown in the graphic below. IPL held a public meeting on October 14, 2020, to discuss the September 2019 ACM with interested and affected parties. Additional corrective measure alternatives are identified in Addendum No. 1 that were not discussed at the October 14 meeting. Since IPL is required to discuss the ACM results in a public meeting at least 30 days before selecting a remedy, a second public meeting will be held to discuss the new alternatives. To facilitate the selection of a remedy for the GPS exceedances at BGS, IPL continues to investigate and assess the nature and extent of the groundwater impacts. Information about the site, the groundwater monitoring completed, the groundwater impacts as they are currently understood, and the ongoing assessment activities are discussed in the sections that follow.



1.2 SITE INFORMATION AND MAP

BGS is located along the west bank of the Mississippi River, about 5 miles south of the city of Burlington, in Des Moines County, Iowa (**Figure 1**). The address of the plant is 4282 Sullivan Slough Road, Burlington, Iowa. In addition to the coal-fired generating station, the property also contains a coal stockpile, diesel-fueled combustion turbines, hydrated fly ash storage area, upper ash pond, lower pond, economizer ash pond, bottom ash pond, and ash seal pond.

The groundwater monitoring system at BGS is a multi-unit system. BGS includes four CCR Units:

- BGS Ash Seal Pond (existing CCR surface impoundment)
- BGS Main Ash Pond (existing CCR surface impoundment)
- BGS Economizer Ash Pond (existing CCR surface impoundment)
- BGS Upper Ash Pond (existing CCR surface impoundment)

A map showing the CCR Units and all background (or upgradient) and downgradient monitoring wells with identification numbers for the CCR groundwater monitoring program is provided as **Figure 2**.

2.0 BACKGROUND

2.1 REGIONAL GEOLOGIC INFORMATION

The uppermost geologic formation beneath BGS that meets the definition of the "uppermost aquifer," as defined under 40 CFR 257.53, is the surficial alluvial aquifer. The alluvial aquifer comprises Mississippi River valley clay, silt, sand, and sand and gravel deposits. These deposits are present along the edges of the entire Mississippi River valley in southeastern Iowa. A map of the regional glacial geology in the area is included in **Appendix A.**

The alluvial aquifer is underlain by Devonian-Mississippian limestone bedrock, which is identified as an aquiclude on the regional bedrock geology map of the area included in **Appendix A.**

The regional groundwater flow direction is generally to the east toward the Mississippi River. A map of regional flow is included in **Appendix A**.

2.2 SITE GEOLOGIC INFORMATION

Monitoring wells MW-301 through MW-313, MW-302A, MW-307A, MW-310A, and MW-313A were installed to intersect the alluvial sands at the site. The unconsolidated material at these well locations is generally clay and silt to approximately 61 feet below ground surface (bgs), and these fine-grained sediments are underlain by sand or silty sand. The total boring depths are between 24 and 61 feet bgs. Bedrock was encountered at 35 feet bgs in the boring for upgradient well MW-310A. The thickness of the alluvium at the site is 25 feet in the area of the upgradient wells and at least 61 feet in the area of the downgradient wells. The boring logs for MW-301 through MW-313, MW-302A, MW-307A, MW-310A, and MW-313A are included in **Appendix B**.

Shallow groundwater at the site generally flows to the east and southeast, toward the Mississippi River. The groundwater flow pattern for April 2019 is shown on **Figure 3**. The groundwater elevation data for the CCR monitoring wells are provided in **Table 1**.

A geologic cross section was prepared with background monitoring well nest MW-310/310A and downgradient monitoring wells MW-306 and MW-312. The cross section line runs through the lower southwest section of the BGS Upper Ash Pond, BGS Economizer Ash Pond, and the coal pile. The cross section location is provided on **Figure 2**, and the geologic cross section is provided on **Figure 6**. Unconsolidated geologic material and water table levels estimated using water levels measured at site monitoring wells are identified on the cross section.

2.3 CCR RULE MONITORING SYSTEM

The original groundwater monitoring system established in accordance with the CCR Rule consists of two upgradient (background) monitoring wells and nine downgradient monitoring wells. The two initial background wells are MW-310 and MW-311. The nine initial downgradient wells are MW 301, MW-302, MW-303, MW-304, MW-305, MW-306, MW-307, MW-308, and MW-309. These wells were installed between December 2015 and March 2016. Two additional downgradient monitoring wells, MW-312 and MW-313, were installed in May 2019 and one additional background well, MW-310A, and three additional downgradient wells, MW-302A, MW-307A, and MW-313A, were installed in June and July of 2020 in accordance with the assessment monitoring requirements of 40 CFR 257.95(g)(1). The majority of the CCR Rule wells are installed in the alluvial aquifer. One deeper background well, MW-310A, is installed in the bedrock aquifer that is hydraulically connected to the alluvial aquifer. Well depths range from approximately 19 to 61 feet bgs. The Groundwater Sampling and Analysis Plan was followed for the sampling and analysis of all existing and new wells.

3.0 NATURE AND EXTENT OF GROUNDWATER IMPACTS

3.1 POTENTIAL SOURCES

The potential sources of groundwater impacts are currently under evaluation. Based on the March 2018 History of Construction for BGS, prepared in accordance with §257.73(c) of the CCR Rule, potential sources of groundwater impacts from the monitored CCR units include the following:

CCR Unit	Potential Sources	Description	Quantity
Ash Seal Pond	CCR	Bottom ash, economizer ash, and precipitator ash	108,800 C.Y.
	Low volume waste water from generating plant	Legacy operations	Regular flows ceased in 2009; may be used during maintenance operations
	Storm water	Annual precipitation	25.0 acre-feet (AC-FT) (Watershed of 7.7 acres)
Main Ash Pond	CCR	Bottom ash, economizer ash, precipitator fly ash, and hydrated fly ash	487,100 C.Y.
	Low volume waste water from generating plant	Boiler seal water system, rinse water from previous chemical cleans, waste water from non-chemical metal cleaning (air heater wash and economizer wash), and boiler makeup/ blowdown water	Average flow is approximately 0.63 million gallons per day (MGD)
	Storm water	Annual precipitation	60.8 AC-FT (Watershed of 18.7 acres)
Economizer Ash Pond	CCR	Economizer ash and precipitator fly ash	535,400 C.Y.
	Storm water	Annual precipitation	35.8 AC-FT (Watershed of 11 acres)
Upper Ash Pond	CCR	Bottom ash, economizer ash, and precipitator fly ash	187,800 C.Y.
	Low volume waste water flows from generating plant	Bottom ash sluicing activities, economizer ash sluicing activities, and process water flows from the generating plant	Average flow from April 2018 – April 2019 was 3.06 MGD
	Storm water	Annual precipitation	43.2 AC-FT (Watershed of 13.3 acres)

Notes: Storm water volume is calculated based on the watershed area for the pond and the annual average precipitation for Burlington, Iowa, of 39 inches/year. The average flow from the Main Ash Pond is based on 36 months of flow data for Outfall 006 over the period of 2006 through 2009. The calculation for average flow from the Upper Ash Pond excludes days when back waters affected flow measurements at Outfall 001.

Estimated CCR quantities have been updated using data from soil borings installed in and around the CCR surface impoundments in December 2019 and January 2020.

Groundwater elevations at BGS have fluctuated by as much 12 feet over the groundwater monitoring that started in 2016. Groundwater elevation data provided in **Table 1** and information available in the operating record for the CCR surface impoundments at BGS, including the March 2018 History of Construction report (HHS 2018) and periodic inspection reports such as the July 2020 CCR Surface Impoundment Annual Inspection Report (HHS 2020), show that some portion of the CCR in the impoundments is likely to be in contact with groundwater at times. The volume of CCR in contact with groundwater will need to be considered as the remedy selection process is completed.

3.2 GROUNDWATER ASSESSMENT

3.2.1 Groundwater Depth and Flow Direction

Depth to groundwater as measured in the site monitoring wells varies from 1 to 17 feet bgs due to topographic variations across the facility and seasonal variations in water levels. Groundwater flow at the site is generally to the east-southeast, and the groundwater flow direction and water levels fluctuate seasonally due to the proximity to the river. Groundwater elevations and flow directions are shown on the April 2019, June 2020, and September 2020 potentiometric surface maps (**Figures 4, 5,** and **6**).

3.2.2 Groundwater Protection Standard Exceedances Identified

The ACM process was triggered by the detection of lithium and molybdenum at statistically significant levels exceeding the GPSs in samples from the following compliance wells:

- Lithium: MW-302, MW-307, MW-308
- Molybdenum: MW-302, MW-307, MW-308

This statistical evaluation of the assessment monitoring results was based on the first four sampling events for the Appendix IV assessment monitoring parameters, including complete sampling events in May, August, and October 2018, and a resampling event for selected wells in March 2019. The complete results for these sampling events are summarized in **Table 3**. Some additional compliance monitoring wells had individual results exceeding the GPSs for these parameters, but the exceedances were not determined to be at statistically significant levels. The evaluation of statistically significant levels exceeding the GPSs was summarized in an Alternative Source Demonstration (ASD) completed in April 2019. This ASD identified a reduced list of well-parameters exceeding the GPS and recommended that IPL initiate the ACM.

In the subsequent April 2019, October 2019, June 2020, and October 2020 sampling events, additional wells with statistically significant levels exceeding the GPSs for lithium and/or molybdenum were identified through additional data collection at existing wells or installation and sampling on new wells. No additional parameters were detected at concentrations exceeding GPSs. Statistically significant levels above the GPS have been identified for the following wells and parameters:

Assessment Monitoring Appendix IV Parameters	Location of GPS Exceedance(s)	Historic Range of Detections at Wells With SSL Above GPS	Groundwater Protection Standards (GPS)
Lithium (µg/L)	MW-302, MW-303, MW-304, MW-306, MW-307, MW-308, MW-313	34.3 – 92	40
Molybdenum (µg/L)	MW-302, MW-307, MW-308, MW-312, MW-313	100 - 320	100

µg/L = micrograms per liter, SSL = Statistically significant level
Note: Historic range includes results from assessment monitoring beginning in April 2018 through October 2020.

3.2.3 Expanding the Groundwater Monitoring Network

Monitoring wells MW-312 and MW-313 were installed in May 2019 downgradient of the CCR units and near the Mississippi River. Monitoring wells MW-312 and MW-313 were installed to expand the groundwater monitoring network at BGS beyond the edge of the CCR unit boundaries and to fulfill the requirements of 40 CFR 257.95(g)(1), which requires additional characterization to support a complete and accurate assessment of corrective measures. Groundwater samples were collected following installation of the two new monitoring wells.

Downgradient monitoring wells MW-302A, MW-307A, and MW-313A and upgradient well MW-310A were installed in June and July 2020. They were installed as deeper nested wells with an existing piezometer to an approximate depth of 60 feet bgs to vertically expand the monitoring network at BGS.

The sampling results from MW-312 and MW-313, shown in **Table 3**, indicate that lithium exceeded the GPS in four samples from MW-313 and molybdenum exceeded the GPS in four samples from both wells. The initial two rounds of sampling results from MW-302A, MW-307A, MW-310A and MW-313A, shown in **Table 3**, indicate that lithium concentrations are below the GPS in all of the samples from the four deeper piezometers. Molybdenum concentrations were greater than the GPS in samples in both rounds from the deeper downgradient piezometers MW-302A, MW-307A, and MW-313A, but not in the deeper upgradient piezometer MW-310A.

The statistical significance of the GPS exceedances for these new wells will be assessed and the potential role of alternative sources will be evaluated once additional sampling has been completed.

3.2.4 MNA Data Collection and Evaluation

An evaluation of the potential for BGS to utilize MNA as a corrective action alternative began with the initiation of an ACM at BGS. The tiered analysis approach in the USEPA guidance, “Monitored Natural Attenuation of Inorganic Contaminants in Groundwater, Volume 1 – Technical Basis for Assessment” (USEPA, 2007), is being used as a guide for evaluating MNA as a potential corrective action alternative at BGS.

There are four tiers of analysis to be addressed in evaluating the site for MNA:

1. Demonstrate active contaminant removal from groundwater
2. Determine mechanism and rate of attenuation

3. Determine system capacity and stability of attenuation
4. Design a performance monitoring program and identify an alternative remedy

Data collection activities during the assessment monitoring and ACM process that begins to address the objectives of tiers 1 and 2 include:

- Installation of downgradient assessment wells MW-312 and MW-313 and deeper upgradient and downgradient piezometers MW-302A, MW-307A, MW-310A, and MW313A to evaluate groundwater flow direction and horizontal and vertical hydraulic gradients.

- Additional groundwater sampling events and analysis of data from all site wells to evaluate contaminant distribution in groundwater and stability of groundwater concentrations over time.

- Analysis of general groundwater chemistry and field parameters in addition to the Appendix III and IV constituents to provide further characterization of groundwater chemistry.

- Analysis of both total and dissolved constituents for selected parameters.

A hydrogeochemical conceptual model and summary of preliminary evaluation of groundwater contaminant attenuation at BGS is included in **Appendix C.** Preliminary findings include:

- Lithium and molybdenum have likely been released from one or more sources (ponds) to the confined alluvial aquifer beneath the site.

- Molybdenum concentrations are comparable in the shallow and deeper portions of the aquifer, indicating that downward vertical gradients within the aquifer have carried molybdenum to depths of at least 60 feet bgs.

- Lithium concentrations decrease significantly with depth, suggesting that some form of attenuation may be present in the upper portions of the aquifer.

- Masses of 27 and 81 kilograms of lithium and molybdenum, respectively, are estimated to be dissolved in groundwater beneath the BGS site.

- The proximity of the Mississippi River, immediately adjacent to BGS, limits, but does not necessarily preclude, the potential for natural attenuation within the aquifer.

- Geochemical data collected to date does not support the presence of natural attenuation for lithium or molybdenum.

- The lithium and molybdenum GPS exceedances in the deep piezometers cannot be confirmed to be statistically significant until a minimum of two additional rounds of samples are collected.

A preliminary evaluation of whether the lithium and molybdenum plume is stable, growing, or decreasing has been completed using a Mann-Kendall trend test. The results of the trend test are provided in **Appendix D.** No statistically significant increasing or decreasing trends were identified in the results obtained since assessment monitoring was initiated. Additional groundwater sampling rounds that include the deep piezometers are required before a complete evaluation is possible.

Before natural attenuation is removed from consideration as a remedial alternative, the following additional data collection and evaluation is recommended:

- Perform additional rounds of groundwater sampling for lithium and molybdenum to further assess plume stability.
- Perform laboratory analysis on aquifer soil samples from areas where lithium concentrations are low or not detected to evaluate lithium adsorption capacity.
- Perform additional research on any published lithium and molybdenum groundwater concentration data from the alluvial aquifer in the vicinity of BGS.

3.3 CONCEPTUAL SITE MODEL

The following conceptual site model describes the compounds and nature of constitutes above the GPS, discusses potential exposure pathways affecting human health and the environment, and presents a cursory review of their potential impacts. The conceptual site model for BGS has been prepared in general conformance with the Standard Guide for Developing Conceptual Site Models for Contaminated Sites (ASTM E1689-95). This conceptual site model is the basis for assessing the efficacy of likely corrective measures to address the source, release mechanisms, and exposure routes.

3.3.1 Nature of Constituents Above GPS

The nature of the constituents in groundwater at BGS that are present at concentrations greater than the GPS (lithium and molybdenum) were described in the September 2019 ACM. No additional constituents have been identified at concentrations above a GPS. Please refer to the details discussion previously provided in Section 3.3.1 of the 2019 ACM.

3.3.2 Potential Receptors and Pathways

As described in **Section 3.3**, ASTM E1689-95 provides a framework for identifying potential receptors (people or other organisms potentially affected by the groundwater impacts at BGS) and pathways (the ways groundwater impacts might reach receptors). In accordance with ASTM E1689-95, we have considered both potential human and ecological exposures to groundwater impacted by the constituents identified in **Section 3.2.3**:

Human Health
In general, human health exposure routes to contaminants in the environment include ingestion, inhalation, and dermal contact with the following environmental media:

- Groundwater
- Surface Water and Sediments
- Air
- Soil
- Biota/Food

If people might be exposed to the impacts described in **Section 3.0** via one of the environmental media listed above, a potential exposure route exists and is evaluated further. For the groundwater impacts at BGS, the following potential exposure pathways have been identified with respect to human health:

- <u>Groundwater – Ingestion and Dermal Contact:</u> The potential for ingestion of, or dermal contact with, impacted groundwater from BGS exists if water supply wells are present in the area of impacted groundwater and are used as a potable water supply. Based on a review of the Iowa Department of Natural Resources (IDNR) GeoSam well database and information provided by BGS:
  - No water supply wells have been identified downgradient or sidegradient in the vicinity of the CCR units.
  - The on-site water supply well is not used as a source of potable water. Potable water at BGS is provided by the Rathbun Regional Water Association.

- <u>Surface Water and Sediments – Ingestion and Dermal Contact:</u> The potential for ingestion of or dermal contact with impacted surface water and sediments exists if impacted groundwater from the BGS facility has interacted with adjacent surface water and sediments, to the extent that the constituents identified in **Section 3.2.3** are present in these media at concentrations that represents a risk to human health.

- <u>Biota/Food – Ingestion:</u> The potential for ingestion of impacted food exists if impacted groundwater from the BGS facility has interacted with elements of the human food chain. Based on discussions with BGS facility staff, no hunting or farming occurs within the current area of known groundwater impacts. Elements of the food chain may also be exposed indirectly through groundwater-to-surface water interactions, which are subject to additional assessment.

Based on the lack of groundwater exposure, only the surface water, sediment, and biota/food exposure pathways were retained for further consideration in the September 2019 ACM. However, the implementation of potential corrective measures may introduce secondary exposure pathways that are discussed in **Section 6.0** and will be evaluated further as a corrective measure is selected for BGS.

Ecological Health

In addition to human exposures to impacted groundwater, potential ecological exposures are also considered. If ecological receptors might be exposed to impacted groundwater, the potential exposure routes are evaluated further. Ecological receptors include living organisms, other than humans, the habitat supporting those organisms, or natural resources potentially adversely affected by CCR impacts. This includes:

- Transfer from an environmental media to animal and plant life. This can occur by bioaccumulation, bioconcentration, and biomagnification:
  - Bioaccumulation is the general term describing a process by which chemicals are taken up by a plant or animal either directly from exposure to impacted media (soil, sediment, water) or by eating food containing the chemical.
  - Bioconcentration is a process in which chemicals are absorbed by an animal or plant to levels higher than the surrounding environment.

- – Biomagnification is a process in which chemical levels in plants or animals increase from transfer through the food web (e.g., predators have greater concentrations of a particular chemical than their prey).

- Benthic invertebrates within adjacent waters.

Based on the information available and presented in the September 2019 ACM, both of the ecological exposure routes required additional evaluation at the time.

Since the September 2019 ACM was completed, exposure pathways subject to groundwater to surface water interactions have been evaluated further through the following:

- Review of USEPA and state surface water standards for lithium and molybdenum.
- Literature review for toxicity of lithium and molybdenum.
- Review of application materials and studies conducted by IPL for the renewal of the National Pollutant Discharge Elimination System (NPDES) permit for BGS.

Based on our evaluation to date, the molybdenum and lithium impacts to groundwater at BGS are unlikely to impact the river. This preliminary conclusion is based on the following:

- Neither USEPA nor the State of Iowa have established surface water standards for these metals. Surface water standards identified in our review are higher than the GPS for these metals and generally higher than the concentrations observed in groundwater at BGS (see standards established in New Mexico, Nevada, and California).

- Neither metal is highly toxic to aquatic organisms, and toxicity testing for these metals found in literature identify "Effective Concentrations" and "No Observable Effect Concentrations" that are higher than the GPS and concentrations observed in groundwater at BGS.

- No population shifts in the mussel communities upstream and downstream of BGS in the Mississippi River were observed in mussel surveys completed to support the NPDES Permit renewal for BGS (Alliant 2019). Mussels, one of the most sensitive animal groups, present at the likely point of groundwater to surface water interaction, showed no population shifts that would be indicative of chronic or acute impacts.

Although an initial assessment indicates that molybdenum and lithium in groundwater at BGS is unlikely to impact the Mississippi River or people and biota utilizing the river, the groundwater-to-surface-water interactions at BGS are the subject of ongoing assessment.

The surface water/sediment, biota/food, and ecological exposure assessment is incomplete as the concentrations within surface water and sediment are presently unknown. The concentrations within groundwater are likely higher and not representative of the surface water subject to dermal contact and ingestion. Similarly, the concentrations within groundwater are likely higher than those interfacing the ecological receptors. Evaluation of constituent concentrations in sediment and surface water may be estimated through calculations and/or additional sampling.

4.0 POTENTIAL CORRECTIVE MEASURES

In this section, we identify potential corrective measures to meet the ACM goals identified in 40 CFR 257.96(a), which are to:

- Prevent further releases
- Remediate releases
- Restore affected areas to original conditions

The development of corrective measure alternatives is described further in the following sections. Corrective measure alternatives developed to address the groundwater impacts at BGS are described in **Section 5.0**. The alternatives selected are qualitatively evaluated in **Section 6.0**.

4.1 IDENTIFICATION OF CORRECTIVE MEASURES

As described in the USEPA Solid Waste Disposal Facility Criteria Technical Manual (USEPA, 1998), corrective measures generally include up to three components, including:

- Source Control
- Containment
- Restoration

Within each component, there are alternative measures that may be used to accomplish the component objectives. The measures from one or more components are then combined to form corrective measure alternatives (discussed in **Section 5.0**) intended to address the observed groundwater impacts. Potential corrective measures were identified based on site information available during development of the ACM for the purpose of meeting the goals described in **Section 4.0**.

Each component and associated corrective measures are further identified in subsequent paragraphs. The corrective measures are evaluated for feasibility and combined to create the corrective action alternatives identified in this section, and further evaluated in **Section 5.0**. We continue to evaluate site conditions and may identify additional corrective measures based on new information regarding the nature and extent of the impacts.

4.1.1 Source Control

The source control component of a corrective measure is intended to identify and locate the source of impacts and provide a mechanism to prevent further releases from the source. For the BGS site, the sources to be controlled are the CCR materials in the impoundments and the associated process water. Each of the source control measures below require closure of the impoundments and for waste water to be re-directed from the CCR units to eliminate the flows that may mobilize constituents from the CCR and transport them to groundwater. We have identified the following potential source control measures:

- **Close and cap in place.** Close the CCR surface impoundments and cap the CCR in the four impoundments in place to reduce the infiltration of rain water into the impoundments, and prevent transport of CCR constituents from unsaturated CCR materials into the groundwater, and reduce the potential for CCR to interface with groundwater.

- **Consolidate and cap.** Consolidate CCR from the four CCR surface impoundments into one or two areas to reduce the cap area exposed to infiltration, reduce the potential source footprint, prevent transport of CCR constituents from unsaturated CCR materials into the groundwater, and minimize the potential for CCR to interface with groundwater.

- **Consolidate and cap with chemical stabilization.** Consolidate CCR from the four CCR surface impoundments into one or two areas to reduce the cap area exposed to infiltration, reduce the potential source footprint, prevent transport of CCR constituents from unsaturated CCR materials into the groundwater, and minimize the potential for CCR to interface with groundwater. Mix a chemical amendment into CCR in-situ prior to placing additional CCR for consolidation and mix the amendment into CCR as it is excavated and placed for consolidation to reduce the mobility of select CCR constituents in the environment. Chemical stabilization may include the use of one or multiple admixtures that serve to physically and/or chemically stabilize the constituents of concern within the CCR. Physically, this may include solidification with cementitious or polymeric materials. Chemically, this may include precipitation or alteration to render arsenic less mobile in the environment. Evaluation of an appropriate commodity amendment that may include Calcium Polysifide, Portland Cement, Calcium Oxide, and/or proprietary chemicals such as FerroBlack-H, MAECTITE, 3Dme, and/or MRC, will occur during the remedy selection process.

- **Excavate and create on-site disposal area.** Excavate and place CCR in a newly lined landfill area on site to prevent further releases from the four potential source areas and isolate the CCR from potential groundwater interactions. Cap the new landfill with final cover to prevent the transport of CCR constituents from unsaturated CCR.

- **Excavate and dispose at a licensed off-site disposal area.** Remove all CCR from the site and haul to a licensed landfill to prevent further on-site releases from the CCR areas.

Water movement through the CCR materials is the mechanism for CCR impacts to groundwater, including surface water that moves vertically through the CCR materials via infiltration of precipitation and surface water runoff.

Based on the available information for this site, all the source control measures have potential to prevent further releases caused by infiltration, thus are retained for incorporation into alternatives for further evaluation.

Based on the ongoing evaluation of MNA mechanisms and site attenuation capacity, chemical stabilization has been added as a source control alternative. Additional source control may be needed to address CCR that could be in contact with groundwater after closure in place if MNA mechanisms are not active at BGS or the site does not have the attenuation capacity to reduce groundwater concentrations of molybdenum and lithium below the GPS.

4.1.2 Containment

The objective of containment is to limit the spread of the impacts beyond the source. The need for containment depends on the nature and extent of impacts, exposure pathways, and risks to receptors. Containment may also be implemented in combination with restoration as described in **Section 4.1.3**.

Containment may be a recommended element of a corrective measure if needed to:

- Prevent off-site migration of groundwater impacts
- Cease completion of a confirmed exposure pathway (e.g., water supply well)

Containment may also be used in lieu of active restoration if an active approach is needed; however, containment with active treatment is not warranted when:

- Water in the affected aquifer is naturally unsuited for human consumption.
- Contaminants are present in low concentration with low mobility.
- Low potential for exposure pathways to be completed, and low risk associated with exposure.
- Low transmissivity and low future user demand.

The following containment measures have potential to limit the spread of continued or remaining groundwater impacts at this site, if necessary:

- **Gradient Control with Pumping.** Gradient control includes a measure to alter the groundwater velocity and direction to slow or isolate impacts. This can be accomplished with pumping wells and/or a trench/sump collection system. If groundwater pumping is considered for capturing an impacted groundwater plume, the impacted groundwater must be managed in conformance with all applicable federal and state requirements.

- **Gradient Control with Phytotechnology.** Gradient control with phytotechnology relies on the ability of vegetation to evapotranspire sources of surface water and groundwater. Water interception capacity by the aboveground canopy and subsequent evapotranspiration through the root system can limit vertical migration of water from the surface downward. The horizontal migration of groundwater can be controlled or contained using deep-rooted species, such as prairie plants and trees, to intercept, take up, and transpire the water. Trees classified as phreatophytes are deep-rooted, high-transpiring, water-loving organisms that send their roots into regions of high moisture and can survive in conditions of temporary saturation.

- **Chemical Stabilization.** Stabilization refers to processes that involve chemical reactions that reduce the leachability of lithium and molybdenum. Stabilization chemically immobilizes impacts or reduces their solubility through a chemical reaction. The desired results of stabilization methods include converting metals into a less soluble, mobile, or toxic form.

- **Containment Walls.** Containment walls can be applied in two ways; first, a wall that creates a physical barrier to the flow of groundwater to limit the movement of constituents of concern in groundwater, and second, a passive barrier installed to intercept the flow of groundwater and constructed with a reactive media designed to adsorb, precipitate, or degrade groundwater constituents to limit their movement in the environment (FRTR 2020).

Based on the currently available information for this site, an active MNA mechanism is yet to be identified, and the assessment of the site capacity to attenuate the lithium and molybdenum impacts to groundwater is ongoing. Thus, active containment may be required for this site due to the potential for CCR to remain in contact with groundwater following closure in place.

4.1.3 Restoration

Restoration is the process through which groundwater quality is restored to meet GPSs. This can be accomplished by way of MNA or intensively addressed by groundwater treatment with or without extraction.

MNA can be a viable remedy or component of a remedial alternative for groundwater impacted with metals. MNA requires ongoing involvement and potentially intense characterization of the geochemical environment to understand the attenuation processes involved, and to justify reliance on them and regular, long-term monitoring to ensure the attenuation processes are meeting remedial goals.

MNA is not a "do-nothing" alternative; rather, it is an effective knowledge-based remedy where a thorough engineering analysis provides the basis for understanding, monitoring, predicting, and documenting natural processes. To properly employ this remedy, there needs to be a strong scientific basis supported by appropriate research and site-specific monitoring implemented in accordance with quality controls. The compelling evidence needed to support proper evaluation of the remedy requires that the processes that lower metal concentrations in groundwater be well understood.

If active treatment is implemented, water may be treated in-situ, on-site, or off-site. The need for active treatment depends on the nature and extent of impacts, exposure pathways, and risks to receptors. If there are no receptors, or when active treatment is not required for the reasons discussed in Section 4.1.2, then MNA is an appropriate option. If existing or future impacts require a more rapid restoration of groundwater quality, then active restoration may be needed.

Treated groundwater may be re-injected, sent to a local publicly owned treatment works (POTW), or discharged to a local body of surface water, depending on local, state, and federal requirements. Typical on-site treatment practices for metals include coagulation and precipitation, ion exchange, or reverse osmosis. Off-site wastewater treatment may include sending the impacted groundwater that is extracted to a local POTW or to a facility designed to treat the contaminants of concern.

The removal rate of groundwater constituents such as lithium and molybdenum will depend on the rate of groundwater extraction, the cation exchange capacity of the soil, and partition coefficients of the constituents sorbed to the soil. As the concentration of metals in groundwater is reduced, the rate at which constituents become partitioned from the soil to the aqueous phase may also be reduced. The amount of flushing of the aquifer material required to remove the metals and reduce their concentration in groundwater below the GPS will generally determine the time frame required for restoration. This time frame is site-specific.

In-situ methods may be appropriate, particularly where pump and treat technologies may present adverse effects. In-situ methods may include the introduction of a chemical amendment to adsorb, precipitate, or degrade a contaminant or biological restoration requiring pH control, addition of specific micro-organisms, and/or addition of nutrients and substrate to augment and encourage degradation by indigenous microbial populations. Bioremediation requires laboratory treatability studies and pilot field studies to determine the feasibility and the reliability of full-scale treatment.

Based on current available information, MNA mechanisms at BGS are still being evaluated, along with the capacity of the site to attenuate the molybdenum and lithium impacts to groundwater. Other restoration measures have been included in this addendum to increase the breadth of alternatives evaluated and available for consideration during the remedy selection process. These additional alternatives are discussed in **Section 5.0**.

5.0 CORRECTIVE MEASURE ALTERNATIVES

We have preliminarily identified the following corrective measure alternatives for the groundwater impacts at BGS:

- Alternative 1 – No Action
- Alternative 2 – Close and Cap in Place with MNA
- Alternative 3 – Consolidate and Cap with MNA
- Alternative 4 – Excavate and Dispose On Site with MNA
- Alternative 5 – Excavate and Dispose in Off-site Landfill with MNA
- Alternative 6 – Consolidate and Cap with Chemical Amendment
- Alternative 7 – Consolidate and Cap with Groundwater Collection
- Alternative 8 – Consolidate and Cap with Barrier Wall

These alternatives were developed by selecting components from the reasonable and appropriate corrective measures components discussed above. With the exception of the No Action alternative, each of the corrective measure alternatives meet the requirements in 40 CFR 257.97(b)(1) through (5) based on the information available at the current time. We may identify additional alternatives based on the continued evaluation of site conditions.

5.1 ALTERNATIVE 1 – NO ACTION

IPL is committed to implementing corrective measures as required under the Rule, and the No-Action alternative is only included as a baseline condition and a point of comparison for the other alternatives. The consideration of this alternative assumes the monitoring of groundwater continues under this action.

5.2 ALTERNATIVE 2 – CLOSE AND CAP IN PLACE WITH MNA

Alternative 2 includes closing the impoundments (no further discharge), covering the CCR materials with a cap, and establishing vegetation in accordance with the requirements for closure in place in 40 CFR 257.102(d). This measure is consistent with landfill cover systems to prevent infiltration of surface water into the CCR as described in **Section 4.1.1**. The capped areas will be subject to enhanced groundwater monitoring via MNA.

This alternative eliminates CCR sluicing/plant process water discharges and, with the installation of a cap, will reduce infiltration through the CCR. This is expected to address the major contributor to the observed GPS exceedances, which is exposure of CCR material to precipitation/surface water infiltration. Further leaching of metals and migration within groundwater will be reduced and may be eliminated over time. MNA is included with this alternative to monitor changes in groundwater impacts and the effectiveness of degradation mechanisms on groundwater concentrations over time.

5.3 ALTERNATIVE 3 – CONSOLIDATE ON-SITE AND CAP WITH MNA

Alternative 3 includes closing the impoundments (no further discharge), relocating and consolidating CCR into a smaller footprint within the CCR surface impoundments, covering the CCR materials with a cap, and establishing vegetation in accordance with the requirements for closure in place in 40 CFR 257.102(d). This measure is consistent with landfill cover systems to prevent infiltration of surface water into the CCR as described in Section 4.1.1. The consolidated and capped areas will be subject to enhanced groundwater monitoring via MNA.

This alternative eliminates CCR sluicing/plant process water discharges and, with the consolidation of the CCR footprint and the installation of a cap, will reduce infiltration through the CCR. This is expected to address the major contributor to the observed GPS exceedances, which is exposure of CCR material to precipitation/surface water infiltration. Consolidation of CCR into a smaller footprint during closure also reduces the volume of potential source materials that may be in contact with groundwater after closure. Further leaching of metals and migration within groundwater will be reduced and may be eliminated over time. MNA is included with this alternative to monitor changes in groundwater impacts and the effectiveness of degradation mechanisms on groundwater concentrations over time.

5.4 ALTERNATIVE 4 – EXCAVATE AND DISPOSE ON-SITE WITH MNA

Alternative 4 includes closing the impoundments (no further discharge), excavation of CCR from the source area, and creation of a new on-site disposal area with a liner and cap system. This alternative will serve to contain the CCR at the site and allow for the collection and management of liquids generated from the disposal area. Further releases from the current source will be prevented by the use of engineering controls constructed/installed to meet the design criteria for new CCR landfills required under 40 CFR 257.70.

This alternative eliminates CCR sluicing/plant process water discharges and, with the consolidation of the CCR footprint and the installation of a new on-site disposal area liner and cap, will reduce infiltration through the CCR. This is expected to address the major contributor to the observed GPS exceedances, which is exposure of CCR material to precipitation/surface water infiltration. MNA is included with this alternative to monitor changes in groundwater impacts and the effectiveness of degradation mechanisms on groundwater concentrations over time.

5.5 ALTERNATIVE 5 – EXCAVATE AND DISPOSE IN OFF-SITE LANDFILL WITH MNA

Alternative 5 includes closing the impoundments (no further discharge), excavation of all CCR, and transport to an approved off-site landfill. Further on-site releases from the CCR sources will be prevented by relocating the source material to another site, which eliminates the potential for ongoing leaching of constituents into groundwater at BGS.

This alternative eliminates CCR sluicing/plant process water discharges and, with the removal of CCR from the site, will eliminate infiltration through the CCR. This is expected to address the major contributor to the observed GPS exceedances, which is exposure of CCR material to precipitation/surface water infiltration. MNA is included with this alternative to monitor changes in groundwater impacts and the effectiveness of degradation mechanisms on groundwater concentrations over time.

5.6 ALTERNATIVE 6 – CONSOLIDATE AND CAP WITH CHEMICAL AMENDMENT

Alternative 6 includes closing the impoundments (no further discharge), adding a chemical amendment to in-place CCR and relocated CCR to reduce the mobilization of molybdenum and lithium prior to relocating and consolidating CCR into a smaller footprint within the CCR surface impoundments, covering the CCR materials with a cap, and establishing vegetation in accordance with the requirements for closure in place in 40 CFR 257.102(d). This measure is consistent with landfill cover systems to prevent infiltration of surface water into the CCR and the reduced contaminant mobilization achieved by chemical amendment as described in **Section 4.1.1**.

This alternative eliminates CCR sluicing/plant process water discharges and, with the consolidation of the CCR footprint and the installation of a cap, will reduce infiltration through the CCR. This is expected to address the major contributor to the observed GPS exceedances, which is exposure of CCR material to precipitation/surface water infiltration. Consolidation of CCR into a smaller footprint during closure also reduces the volume of potential source materials that may be in contact with groundwater after closure. Further leaching of metals and migration within groundwater will be reduced by minimizing the footprint of CCR in contact with groundwater and by fixation using a chemical amendment.

5.7 ALTERNATIVE 7 – CONSOLIDATE AND CAP WITH GROUNDWATER COLLECTION

Alternative 7 includes closing the impoundments (no further discharge), relocating and consolidating CCR into a smaller footprint within the CCR surface impoundments, covering the CCR materials with a cap, and establishing vegetation in accordance with the requirements for closure in place in 40 CFR 257.102(d). This measure is consistent with landfill cover systems to prevent infiltration of surface water into the CCR as described in **Section 4.1.1**. Impacted groundwater will be collected using pumps and treated prior to discharge according to state and federal requirements as described in **Section 4.1.2**.

This alternative eliminates CCR sluicing/plant process water discharges and, with the consolidation of the CCR footprint and the installation of a cap, will reduce infiltration through the CCR. This is expected to address the major contributor to the observed GPS exceedances, which is exposure of CCR material to precipitation/surface water infiltration. Consolidation of CCR into a smaller footprint during closure also reduces the volume of potential source materials that may be in contact with groundwater after closure. Further leaching of metals and migration within groundwater will be reduced and may be eliminated over time as impacted groundwater is collected to contain and restore molybdenum and lithium concentrations in groundwater to levels below the GPS.

5.8 ALTERNATIVE 8 – CONSOLIDATE AND CAP WITH BARRIER WALL

Alternative 8 includes closing the impoundments (no further discharge), relocating and consolidating CCR into a smaller footprint within the CCR surface impoundments, covering the CCR materials with a cap, and establishing vegetation in accordance with the requirements for closure in place in 40 CFR 257.102(d). This measure is consistent with landfill cover systems to prevent infiltration of surface water into the CCR as described in **Section 4.1.1**. Impacted groundwater will be intercepted with a barrier wall to minimize the migration of molybdenum and lithium as described in **Section 4.1.2**.

This alternative eliminates CCR sluicing/plant process water discharges and, with the consolidation of the CCR footprint and the installation of a cap, will reduce infiltration through the CCR. This is expected to address the major contributor to the observed GPS exceedances, which is exposure of CCR material to precipitation/surface water infiltration. Consolidation of CCR into a smaller footprint during closure also reduces the volume of potential source materials that may be in contact with groundwater after closure. Further leaching of metals and migration within groundwater will be reduced and may be eliminated over time as impacted groundwater is intercepted with a barrier wall to minimize the spread of molybdenum and lithium in groundwater.

6.0 EVALUATION OF CORRECTIVE MEASURE ALTERNATIVES

As required by 40 CFR 257.96(c), the following sections provide an evaluation of the effectiveness of corrective measure alternatives in meeting the requirements and objectives outlined in 40 CFR 257.97. The evaluation addresses the requirements and objectives identified in 40 CFR 257.96(c)(1) through (3), which include:

- The performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to residual contamination.
- The time required to begin and complete the remedy.
- 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.

In addition to the discussion of the items listed above, **Table 4** provides a summary of the initial evaluation of the alternatives including each of the criteria listed in 40 CFR 257.97.

6.1 ALTERNATIVE 1 – NO ACTION

As described in **Section 5.1**, the No Action alternative is only included as a baseline condition and a point of comparison for the other alternatives. This alternative does not satisfy all five criteria in 40 CFR 257.97(b)(1) through (5), so it is not an acceptable corrective measure under the CCR Rule. For comparison only, Alternative 1 is evaluated with regard to the criteria in 40 FR 257.96(c) below:

- **Performance, Reliability, Implementation, and Impacts.**
  - **Performance.** The ability to attain the GPS for lithium and molybdenum without any additional action is unlikely.
  - **Reliability.** Alternative 1 does not provide any reduction in existing risk.
  - **Implementation.** Nothing is required to implement Alternative 1.
  - **Impacts.** No additional safety or cross-media impacts are expected with Alternative 1. This alternative does not control current suspected routes of exposure to residual contamination.
- **Timing.** No time is required to begin; however, the time required to attain the GPS for lithium and molybdenum under Alternative 1 is unknown.

- **Institutional Requirements.** No institutional requirements beyond maintaining current regulatory approvals exist for Alternative 1.

6.2 ALTERNATIVE 2 – CLOSE AND CAP IN PLACE WITH MNA

As described in **Section 5.2**, Alternative 2 includes closing the impoundments, covering the CCR materials with a cap, and establishing vegetation in accordance with the requirements for closure in place in 40 CFR 257.102(d).

- **Performance, Reliability, Implementation, and Impacts.**
  - **Performance.** Ceasing wastewater discharges and closing the impoundments by capping is expected to address infiltration, which is a key contributor to groundwater impacts. MNA monitoring will identify, if active, the natural attenuation processes that reduce mass, toxicity, mobility, volume, or concentrations of the constituents of concern in groundwater. Alternative 2 is capable of and expected to attain the GPS for lithium and molybdenum.

  - **Reliability.** The expected reliability of capping is good. Capping is a common practice and standard remedial method for closure in place in remediation and solid waste management. There is significant industry experience with the design and construction of this method.

  - **Implementation.** The complexity of constructing the cap is low. Dewatering will be required to the extent a suitable subgrade is established for cap construction, which can likely be achieved through standard dewatering methods. The cap construction may put a high demand on the local supply of suitable cap materials. The local availability of cap materials will be evaluated further during remedy selection. The equipment and personnel required to implement Alternative 2 are not specialized and are generally readily available.

  - **Impacts.** Safety impacts associated with the implementation of Alternative 2 are not significantly different than other heavy civil construction projects. Cross-media impacts are expected to be limited due to the small volume of CCR expected to be relocated on site, the short duration of cap construction, the effectiveness of standard engineering controls during construction (e.g., dust control), and the lack of off-site transportation of CCR. Although the risk to surface water receptors is already low, and ending wastewater discharges and capping the impoundments minimizes infiltration (a significant source of water and CCR interaction), some interaction between CCR and groundwater will remain. The ease of implementation and the low-impact nature of MNA as a groundwater restoration method must be evaluated against the effectiveness of passive groundwater restoration, which is the subject of ongoing evaluations. A lack of active MNA mechanism, insufficient site attenuation capacity, or changes in groundwater conditions may require additional action to restore groundwater or prevent cross-media impacts between groundwater and surface water. The potential for exposure to residual contamination is low since CCR will be capped.

- **Timing.** Closure of the impoundments can be completed within 1-2 years following cessation of ash placement in the impoundments. Coal will no longer be used as a fuel at BGS after December 31, 2021, and the closure of the impoundments is expected to be complete by October 17, 2023. The time required to attain the GPS for lithium and molybdenum will be evaluated further during the remedy selection process, but is expected to take between 2 and 10 years after closure construction is complete. Alternative 2 can provide full protection within the 30-year post-closure monitoring period.

- **Institutional Requirements.** The following permits and approvals are expected to be required to implement Alternative 2:
  - IDNR Closure Permit
  - Federal, state, and local floodplain permits
  - State and local erosion control/construction storm water management permits
  - Federal and state wetland permitting may also be required.

6.3 ALTERNATIVE 3 – CONSOLIDATE ON-SITE AND CAP WITH MNA

As described in **Section 5.3**, Alternative 3 includes closing the impoundments, relocating and consolidating CCR into a smaller footprint within the CCR surface impoundments, covering the CCR materials with a cap, and establishing vegetation in accordance with the requirements for closure in place in 40 CFR 257.102(d).

- **Performance, Reliability, Implementation, and Impacts.**
  - **Performance.** Ceasing wastewater discharges and closing the impoundments by capping is expected to address infiltration, which is a key contributor to groundwater impacts. The consolidation of CCR into a smaller footprint may enhance the performance of the cap by further reducing the area exposed to limited post-construction infiltration through the cap. The smaller closure footprint also reduces the potential for ongoing CCR contact with groundwater. MNA monitoring will identify, if active, the natural attenuation processes that reduce mass, toxicity, mobility, volume, or concentrations of the constituents of concern in groundwater. Alternative 3 is capable of and expected to attain the GPS for lithium and molybdenum.

  - **Reliability.** The expected reliability of capping is good. Capping is a common practice and standard remedial method for closure in place in remediation and solid waste management. There is significant industry experience with the design and construction of this method. A consolidated cap footprint may enhance reliability by reducing the scale of post-closure maintenance.

  - **Implementation.** The complexity of constructing the cap is low. The logistics of moving CCR around the site to consolidate the closure footprint increases the complexity of the alternative. CCR dewatering will be required to the extent required to excavate and relocate CCR within the CCR impoundments and provide a suitable subgrade for cap construction. Some conditioning (e.g., drying) of relocated CCR is expected during on-site re-disposal. Alternative 3 can likely be achieved through standard dewatering and conditioning methods. Although the cap footprint will be minimized, cap construction may put a high demand on the local supply of suitable cap materials. The local availability of cap materials will be evaluated further during remedy selection. The equipment and personnel required to implement Alternative 3 are not specialized and are generally readily available.

  - **Impacts.** Safety impacts associated with the implementation of Alternative 3 are not significantly different than other heavy civil construction projects. The level of disturbance required to consolidate CCR before capping may represent some increase in safety risk due to site conditions and on-site construction traffic. Cross-media impacts are expected to be limited due to the small volume of CCR expected to be relocated on site, the short duration of cap construction, the effectiveness of standard engineering controls during construction (e.g., dust control), and the lack of off-site transportation of CCR. Although the risk to surface water receptors is already low and ending wastewater discharges and capping the impoundments minimizes infiltration (a significant source of water and CCR interaction), some interaction between CCR and groundwater will remain. The consolidation of CCR prior to capping under Alternative 3 reduces the potential for CCR and groundwater interaction after closure. The ease of implementation and low-impact nature of MNA as a groundwater restoration method must be evaluated against the effectiveness of passive groundwater restoration, which is the subject of ongoing evaluations. A lack of active MNA mechanism, insufficient site attenuation capacity, or changes in groundwater conditions may require additional action to restore groundwater or prevent cross-media impacts between groundwater and surface water. The potential for exposure to residual contamination is low since CCR will be capped and the footprint of the cap minimized.

- **Timing.** Closure of the impoundments can be completed within 1-2 years following cessation of ash placement in the impoundments. Coal will no longer be used as a fuel at BGS after December 31, 2021, and the closure of the impoundments is expected to be complete by October 17, 2023. The time required to attain the GPS for lithium and molybdenum will be evaluated further during the remedy selection process, but is expected to take between 2 and 10 years after closure construction is complete. The level of source disturbance during construction may increase the time required to reach GPS. The consolidation of CCR into a smaller cap area may decrease the time to reach GPS. Alternative 3 can provide full protection within the 30-year post-closure monitoring period.

- **Institutional Requirements.** The following permits and approvals are expected to be required to implement Alternative 3:
  - IDNR Closure Permit
  - Federal, state, and local floodplain permits
  - State and local erosion control/construction storm water management permits
  - Federal and state wetland permitting may also be required.

6.4 ALTERNATIVE 4 – EXCAVATE AND DISPOSE ON-SITE WITH MNA

As described in **Section 5.4**, Alternative 4 includes closing the impoundments, excavation of CCR from the source area, and creation of a new on-site disposal that meets the design criteria for new CCR landfills required under 40 CFR 257.70

- **Performance, Reliability, Implementation, and Impacts.**
  - **Performance.** Ceasing wastewater discharges and closing the impoundments by removing and re-disposing CCR in a new lined/capped disposal area is expected to address infiltration, which is a key contributor to groundwater impacts. The consolidation of CCR into a smaller footprint may enhance the performance of the cap by further reducing the area exposed to limited post-construction infiltration through the cap. The separation from groundwater and other location criteria for the new on-site disposal facility may enhance the performance of this alternative.

MNA monitoring will identify, if active, the natural attenuation processes that reduce mass, toxicity, mobility, volume, or concentrations of the constituents of concern in groundwater. Alternative 4 is capable of and expected to attain the GPS for lithium and molybdenum.

– **Reliability.** The expected reliability of on-site re-disposal with a composite liner and cap is good. Disposal facilities that meet the requirements in 40 CFR 257.70 or other similar requirements have been used for solid waste disposal including municipal and industrial waste for numerous years. There is significant industry experience with the design and construction of similar disposal facilities. The composite liner and cover, combined with a consolidated disposal footprint, may enhance reliability by reducing infiltration and the scale of post-closure maintenance. At the same time, post-closure maintenance is likely more complex due to maintenance of a leachate collection system and geosynthetic repairs requiring specialized personnel, material, and equipment.

– **Implementation.** The complexity of constructing the new liner and cap is moderate due to the composite design. The limited area available at the facility for developing an on-site disposal facility makes this alternative logistically complex. Significant volumes of CCR will be excavated and stored on site while the disposal facility is constructed. Significant dewatering will be required to excavate and relocate CCR to a temporary storage area. Conditioning (e.g., drying) of relocated CCR is expected to facilitate temporary storage and on-site re-disposal. Alternative 4 can likely be achieved through standard dewatering and conditioning methods, but may be impacted by the space available for these activities. Although the post-closure CCR footprint will be minimized, composite liner and cap construction may put a high demand on the local supply of suitable cap materials. The local availability of liner and cap materials will be evaluated further during remedy selection. The equipment and personnel required to implement Alternative 4 are not specialized and are generally readily available with the exception of the resources needed to install the geosynthetic portions of the composite liner and cover, which are not locally available.

– **Impacts.** Safety impacts associated with the implementation of Alternative 4 are not significantly different than other heavy civil construction projects. However, the level of disturbance required to excavate, store, and re-dispose CCR on site and the traffic required to import composite liner and cap material are not typical and likely represent an increase in safety risk due to site conditions, on-site construction traffic, and incoming/outgoing off-site construction traffic. A risk of cross-media impacts is possible due to the large volume of CCR to be excavated, stored, and relocated on site. Although the risk to surface water receptors is already low, Alternative 4 significantly reduces the potential interaction between CCR and water after closure. The ease of implementation and low-impact nature of MNA as a groundwater restoration method must be evaluated against the effectiveness of passive groundwater restoration, which is the subject of ongoing evaluations. A lack of active MNA mechanism, insufficient site attenuation capacity, or changes in groundwater conditions may require additional action to restore groundwater or prevent cross-media impacts between groundwater and surface water. The potential for exposure to residual contamination is low since CCR will be capped and the footprint of the cap minimized.

- **Timing.** Closure of the impoundments can be completed within 1-2 years following cessation of ash placement in the impoundments. Coal will no longer be used as a fuel at BGS after December 31, 2021, and the closure of the impoundments is expected to be complete by October 17, 2023; however, the time required to permit and develop the on-site disposal facility may extend this schedule. The time required to attain the GPS for lithium and molybdenum will be evaluated further during the remedy selection process, but is expected to take between 2 and 10 years after closure construction is complete. The level of source disturbance during construction may increase the time required to reach GPS. The consolidation of CCR into a new on-site disposal facility with a composite liner and cap may decrease the time to reach GPS. Alternative 4 can provide full protection within the 30-year post-closure monitoring period.

- **Institutional Requirements.** The following permits and approvals are expected to be required to implement Alternative 4:
  - IDNR Closure Permit
  - IDNR Disposal Facility (Landfill) Permit
  - Federal, state, and local floodplain permits
  - State and local erosion control/construction stormwater management permits
  - Federal and state wetland permitting

6.5 ALTERNATIVE 5 – EXCAVATE AND DISPOSE IN OFF-SITE LANDFILL WITH MNA

As described in **Section 5.5**, Alternative 5 includes closing the impoundments, excavation of CCR from the source area, and transporting the CCR off site for disposal.

- **Performance, Reliability, Implementation, and Impacts.**
  - **Performance.** Ceasing wastewater discharges and closing the impoundments by removing and re-disposing CCR off site will eliminate the source material exposed to infiltration, which is a key contributor to groundwater impacts. The off-site disposal of CCR prevents further releases at BGS, but introduces the possibility of releases at the receiving facility. Although the risk to surface water receptors is already low, Alternative 5 nearly eliminates the potential interaction between CCR and water after closure. The ease of implementation and low-impact nature of MNA as a groundwater restoration method must be evaluated against the effectiveness of passive groundwater restoration, which is the subject of ongoing evaluations. A lack of active MNA mechanism, insufficient site attenuation capacity, or changes in groundwater conditions may require additional action to restore groundwater or prevent cross-media impacts between groundwater and surface water. MNA monitoring will identify, if active, the natural attenuation processes that reduce mass, toxicity, mobility, volume, or concentrations of the constituents of concern in groundwater. Alternative 5 is capable of and expected to attain the GPS for lithium and molybdenum.

  - **Reliability.** The expected reliability of excavation and off-site disposal is good. Off-site disposal facilities are required to meet the requirements in 40 CFR 257.70 or other similar requirements, which have been used for solid waste disposal including municipal and industrial waste for numerous years. There is significant industry experience with the design and construction of these disposal facilities.

- **Implementation.** The complexity of excavating CCR for off-site disposal is low. The scale of CCR excavation (expected to exceed 1 million cy), off-site transportation, and the permitting/development of off-site disposal facility airspace makes this alternative logistically complex. Significant dewatering will be required to excavate CCR. Conditioning (e.g., drying) of excavated CCR is expected to facilitate off-site transportation and re-disposal. Alternative 5 can likely be achieved through standard dewatering and conditioning methods, but may be impacted by the space available for these activities. Although the source area at BGS is eliminated, the development of off-site disposal airspace will put a high demand on the receiving disposal facility, which may not have the current physical or logistical capacity to receive large volumes of CCR in a short period of time. The equipment and personnel required to implement on-site and off-site aspects of Alternative 5 are not specialized and are generally readily available with the exception of the resources needed to install the geosynthetic portions of the off-site composite liner and cover, which are not locally available.

- **Impacts.** Safety impacts associated with the implementation of Alternative 5 are not significantly different than other heavy civil construction projects. However, the level of disturbance required to excavate, transport, and re-dispose CCR, and the traffic required to import composite liner and cap material at the receiving disposal facility are not typical and likely represent an increase in safety risk due to large volumes of incoming/outgoing off-site construction traffic at both sites. A risk of cross-media impacts is possible due to the large volume of CCR to be excavated and transported from the site. The potential for exposure to residual contamination on site is very low since CCR will be removed; however, the off-site potential for exposure to CCR is increased due to the relocation of the source material.

- **Timing.** Closure of the impoundments can be completed within 1-2 years following cessation of ash placement in the impoundments. Coal will no longer be used as a fuel at BGS after December 31, 2021, and the closure of the impoundments is expected to be complete by October 17, 2023. However, the time required to secure the off-site disposal airspace required to complete this alternative, including potential procurement, permitting, and construction, may extend this schedule significantly. The time required to attain the GPS for lithium and molybdenum will be evaluated further during the remedy selection process, but is expected to take between 2 and 10 years after closure construction is complete. The level of source disturbance during construction may increase the time required to reach GPS. The removal of CCR from BGS may decrease the time to reach GPS. Alternative 5 can provide full protection within the 30-year post-closure monitoring period.

- **Institutional Requirements.** The following permits and approvals are expected to be required to implement Alternative 5:
  - IDNR Closure Permit
  - Approval of off-site disposal facility owner or landfill permit for new off-site facility
  - Federal, state, and local floodplain permits
  - State and local erosion control/construction storm water management permits
  - Federal and state wetland permitting
  - Transportation agreements and permits (local roads and railroads)
  - State solid waste comprehensive planning approvals may also be required.

6.6 ALTERNATIVE 6 – CONSOLIDATE AND CAP WITH CHEMICAL AMENDMENT

As described in **Section 5.6**, Alternative 6 includes closing the impoundments, relocating and consolidating CCR into a smaller footprint within the CCR surface impoundments, adding a chemical amendment to the CCR to reduce the mobilization of molybdenum and lithium prior to relocating, covering the CCR materials with a cap, and establishing vegetation in accordance with the requirements for closure in place in 40 CFR 257.102(d).

- **Performance, Reliability, Implementation, and Impacts.**
  - **Performance.** Ceasing wastewater discharges and closing the impoundments by capping is expected to address infiltration, which is a key contributor to groundwater impacts. The consolidation of CCR into a smaller footprint may enhance the performance of the cap by further reducing the area exposed to limited post-construction infiltration through the cap. The smaller closure footprint also reduces the potential for ongoing CCR contact with groundwater. The application of a chemical amendment to the CCR that will remain on site may further reduce the potential for ongoing groundwater impacts after closure. Although the risk to surface water receptors is already low, the potential for CCR to interact with groundwater will remain after closure. Alternative 6 further reduces the potential for ongoing groundwater impacts from that interaction between CCR and water. If needed to address changes in groundwater conditions or prevent cross-media impacts between groundwater and surface water, the initial application of a chemical amendment during closure can be supplemented with additional applications in the future outside of the capped area. Alternative 6 is capable of and expected to attain the GPS for lithium and molybdenum.

  - **Reliability.** The expected reliability of capping is good. Capping is a common practice and standard remedial method for closure in place in remediation and solid waste management. There is significant industry experience with the design and construction of this method. A consolidated cap footprint may enhance reliability by reducing the scale of post-closure maintenance. Based on a review of information in the Federal Remediation Technologies Roundtable (FRTR) Technology Screening Matrix, amending source material using site-specific chemistries can be an effective means of sequestering metals to limit the future release to groundwater from residual source material. The technology can be applied to source material and groundwater plumes. The approach has been used at full scale to remediate inorganics (FRTR 2020).

  - **Implementation.** The complexity of constructing the cap is low. The logistics of moving CCR around the site to consolidate the closure footprint increases the complexity of the alternative. CCR dewatering will be required to the extent required to excavate and relocate CCR within the CCR impoundments and provide a suitable subgrade for cap construction. Some conditioning (e.g., drying) of relocated CCR is expected during on-site re-disposal. So long as an appropriate amendment chemistry can be identified for BGS, the technology and equipment used for the in-situ application or mixing as part of excavation/consolidation activities is commercially available. Alternative 6 can likely be achieved through standard dewatering and conditioning methods. Although the cap footprint will be minimized, cap construction may put a high demand on the local supply of suitable cap materials. The local availability of cap materials will be evaluated further during remedy selection. The equipment and personnel required to implement the consolidation and capping portion of Alternative 6 are not specialized and are generally readily available; however, the equipment for the in-situ chemical amendment application is more specialized and may be in high demand.

- **Impacts.** Safety impacts associated with the implementation of Alternative 6 are not significantly different than other heavy civil construction projects. The level of disturbance required to consolidate CCR before capping may represent some increase in safety risk due to site conditions and on-site construction traffic. Some elevated risk may exist due to the use of and application of amendment chemistry, but can likely be addressed with additional worker protective measures. Cross-media impacts are expected to be limited due to the small volume of CCR expected to be relocated on site, the short duration of cap construction, the effectiveness of standard engineering controls during construction (e.g., dust control), and the lack of off-site transportation of CCR. Although the risk to surface water receptors is already low based on available data, the additional source control provided by Alternative 6 may offer further reduction of risks if groundwater conditions change. The potential for exposure to residual contamination is low since the CCR will be chemically stabilized, capped, and the footprint of the cap minimized.

- **Timing.** Closure of the impoundments can be completed within 1-2 years following cessation of ash placement in the impoundments. Coal will no longer be used as a fuel at BGS after December 31, 2021, and the closure of the impoundments is expected to be complete by October 17, 2023. The time required to attain the GPS for lithium and molybdenum will be evaluated further during the remedy selection process, but is expected to take between 2 and 10 years after closure construction is complete. The level of source disturbance during construction may increase the time required to reach GPS. The consolidation of CCR into a smaller cap area may decrease the time to reach GPS. Alternative 6 can provide full protection within the 30-year post-closure monitoring period.

- **Institutional Requirements.** The following permits and approvals are expected to be required to implement Alternative 6:
  - IDNR Closure Permit
  - Federal, state, and local floodplain permits
  - Injection permits
  - State and local erosion control/construction storm water management permits
  - Federal and state wetland permitting may also be required.

6.7 ALTERNATIVE 7 – CONSOLIDATE AND CAP WITH GROUNDWATER COLLECTION

As described in **Section 5.7**, Alternative 7 includes closing the impoundments, relocating and consolidating CCR into a smaller footprint within the CCR surface impoundments, covering the CCR materials with a cap, establishing vegetation in accordance with the requirements for closure in place in 40 CFR 257.102(d), and installing a groundwater pump and treat system to prevent the migration of and/or to recover groundwater with lithium and molybdenum concentrations greater than the GPS.

- **Performance, Reliability, Implementation, and Impacts.**
  - **Performance.** Ceasing wastewater discharges and closing the impoundments by capping is expected to address infiltration, which is a key contributor to groundwater impacts. The consolidation of CCR into a smaller footprint may enhance the performance of the cap by further reducing the area exposed to limited post-construction infiltration through the cap. The groundwater pump and treat system may further reduce the potential for downgradient migration of groundwater impacts after closure. Although the risk to surface water receptors is already low, the potential for CCR to interact with groundwater will remain after closure. Alternative 7 further reduces the risk of potential ongoing groundwater impacts from that interaction between CCR and water. The groundwater pump and treat system offers additional flexibility to address changes in groundwater conditions or prevent cross-media impacts between groundwater and surface water. Alternative 7 is capable of and expected to attain the GPS for lithium and molybdenum.

  - **Reliability.** The expected reliability of capping is good. Capping is a common practice and standard remedial method for closure in place in remediation and solid waste management. There is significant industry experience with the design and construction of this method. A consolidated cap footprint may enhance reliability by reducing the scale of post-closure maintenance. Similar to capping, groundwater pump and treat is a common method used to limit the migration of impacted groundwater or remove impacted groundwater to restore groundwater concentrations to levels below the GPS.

  - **Implementation.** The complexity of constructing the cap is low. The logistics of moving CCR around the site to consolidate the closure footprint increases the complexity of the alternative. CCR dewatering will be required to the extent required to excavate and relocate CCR within the CCR impoundments and provide a suitable subgrade for cap construction. Some conditioning (e.g., drying) of relocated CCR is expected during on-site re-disposal. The complexity of the groundwater pump and treat system is also low. Alternative 7 can likely be achieved through standard dewatering and conditioning methods. Although the cap footprint will be minimized, cap construction may put a high demand on the local supply of suitable cap materials. The local availability of cap materials will be evaluated further during remedy selection. The equipment and personnel required to implement Alternative 7 are not specialized and are generally readily available. The development, operation, maintenance, and monitoring of adequate treatment for large volumes of groundwater with relatively low concentrations of lithium and molybdenum likely increases the complexity of implementing this alternative.

  - **Impacts.** Safety impacts associated with the implementation of Alternative 7 are not significantly different than other heavy civil construction projects. The level of disturbance required to consolidate CCR before capping may represent some increase in safety risk due to site conditions and on-site construction traffic. Some elevated risk may exist due to the additional construction involved with the groundwater pump and treat system and the higher complexity of the long term maintenance required. Cross-media impacts are expected to be limited due to the small volume of CCR expected to be relocated on site, the short duration of cap construction, the effectiveness of standard engineering controls during construction (e.g., dust control), and the lack of off-site transportation of CCR.

Although the risk to surface water receptors is already low based on available data, the active nature of the groundwater plume containment provided by Alternative 7 may offer further reduction of risks if groundwater conditions change. The potential for exposure to residual contaminated source material is low since CCR will be capped and the footprint of the cap minimized. The potential exposure to contaminated groundwater is increased due to the ex-situ groundwater treatment required and the potential for worker exposure and spills.

- **Timing.** Closure of the impoundments can be completed within 1-2 years following cessation of ash placement in the impoundments. Coal will no longer be used as a fuel at BGS after December 31, 2021, and the closure of the impoundments is expected to be complete by October 17, 2023. The time required to attain the GPS for lithium and molybdenum will be evaluated further during the remedy selection process, but is expected to take between 2 and 10 years after closure construction is complete. The level of source disturbance during construction may increase the time required to reach GPS. The additional time required to design and install the groundwater pump and treat system is unlikely to have a significant impact on the implementation timing but may reduce the time required to attain the GPS. The consolidation of CCR into a smaller cap area may decrease the time to reach GPS. Alternative 7 can provide full protection within the 30-year post-closure monitoring period.

- **Institutional Requirements.** The following permits and approvals are expected to be required to implement Alternative 7:
  - IDNR Closure Permit
  - Federal, state, and local floodplain permits
  - State and local well installation permits
  - NPDES permitting for post-treatment groundwater discharges
  - State and local erosion control/construction storm water management permits
  - Federal and state wetland permitting may also be required.

6.8 ALTERNATIVE 8 – CONSOLIDATE AND CAP WITH BARRIER WALL

As described in **Section 5.8**, Alternative 8 includes closing the impoundments, relocating and consolidating CCR into a smaller footprint within the CCR surface impoundments, covering the CCR materials with a cap, establishing vegetation in accordance with the requirements for closure in place in 40 CFR 257.102(d), and installing a downgradient barrier wall to prevent the migration of groundwater with lithium and molybdenum concentrations greater than the GPS.

- **Performance, Reliability, Implementation, and Impacts.**
  - **Performance.** Ceasing wastewater discharges and closing the impoundments by capping is expected to address infiltration, which is a key contributor to groundwater impacts. The consolidation of CCR into a smaller footprint may enhance the performance of the cap by further reducing the area exposed to limited post-construction infiltration through the cap. The barrier wall may further reduce the potential for ongoing groundwater impacts after closure. Although the risk to surface water receptors is already low, the potential for CCR to interact with groundwater will remain after closure. Alternative 8 further reduces the risk of potential ongoing groundwater impacts from that interaction between CCR and water. Although it acts passively, the barrier wall reduces the risk from a more passive groundwater restoration approach such as MNA. If MNA mechanisms are not active, the site has insufficient site attenuation capacity, or groundwater

conditions change in a way that increases the potential for cross-media impacts between groundwater and surface water. Alternative 8 is capable of and expected to attain the GPS for lithium and molybdenum.

– **Reliability.** The expected reliability of capping is good. Capping is a common practice and standard remedial method for closure in place in remediation and solid waste management. There is significant industry experience with the design and construction of this method. A consolidated cap footprint may enhance reliability by reducing the scale of post-closure maintenance. A barrier wall at BGS will likely have to consist of a permeable reactive barrier (PRB) due to the lack of an impermeable layer to key a low permeability barrier wall into. In general the reliability of PRBs for containment of inorganics is favorable based on information available in the FRTR Technology Screening Matrix (FRTR 2020). The reliability of a PRB requires the identification of a suitable reactive media for the conditions at BGS and the ability to effectively locate the barrier, which are both likely but require additional evaluations. Initial reviews indicate suitable reagents for a PRB at BGS include:

  - Lithium: Sorbents including clay minerals, aluminum hydroxide, manganese oxides, and/or carbon.
  - Molybdenum: Reducing agent such as zero-valent iron.

  PRB performance can diminish over time as consumptive media is exhausted or hydraulic conditions change due to chemical precipitation or biofouling. Long-term monitoring and maintenance is required to ensure continued performance.

– **Implementation.** The complexity of constructing the cap is low. The logistics of moving CCR around the site to consolidate the closure footprint increases the complexity of the alternative. CCR dewatering will be required to the extent required to excavate and relocate CCR within the CCR impoundments and provide a suitable subgrade for cap construction. Some conditioning (e.g., drying) of relocated CCR is expected during on-site re-disposal. The complexity of the PRB wall significantly increases the level of complexity for implementing this alternative. PRB installation contractors and equipment have lengthy procurement timelines. Alternative 8 can likely be achieved through standard dewatering and conditioning methods. Although the cap footprint will be minimized, cap construction may put a high demand on the local supply of suitable cap materials. The equipment and personnel required to implement the consolidation and capping portion of Alternative 8 are not specialized and are generally readily available; however, the equipment for the barrier wall is more specialized and may be in high demand.

– **Impacts.** Safety impacts associated with the implementation of Alternative 8 are not significantly different than other heavy civil construction projects. The level of disturbance required to consolidate CCR before capping may represent some increase in safety risk due to site conditions and on-site construction traffic. Some elevated risk may exist due to the additional construction involved with the barrier wall construction and the higher complexity of the long term barrier wall performance monitoring. Cross-media impacts are expected to be limited due to the small volume of CCR expected to be relocated on site, the short duration of cap construction, the effectiveness of standard engineering controls during construction (e.g., dust control), and the lack of off-site transportation of CCR.

Although the risk to surface water receptors is already low based on available data, the enhanced nature of the passive groundwater plume containment provided by Alternative 8 may offer further reduction of risks if groundwater conditions change. The potential for exposure to residual contaminated source material is low since CCR will be capped and the footprint of the cap minimized.

- **Timing.** Closure of the impoundments can be completed within 1-2 years following cessation of ash placement in the impoundments. Coal will no longer be used as a fuel at BGS after December 31, 2021, and the closure of the impoundments is expected to be complete by October 17, 2023. The time required to attain the GPS for lithium and molybdenum will be evaluated further during the remedy selection process, but is expected to take between 2 and 10 years after closure construction is complete. The level of source disturbance during construction may increase the time required to reach GPS. The additional time required to design and install the barrier wall is unlikely to have a significant impact on the implementation timing but may reduce the time required to attain the GPS. The consolidation of CCR into a smaller cap area may decrease the time to reach GPS. Alternative 8 can provide full protection within the 30-year post-closure monitoring period.

- **Institutional Requirements.** The following permits and approvals are expected to be required to implement Alternative 8:
  - IDNR Closure Permit
  - Federal, state, and local floodplain permits
  - State and local well installation permits
  - State and local erosion control/construction storm water management permits
  - Federal and state wetland permitting may also be required.

7.0 SUMMARY OF ASSESSMENT

Each of the identified corrective measure alternatives exhibit favorable and unfavorable outcomes with respect to the assessment factors that must be evaluated in accordance with 40 CFR 257.97(c). At the present time, limited impacts have been identified as described in **Section 3.0**. The nature and extent of those impacts are the subject of ongoing assessment, and IPL continues to assess remedies to meet the requirements and objectives described in 40 CFR 257.97.

8.0 REFERENCES

Alliant Energy (2019), Interstate Power and Light Company – Burlington Generating Station, NPDES Renewal Application (NPDES Permit No.: 2900101), October 18, 2019.

Federal Remediation Technologies Roundtable (FRTR) (2020), Technology Screening Matrix https://frtr.gov/matrix/default.cfm, Accessed November 17-19, 2020.

Hard Hat Services (HHS) (2018), History of Construction, Burlington Generating Station, Interstate Power and Light Company, Revised March 2018.

HHS (2020), CCR Surface Impoundment Annual Inspection Report, Burlington Generating Station, Interstate Power and Light Company, July 2020.

United States Environmental Protection Agency (USEPA) (1998), "Solid Waste Disposal Facility Criteria Technical Manual (EPA530-R-93-017), Revised April 13, 1998," Solid Waste and Emergency Response.

USEPA (2007), "Monitored Natural Attenuation of Inorganic Contaminants in Groundwater, Volume 1 – Technical Basis for Assessment, (EPA600-R-07-139)," Office of Research and Development, National Risk Management Laboratory, Ada, Oklahoma.

Table 1. Groundwater Elevation Summary
Burlington Generating Station / SCS Engineers Project #25220066.00

Well Number	MW-301	MW-302	MW-302A	MW-303	MW-304	MW-305	MW-306	MW-307	MW-307A	MW-308	MW-309	MW-310	MW-310A	MW-311	MW-312	MW-313	MW-313A
Top of Casing Elevation (feet amsl)	538.38	535.69	535.89	533.60	534.42	533.28	536.92	536.96	536.22	537.20	536.42	531.99	532.53	532.32	536.43	535.82	536.03
Screen Length (ft)		5.00	5					5.00	5				5			5	5
Total Depth (ft from top of casing)	31.90	29.95	62.55	28.59	25.27	29.43	34.41	28.64	61.93	30.31	27.31	18.76	48.8	22.63	27.70	32.97	63.38
Top of Well Screen Elevation (ft)	511.48	510.74	478.34	510.01	514.15	508.85	507.51	513.32	479.29	511.89	514.11	518.23	488.73	514.69	513.80	507.85	477.65
Measurement Date																	
April 20, 2016	522.63	521.91	NI	521.76	521.78	521.96	521.74	522.38	NI	521.93	522.09	525.43	NI	523.72	NM	NM	NI
June 6 & 7, 2016	521.07	521.21	NI	521.26	521.28	521.48	521.43	521.75	NI	521.43	521.39	524.13	NI	521.80	NM	NM	NI
August 16 & 17, 2016	521.81	521.35	NI	521.31	521.37	521.46	521.53	521.91	NI	521.56	521.70	524.84	NI	522.92	NM	NM	NI
October 3, 2016	527.48	527.54	NI	527.57	527.57	527.71	527.67	527.81	NI	527.62	527.57	527.58	NI	527.34	NM	NM	NI
January 9 & 10, 2017	525.38	525.50	NI	525.56	525.62	525.74	525.67	525.81	NI	525.65	525.57	525.78	NI	525.16	NM	NM	NI
April 3 & 4, 2017	523.08	522.84	NI	522.81	522.87	523.03	523.07	523.14	NI	523.07	523.10	525.52	NI	524.01	NM	NM	NI
June 12 & 13, 2017	523.21	522.84	NI	522.80	522.90	522.78	522.87	523.17	NI	522.90	522.91	524.94	NI	523.55	NM	NM	NI
August 15 & 16, 2017	519.96	519.39	NI	519.30	519.23	519.93	519.82	520.16	NI	519.80	519.93	523.89	NI	521.12	NM	NM	NI
October 16, 2017	522.13	522.20	NI	522.23	522.32	522.48	522.72	522.55	NI	522.46	522.67	525.49	NI	523.44	NM	NM	NI
May 8 & 9, 2018	525.51	525.81	NI	525.80	525.85	526.06	526.00	526.06	NI	525.62	525.54	525.79	NI	525.08	NM	NM	NI
August 13 & 14, 2018	520.19	519.87	NI	519.78	519.81	520.29	520.14	520.46	NI	520.22	520.22	523.69	NI	521.06	NM	NM	NI
October 9 &10, 2018	528.01	528.08	NI	528.78	528.82	528.97	528.95	529.08	NI	528.98	528.93	529.00	NI	528.49	NM	NM	NI
March 11, 2019	523.38	522.83	NI	522.74	522.80	NM	523.21	523.49	NI	523.13	NM	NM	NI	NM	NM	NM	NI
April 3, 2019	528.15	528.21	NI	528.22	528.27	528.36	528.40	528.63	NI	528.39	528.40	528.62	NI	528.20	NM	NM	NI
June 6, 2019	530.70	531.02	NI	531.00	531.04	TOC	531.19	531.38	NI	531.15	531.08	531.48	NI	531.07	531.08	531.05	NI
October 10 & 11, 2019	526.80	526.88	NI	526.87	526.97	527.03	527.22	527.45	NI	527.08	527.02	526.25	NI	526.68	526.97	526.97	NI
June 2-4, 2020	523.94	523.98	NI	523.97	524.02	524.12	524.45	524.62	NI	524.10	524.06	525.36	NI	524.05	524.05	524.02	NI
September 9, 2020	519.90	519.79	519.71	519.73	519.83	520.00	520.14	520.41	519.97	520.11	520.13	524.13	509.16	520.87	519.85	519.83	519.76
Ocober 19, 2020		518.94	518.79					519.33	519.00			523.81	514.13			518.70	518.61
Bottom of Well Elevation (ft)	506.48	505.74	473.34	505.01	509.15	503.85	502.51	508.32	474.29	506.89	509.11	513.23	483.73	509.69	508.73	502.85	472.65

Notes:
NM = not measured
TOC = top of casing
NI = not installed

Created by: KAK Date: 6/15/2016
Last revision by: TK Date: 10/23/2020
Checked by: NDK Date: 10/23/2020

\\Mad-fs01\data\Projects\25220066.00\Data and Calculations\Tables\[wlstat_BGS.xls]levels

Table 2. CCR Rule Groundwater Samples Summary
Burlington Generating Station / SCS Engineers Project #25218201.00

	Downgradient Wells														Background Wells		
Sample Dates	MW-301	MW-302	MW-302A	MW-303	MW-304	MW-305	MW-306	MW-307	MW-307A	MW-308	MW-309	MW-312	MW-313	MW-313A	MW-310	MW310A	MW-311
4/20-21/2016	B	B	--	B	B	B	B	B	--	B	B	--	--	--	B	--	B
6/6-7/2016	B	B	--	B	B	B	B	B	--	B	B	--	--	--	B	--	B
8/16-17/2016	B	B	--	B	B	B	B	B	--	B	B	--	--	--	B	--	B
10/3/2016	B	B	--	B	B	B	B	B	--	B	B	--	--	--	B	--	B
1/9-10/2017	B	B	--	B	B	B	B	B	--	B	B	--	--	--	B	--	B
4/3-4/2017	B	B	--	B	B	B	B	B	--	B	B	--	--	--	B	--	B
6/12-13/2017	B	B	--	B	B	B	B	B	--	B	B	--	--	--	B	--	B
8/15-16/2017	B	B	--	B	B	B	B	B	--	B	B	--	--	--	B	--	B
10/16-17/2017	D	D	--	D	D	D	D	D	--	D	D	--	--	--	D	--	D
5/8-9/2018	A	A	--	A	A	A	A	A	--	A	A	--	--	--	A	--	A
8/13-14/2018	A	A	--	A	A	A	A	A	--	A	A	--	--	--	A	--	A
10/9-10/2018	A	A	--	A	A	A	A	A	--	A	A	--	--	--	A	--	A
3/12-13/2019	R	R	--	R	R	--	R	R	--	R	--	--	--	--	--	--	--
4/3-4/2019	A	A	--	A	A	A	A	A	--	A	A	--	--	--	A	--	A
6/6/2019	--	--	--	--	--	--	--	--	--	--	--	A	A	--	--	--	--
10/10-11/2019	A	A	--	A	A	A	A	A	--	A	A	A	A	--	A	--	A
6/2-4/2020	A	A	--	A	A	A	A	A	--	A	A	A	A	--	A	--	A
09/09/20	--	--	A	--	--	--	--	--	A	--	--	--	--	A	--	A	--
10/14-16/2020	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Abbreviations:
A = Required by Assessment Monitoring Program
B = Background Sample
-- = Not applicable
D = Required by Detection Monitoring Program
R = Resample Event

Created by:	NDK	Date:	6/18/2019
Last revision by:	TK	Date:	11/19/2020
Checked by:	NDK	Date:	11/19/2020

\\10.2.18.8\data\Projects\25219168.00\Data and Calculations\Tables\[2_GW_Samples_Summary_Table_BGS.xlsx]GW Summary

Table 3. Groundwater Analytical Results Summary - Assessment Monitoring
Burlington Generating Station, Burlington, IA / SCS Engineers Project #25220066.00

Parameter Name	UPL Method	UPL	GPS	Background Wells									
				MW-310								MW-310A*%	
				10/16/2017	5/9/2018	8/14/2018	10/10/2018	4/4/2019	10/11/2019	6/2/2020	10/14/2020	9/9/2020	10/16/2020
Appendix III													
Boron, ug/L	NP	2,950		305	217	256	268	560	380	500	290	2,200	1200
Calcium, mg/L	P	210		105	104	102	107	120	120	130	92	150	62
Chloride, mg/L	P	209		38.3	24.4	33.8	67.1	88	59	87	17	18	16
Fluoride, mg/L	P	0.427		0.39	0.33	0.39	0.4	0.55	0.34 J	0.65	<0.23	0.27 J	<0.23
Field pH, Std. Units	P	8.17		7.92	7.46	7.44	7.20	7.84	6.95	7.30	7.34	7.33	NA
Sulfate, mg/L	P	457		35.1	28.8	27.2	37.9	21	51	100	19	100	130
Total Dissolved Solids, mg/L	P	1,113		445	462	472	512	600	410	590	390	570	620
Appendix IV		**UPL**	**GPS**										
Antimony, ug/L	P*	0.17	6	NA	<0.026	<0.15	<0.078	<0.53	<0.53	<0.58	1.9	1.1	1.5
Arsenic, ug/L**	P	114.9	114.9	NA	57.8	56.2	62.1	65	61	55	63	15	5.1
Barium, ug/L	P	1,147	2,000	NA	403	398	450	560	500	550	400	290	90
Beryllium, ug/L	NP*	0.036	4	NA	<0.012	<0.12	<0.089	<0.27	<0.27	<0.27	<0.27	2.3	<0.27
Cadmium, ug/L	NP*	0.025	5	NA	<0.018	<0.070	<0.033	<0.077	<0.039	<0.039	<0.049	0.69	0.062 J
Chromium, ug/L	P*	0.090	100	NA	0.16 J,B	<0.19	0.082 J	<0.98	<0.98	<1.1	<1.1	5.4	<1.1
Cobalt, ug/L	P	3.87	6	NA	1.2	1.4	1.4	1.9	1.9	2.3	1.5	28	3.4
Fluoride, mg/L	P	0.427	4	NA	0.33	0.39	0.4	0.55	0.34 J	0.65	<0.23	0.27 J	<0.23
Lead, ug/L	NP*	0.64	15	NA	0.044 J	<0.12	<0.13	<0.27	<0.27	<0.27	<0.11	20	3.5
Lithium, ug/L	NP*	7.7	40	NA	<4.6	5.3 J	<4.6	<2.7	<2.7	<2.3	<2.5	32	36
Mercury, ug/L	DQ	DQ	2	NA	<0.090	NA	<0.090	<0.10	NA	<0.10	<0.10	<0.10	<0.10
Molybdenum, ug/L	NP	14.7	100	NA	4.2	4	4.6	5.2	6.0	5.8	3.6	19	33
Selenium, ug/L	P*	0.28	50	NA	0.14 J	<0.16	0.19 J	<1.0	<1.0	<1.0	<1.0	1.5 J	<0.10
Thallium, ug/L	NP*	0.35	2	NA	<0.036	NA	<0.099	<0.27	NA	<0.26	NA	<0.26	NA
Radium 226/228 Combined, pCI/L	P	3.36	5	NA	0.755	1.55	2.56	1.19	0.490	0.844	Pending	4.91	Pending
Additional Parameter Collected for Selection of Remedy													
Lithium, dissolved,# ug/L	UPL or GPS not applicable			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron, dissolved,# ug/L				NA	NA	NA	NA	NA	NA	NA	16,000	NA	<50.0
Iron, ug/L				NA	NA	NA	NA	NA	NA	NA	18,000	NA	1,600
Magnesium, dissolved,#				NA	NA	NA	NA	NA	NA	NA		NA	
Magnesium, ug/L				NA	NA	NA	NA	NA	NA	NA	24,000	NA	25,000
Manganese, dissolved,# ug/L				NA	NA	NA	NA	NA	NA	NA	4,000	NA	420
Manganese, ug/L				NA	NA	NA	NA	NA	NA	NA	4,400	NA	470
Molybdenum, dissolved,# ug/L				NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium, ug/L				NA	NA	NA	NA	NA	NA	NA	2,700	NA	6,900
Sodium, ug/L				NA	NA	NA	NA	NA	NA	NA	13,000	NA	####
Bicarbonate Alkalinity, mg/L				NA	NA	NA	NA	NA	NA	NA	330	NA	410
Carbonate Alkalinity, mg/L				NA	NA	NA	NA	NA	NA	NA	<3.80	NA	<3.8
Total Alkalinity, mg/L				NA	NA	NA	NA	NA	NA	NA	330	NA	410

Parameter Name	Background Wells								Compliance Wells								
	MW-311								MW-301								
	10/16/2017	5/9/2018	8/14/2018	10/10/2018	4/4/2019	10/11/2019	6/2/2020	10/14/2020	10/16/2017	5/9/2018	8/13/2018	10/10/2018	3/12/2019	4/3/2019	10/10/2019	6/3/2020	10/16/2020
Appendix III																	
Boron, ug/L	2,810	2,200	2,580	2,820	1,800	2,800	2,500	3500	9,900 M1	9,140	12,800	8,040	NA	12,000	8,100	10,000	12000
Calcium, mg/L	145	173	156	130	200	150	190	140	140 M1	85.3	174	103	NA	150	130	140	220
Chloride, mg/L	50.9	79.9	69.9	54	110	65	120	61	22.0	22.7	21.7	21.5	NA	21	20	22	20
Fluoride, mg/L	0.36	0.31	0.36	0.35	0.41 J	0.37 J	0.64	<0.23	0.27	0.36	0.52	0.26	NA	0.77	<0.23	0.26 J	<0.23
Field pH, Std. Units	8.27	7.26	7.33	7.49	7.64	7.07	7.10	7.41	7.58	7.4	7.91	7.34	6.38	7.53	6.85	6.99	7.07
Sulfate, mg/L	119	176	144	127	230	130	220	110	454	188	187	358	NA	190	390	250	170
Total Dissolved Solids, mg/L	615	864	777	678	980	590	950	640	780	568	960	656	NA	890	690	910	970
Appendix IV																	
Antimony, ug/L	NA	<0.026	<0.15	<0.078	<0.53	<0.53	<0.58	<0.51	NA	<0.026	<0.15	0.080 J	NA	<0.53	<0.53	<0.58	<0.51
Arsenic, ug/L**	NA	14.0	15.7	15.2	19	18	19	15	NA	34.9	40.1	37.7	NA	42	40	46	54
Barium, ug/L	NA	256	239	214	280	210	300	220	NA	198	420	276	NA	380	320	330	500
Beryllium, ug/L	NA	<0.023 D3	<0.12	<0.089	<0.27	<0.27	<0.27	<0.27	NA	<0.012	<0.12	<0.089	NA	<0.27	<0.27	<0.27	<0.27
Cadmium, ug/L	NA	<0.018	<0.070	<0.033	<0.077	<0.039	<0.039	<0.049	NA	0.040 J	<0.070	<0.033	NA	<0.077	<0.039	<0.039	<0.049
Chromium, ug/L	NA	0.20 J,B	0.22 J	0.78 J	<0.98	<0.98	<1.1	<1.1	NA	0.25 J,B	0.36 J	0.12 J	NA	<0.98	<0.98	<1.1	<1.1
Cobalt, ug/L	NA	0.30 J	0.37 J	0.57 J	0.45 J	0.27 J	0.81	0.28 J	NA	0.15 J	0.45 J	0.10 J	NA	0.44 J	0.18 J	0.31 J	0.7
Fluoride, mg/L	NA	0.31	0.36	0.35	0.41 J	0.37 J	0.64	<0.23	NA	0.36	0.52	0.26	NA	0.77	<0.23	0.26 J	<0.23
Lead, ug/L	NA	0.043 J	0.13 J	0.48 J,B	0.37 J	<0.27	1.1	<0.11	NA	0.17 J	0.13 J	<0.13	NA	<0.27	<0.27	<0.27	<0.11
Lithium, ug/L	NA	<4.6	<4.6	<4.6	<2.7	<2.7	<2.3	<2.5	NA	17.8	18.9	24.5	NA	13	26	16	10
Mercury, ug/L	NA	<0.090	NA	<0.090	<0.10	NA	0.13 J	<0.10	NA	<0.090	NA	<0.090	NA	<0.10	NA	<0.10	<0.10
Molybdenum, ug/L	NA	11.6	13.9	16.3	8.5	15	11	23	NA	113	81.7	120	62.7	77	130	110	67
Selenium, ug/L	NA	0.17 J	0.18 J	0.23 J	<1.0	<1.0	<1.0	<1.0	NA	0.25 J	0.28 J	0.13 J	NA	<1.0	<1.0	<1.0	<1.0
Thallium, ug/L	NA	<0.036	NA	<0.099	<0.27	NA	<0.26	NA	NA	<0.036	NA	<0.099	NA	<0.27	NA	<0.26	NA
Radium 226/228 Combined, pCI/L	NA	0.987	0.969	0.819	0.815	0.599	0.802	Pending	NA	0.712	1.15	1.50	NA	1.15	1.03	0.928	Pending
Additional Parameter Collected for Selection of Remedy																	
Lithium, dissolved,# ug/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron, dissolved,# ug/L	NA	NA	NA	NA	NA	NA	NA	16,000	NA	NA	NA	NA	NA	NA	NA	NA	34,000
Iron, ug/L	NA	NA	NA	NA	NA	NA	NA	16,000	NA	NA	NA	NA	NA	NA	NA	NA	34,000
Magnesium, dissolved,#	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	
Magnesium, ug/L	NA	NA	NA	NA	NA	NA	NA	30,000	NA	NA	NA	NA	NA	NA	NA	NA	63,000
Manganese, dissolved,# ug/L	NA	NA	NA	NA	NA	NA	NA	4,300	NA	NA	NA	NA	NA	NA	NA	NA	13,000
Manganese, ug/L	NA	NA	NA	NA	NA	NA	NA	4,200	NA	NA	NA	NA	NA	NA	NA	NA	12,000
Molybdenum, dissolved,# ug/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	66.0
Potassium, ug/L	NA	NA	NA	NA	NA	NA	NA	2,300	NA	NA	NA	NA	NA	NA	NA	NA	4,100
Sodium, ug/L	NA	NA	NA	NA	NA	NA	NA	36,000	NA	NA	NA	NA	NA	NA	NA	NA	45,000
Bicarbonate Alkalinity, mg/L	NA	NA	NA	NA	NA	NA	NA	380	NA	NA	NA	NA	NA	NA	NA	NA	760
Carbonate Alkalinity, mg/L	NA	NA	NA	NA	NA	NA	NA	<3.80	NA	NA	NA	NA	NA	NA	NA	NA	<3.80
Total Alkalinity, mg/L	NA	NA	NA	NA	NA	NA	NA	380	NA	NA	NA	NA	NA	NA	NA	NA	760

4.4	Blue highlighted cell indicates the compliance well result exceeds the UPL (background) and the LOQ.
30.8	Yellow highlighted cell indicates the compliance well result exceeds the GPS.
17	Grayscale indicates Additional Parameters sampled for selection of remedy and evaluation of Monitored Natural Attenuation.

See page 5 for Notes and Abbreviations

Table 3. Groundwater Analytical Results Summary - Assessment Monitoring
Burlington Generating Station, Burlington, IA / SCS Engineers Project #25220066.00

Parameter Name	UPL Method	UPL	GPS	Compliance Wells MW-302									MW-302A		MW-303									MW-304								
				10/17/2017	5/9/2018	8/13/2018	10/10/2018	3/12/2019	4/3/2019	10/10/2019	6/3/2020	10/16/2020	9/9/2020	10/16/2020	10/17/2017	5/9/2018	8/13/2018	10/10/2018	3/12/2019	4/3/2019	10/10/2019	6/3/2020	10/16/2020	10/17/2017	5/9/2018	8/13/2018	10/10/2018	3/12/2019	4/3/2019	10/10/2019	6/3/2020	10/15/2020
Appendix III																																
Boron, ug/L	NP	2,950		10,000	10,200	10,000	10,400	NA	12,000	11,000	13,000	11000	11,000	11000	25,400	22,900	24,500	24,500	NA	22,000	21,000	23,000	19000	5,580	5,140	5,440	6,180	NA	6,300	5,100	6,400	7400
Calcium, mg/L	P	210		231	231	210	219	NA	220	220	210	200	120	130	84.5	87.0	85.9	87.8	NA	86	91	120	120	103	107	102	88.5	NA	72	140	150	150
Chloride, mg/L	P	209		16.4	14.1	14.7	13.5	NA	13	11	12	10	27	23	15.3	15.1	15.7	16.3	NA	15	16	18	17	46.5	58.1	25.9	50.3	NA	39	25	21	21
Fluoride, mg/L	P	0.427		0.11 J	0.11 J	<0.063	<0.19	NA	0.37 J	<0.23	<0.23	<0.23	<0.23	<0.23	0.25	0.22	0.44	0.27	NA	0.43 J	<0.23	0.27 J	<0.23	0.12 J	0.11 J	0.13 J	<0.19	NA	0.35 J	<0.23	<0.23	<0.23
Field pH, Std. Units	P	8.17		8.72	8.19	9.32	7.89	6.94	8.70	7.49	7.88	7.87	7.31	7.26	8.59	7.51	8.03	7.10	6.46	7.79	7.13	7.12	7.19	9.52	8.51	7.6	9.01	6.94	8.56	7.17	7.23	8.46
Sulfate, mg/L	P	457		541	553	542	658	NA	510	510	490	460	340	330	42.1	128	78.7	31.8	NA	120	84	100	190	248	273	188	271	NA	140	220	250	420
Total Dissolved Solids, mg/L	P	1,113		951	1,080	1,000	1,030	NA	1,000	960	1,000	910	730	710	436	502	520	462	NA	540	420	640	630	540	657	551	537	NA	460	710	750	820
Appendix IV		UPL	GPS																													
Antimony, ug/L	P*	0.17	6	NA	<0.026	<0.15	0.082 J	NA	<0.53	<0.53	<0.58	<0.51	<0.51	1.7	NA	<0.026	<0.15	<0.078	NA	<0.53	<0.53	<0.58	0.57 J	NA	0.75 J	0.3 J	0.77 J	NA	0.66 J	<0.53	<0.58	0.52 J
Arsenic, ug/L**	P	114.9	114.9	NA	56.2	49.6	76.4	NA	53	73	110	76	2.9	2.9	NA	7.9	52	29.8	NA	6.4	17	18	14	NA	57.2	45.4	58.3	NA	59	36	35	49
Barium, ug/L	P	1,147	2,000	NA	363	340	180	NA	320	260	340	250	270	280	NA	412	354	415	NA	440	440	610	480	NA	115	140	92	NA	90	210	220	170
Beryllium, ug/L	NP*	0.036	4	NA	<0.012	<0.12	<0.089	NA	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	NA	<0.012	<0.12	<0.089	NA	<0.27	<0.27	<0.27	<0.27	NA	<0.012	<0.12	<0.089	NA	<0.27	<0.27	<0.27	<0.27
Cadmium, ug/L	NP*	0.025	5	NA	0.037 J	<0.070	0.040 J	NA	<0.077	<0.039	0.045 J	0.11	<0.049	0.065 J	NA	0.028 J	<0.070	<0.033	NA	<0.077	<0.039	<0.039	<0.049	NA	<0.018	<0.070	0.054 J	NA	<0.077	<0.039	<0.039	<0.049
Chromium, ug/L	P*	0.090	100	NA	0.22 J, B	0.33 J	0.097 J	NA	<0.98	<0.98	<1.1	<1.1	<1.1	<1.1	NA	0.27 J,B	0.29 J	0.69 J	NA	<0.98	<0.98	<1.1	<1.1	NA	0.22 J,B	0.34 J	0.091 J	NA	<0.98	<0.98	<1.1	<4.4
Cobalt, ug/L	P	3.87	6	NA	0.19 J	0.15 J	0.18 J	NA	0.19 J	0.23 J	0.21 J	0.26 J	0.12 J	0.11 J	NA	0.31 J	0.46 J	0.62 J	NA	0.36 J	0.45 J	0.56	0.49 J	NA	0.098 J	<0.15	0.19 J	NA	0.11 J	0.13 J	0.15 J	<0.36
Fluoride, mg/L	P	0.427	4	NA	0.11 J	<0.063	<0.19	NA	0.37 J	<0.23	<0.23	<0.23	<0.23	<0.23	NA	0.22	0.44	0.27	NA	0.43 J	<0.23	0.27 J	<0.23	NA	0.11 J	0.13 J	<0.19	NA	0.35 J	<0.23	<0.23	<0.23
Lead, ug/L	NP*	0.64	15	NA	0.17 J	<0.12	<0.13	NA	0.58	<0.27	<0.27	0.17 J	0.11 J	<0.11	NA	0.21 J	0.22 J	0.54 J,B	NA	0.49 J	<0.27	0.29 J	0.18 J	NA	<0.033	<0.12	<0.13	NA	<0.27	<0.27	<0.27	<0.11
Lithium, ug/L	NP*	7.7	40	NA	65.4	61.4	57.8	59.9	56	57	55	64	11	11	NA	50.7	42.1	35.8	51.6	52	46	48	59	NA	63.8	34.3	82.4	35.9	52	38	47	92
Mercury, ug/L	DQ	DQ	2	NA	<0.090	NA	<0.090	NA	<0.10	NA	<0.10	<0.10	<0.10	<0.10	NA	<0.090	NA	<0.090	NA	<0.10	NA	<0.10	<0.10	NA	<0.090	NA	<0.090	NA	<0.10	NA	0.11 J, F1	<0.10
Molybdenum, ug/L	NP	14.7	100	NA	118	121	122	123	100	100	140	130	120	110	NA	75.4	77.9	56.5	NA	110	76	66	84	NA	126	74.9	113	47.4	58	47	45	140
Selenium, ug/L	P*	0.28	50	NA	0.25 J	0.22 J	0.23 J	NA	<1.0	<1.0	<1.0	1.1 J	<1.0	<1.0	NA	0.19 J	0.24 J	0.33 J	NA	<1.0	<1.0	<1.0	<1.0	NA	0.24 J	0.21 J	0.26 J	NA	<1.0	<1.0	<1.0	<4.0
Thallium, ug/L	NP*	0.35	2	NA	<0.036	NA	<0.099	NA	<0.27	NA	<0.26	NA	<0.26	NA	NA	<0.036	NA	<0.099	NA	<0.27	NA	<0.26	NA	NA	<0.036	NA	<0.099	NA	<0.27	NA	<0.26	NA
Radium 226/228 Combined, pCI/L	P	3.36	5	NA	1.51	1.53	2.15	NA	0.872	0.644	0.626	Pending	1.15	Pending	NA	1.64	1.79	1.91	NA	1.26	1.04	0.892	Pending	NA	0.589	0.725	0.706	NA	0.408	0.781	0.573	Pending
Additional Parameter Collected for Selection of Remedy																																
Lithium, dissolved,# ug/L	UPL or GPS not applicable			NA	NA	NA	NA	NA	NA	NA	NA	64.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	59.0	NA	NA	NA	NA	NA	NA	NA	NA	93.0
Iron, dissolved,# ug/L				NA	NA	NA	NA	NA	NA	NA	NA	3,200	NA	8,600	NA	NA	NA	NA	NA	NA	NA	NA	8,700	NA	NA	NA	NA	NA	NA	NA	NA	720
Iron, ug/L				NA	NA	NA	NA	NA	NA	NA	NA	2,900	NA	8,400	NA	NA	NA	NA	NA	NA	NA	NA	8,500	NA	NA	NA	NA	NA	NA	NA	NA	660
Magnesium, dissolved,#				NA	NA	NA	NA	NA	NA	NA	NA		NA		NA	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	
Magnesium, ug/L				NA	NA	NA	NA	NA	NA	NA	NA	18,000	NA	28,000	NA	NA	NA	NA	NA	NA	NA	NA	21,000	NA	NA	NA	NA	NA	NA	NA	NA	3,800
Manganese, dissolved,# ug/L				NA	NA	NA	NA	NA	NA	NA	NA	1,600	NA	3,800	NA	NA	NA	NA	NA	NA	NA	NA	3,900	NA	NA	NA	NA	NA	NA	NA	NA	440
Manganese, ug/L				NA	NA	NA	NA	NA	NA	NA	NA	1,400	NA	3,600	NA	NA	NA	NA	NA	NA	NA	NA	3,700	NA	NA	NA	NA	NA	NA	NA	NA	380
Molybdenum, dissolved,# ug/L				NA	NA	NA	NA	NA	NA	NA	NA	120	NA	120	NA	NA	NA	NA	NA	NA	NA	NA	85.0	NA	NA	NA	NA	NA	NA	NA	NA	140
Potassium, ug/L				NA	NA	NA	NA	NA	NA	NA	NA	12,000	NA	3,600	NA	NA	NA	NA	NA	NA	NA	NA	22,000	NA	NA	NA	NA	NA	NA	NA	NA	14,000
Sodium, ug/L				NA	NA	NA	NA	NA	NA	NA	NA	24,000	NA	34,000	NA	NA	NA	NA	NA	NA	NA	NA	30,000	NA	NA	NA	NA	NA	NA	NA	NA	51,000
Bicarbonate Alkalinity, mg/L				NA	NA	NA	NA	NA	NA	NA	NA	240	NA	150	NA	NA	NA	NA	NA	NA	NA	NA	290	NA	NA	NA	NA	NA	NA	NA	NA	130
Carbonate Alkalinity, mg/L				NA	NA	NA	NA	NA	NA	NA	NA	<3.80	NA	<3.80	NA	NA	NA	NA	NA	NA	NA	NA	<3.80	NA	NA	NA	NA	NA	NA	NA	NA	<3.80
Total Alkalinity, mg/L				NA	NA	NA	NA	NA	NA	NA	NA	240	NA	150	NA	NA	NA	NA	NA	NA	NA	NA	290	NA	NA	NA	NA	NA	NA	NA	NA	130

4.4	Blue highlighted cell indicates the compliance well result exceeds the UPL (background) and the LOQ.
30.8	Yellow highlighted cell indicates the compliance well result exceeds the GPS.
17	Grayscale indicates Additional Parameters sampled for selection of remedy and evaluation of Monitored Natural Attenuation.

See page 5 for Notes and Abbreviations

Table 3. Groundwater Analytical Results Summary - Assessment Monitoring
Burlington Generating Station, Burlington, IA / SCS Engineers Project #25220066.00

Compliance Wells

Parameter Name	UPL Method	UPL	GPS	MW-305 10/16/2017	MW-305 5/9/2018	MW-305 8/13/2018	MW-305 10/10/2018	MW-305 4/3/2019	MW-305 10/11/2019	MW-305 6/3/2020	MW-305 10/15/2020
Appendix III											
Boron, ug/L	NP	2,950		2,480	2,000	2,400	2,040	2,000	2,100	2,200	2400
Calcium, mg/L	P	210		92.2	82.5	103	93.2	83	90	120	120
Chloride, mg/L	P	209		35.8	34.8	34.8	34.9	33	33	36	32
Fluoride, mg/L	P	0.427		0.43	0.48	0.45	0.44	0.75	0.37 J	0.45 J	<0.23
Field pH, Std. Units	P	8.17		7.78	7.72	7.81	7.29	7.80	7.36	7.12	7.23
Sulfate, mg/L	P	457		24.6	11.7	24.8	19.6	10	8.8	33	54
Total Dissolved Solids, mg/L	P	1,113		437	441	542	490	470	490	640	600
Appendix IV		UPL	GPS								
Antimony, ug/L	P*	0.17	6	NA	<0.026	<0.15	<0.078	<0.53	<0.53	<0.58	<0.51
Arsenic, ug/L**	P	114.9	114.9	NA	0.28 J	0.39 J	0.44 J	<0.75	<0.75	<0.88	<0.88
Barium, ug/L	P	1,147	2,000	NA	173	219	197	160	180	230	250
Beryllium, ug/L	NP*	0.036	4	NA	<0.012	<0.12	<0.089	<0.27	<0.27	<0.27	<0.27
Cadmium, ug/L	NP*	0.025	5	NA	<0.018	<0.070	<0.033	<0.077	<0.039	<0.039	<0.049
Chromium, ug/L	P*	0.090	100	NA	0.25 J,B	0.21 J	0.27 J	<0.98	<0.98	<1.1	<1.1
Cobalt, ug/L	P	3.87	6	NA	0.14 J	<0.15	0.17 J	0.16 J	0.13 J	0.18 J	0.15 J
Fluoride, mg/L	P	0.427	4	NA	0.48	0.45	0.44	0.75	0.37 J	0.45 J	<0.23
Lead, ug/L	NP*	0.64	15	NA	0.034 J	<0.12	0.20 J,B	<0.27	<0.27	<0.27	<0.11
Lithium, ug/L	NP*	7.7	40	NA	27.8	33.6	27.6	29	26	28	34
Mercury, ug/L	DQ	DQ	2	NA	<0.090	NA	<0.090	<0.10	NA	0.12 J	<0.10
Molybdenum, ug/L	NP	14.7	100	NA	0.87 J	1	0.72 J	<1.1	<1.1	<1.1	1.1 J
Selenium, ug/L	P*	0.28	50	NA	0.24 J	0.16 J	0.16 J	<1.0	<1.0	<1.0	<1.0
Thallium, ug/L	NP*	0.35	2	NA	<0.036	NA	<0.099	<0.27	NA	<0.26	NA
Radium 226/228 Combined, pCI/L	P	3.36	5	NA	2.11	1.78	1.22	0.519	0.441	0.759	Pending
Additional Parameter Collected for Selection of Remedy											
Lithium, dissolved,# ug/L				NA	NA	NA	NA	NA	NA	NA	NA
Iron, dissolved,# ug/L				NA	NA	NA	NA	NA	NA	NA	3,000
Iron, ug/L				NA	NA	NA	NA	NA	NA	NA	3,000
Magnesium, dissolved,#				NA	NA	NA	NA	NA	NA	NA	
Magnesium, ug/L				NA	NA	NA	NA	NA	NA	NA	26,000
Manganese, dissolved,# ug/L				NA	NA	NA	NA	NA	NA	NA	2,900
Manganese, ug/L				NA	NA	NA	NA	NA	NA	NA	2,800
Molybdenum, dissolved,# ug/L	UPL or GPS not applicable			NA	NA	NA	NA	NA	NA	NA	NA
Potassium, ug/L				NA	NA	NA	NA	NA	NA	NA	5,700
Sodium, ug/L				NA	NA	NA	NA	NA	NA	NA	54,000
Bicarbonate Alkalinity, mg/L				NA	NA	NA	NA	NA	NA	NA	470
Carbonate Alkalinity, mg/L				NA	NA	NA	NA	NA	NA	NA	<3.80
Total Alkalinity, mg/L				NA	NA	NA	NA	NA	NA	NA	470

Parameter Name	MW-306 10/16/2017	MW-306 5/9/2018	MW-306 8/14/2018	MW-306 10/10/2018	MW-306 3/11/2019	MW-306 4/3/2019	MW-306 10/11/2019	MW-306 6/4/2020	MW-306 10/15/2020
Appendix III									
Boron, ug/L	3,680	3,480	3,430	3,350	NA	2,900	3,100	3,200	3200
Calcium, mg/L	35.3	32.0	33.5	34.6	NA	37	38	41	37
Chloride, mg/L	20.6	20.3	20.6	20.9	NA	21	20	21	18
Fluoride, mg/L	0.15 J	0.12 J	0.1 J	<0.19	NA	0.36 J	<0.23	<0.23	<0.23
Field pH, Std. Units	10.66	6.80	10.33	6.04	6.27	6.69	10.53	10.48	10
Sulfate, mg/L	97.5	107	111	121	NA	110	110	120	71
Total Dissolved Solids, mg/L	301	396	303	289	NA	320	290	320	300
Appendix IV									
Antimony, ug/L	NA	1.2	1.4	1.2	NA	1.1	1.2	1.1	0.9 J
Arsenic, ug/L**	NA	52.6	48	50.6	NA	50	46	50	46
Barium, ug/L	NA	13.6	15.5	14.8	NA	14	14	16	16
Beryllium, ug/L	NA	<0.012	0.14 J	<0.089	NA	<0.27	<0.27	<0.27	<0.27
Cadmium, ug/L	NA	0.029 J	0.18 J	<0.033	NA	<0.077	<0.039	<0.039	<0.049
Chromium, ug/L	NA	0.24 J,B	0.25 J	0.18 J	NA	<0.98	<0.98	<1.1	<1.1
Cobalt, ug/L	NA	0.035 J	0.18 J	<0.062	NA	<0.091	<0.091	<0.091	<0.091
Fluoride, mg/L	NA	0.12 J	0.1 J	<0.19	NA	0.36 J	<0.23	<0.23	<0.23
Lead, ug/L	NA	0.26 J	0.69 J	0.37 J,B	NA	<0.27	0.44 J	0.33 J	0.43 J
Lithium, ug/L	NA	36.6	46.8	41.4	39.2	45	46	43	42
Mercury, ug/L	NA	<0.090	NA	<0.090	NA	<0.10	NA	0.10 J	<0.10
Molybdenum, ug/L	NA	84.7	82.9	83.5	NA	78	84	86	82
Selenium, ug/L	NA	0.66 J	0.97 J	0.6 J	NA	<1.0	<1.0	<1.0	<1.0
Thallium, ug/L	NA	<0.036	NA	<0.099	NA	<0.27	NA	<0.26	NA
Radium 226/228 Combined, pCI/L	NA	0.482	1.04	1.10	NA	0.165	0.526	0.0769	Pending
Additional Parameter Collected for Selection of Remedy									
Lithium, dissolved,# ug/L	NA	NA	NA	NA	NA	NA	NA	NA	42
Iron, dissolved,# ug/L	NA	NA	NA	NA	NA	NA	NA	NA	<50.0
Iron, ug/L	NA	NA	NA	NA	NA	NA	NA	NA	<50.0
Magnesium, dissolved,#	NA	NA	NA	NA	NA	NA	NA	NA	
Magnesium, ug/L	NA	NA	NA	NA	NA	NA	NA	NA	<100
Manganese, dissolved,# ug/L	NA	NA	NA	NA	NA	NA	NA	NA	<4.0
Manganese, ug/L	NA	NA	NA	NA	NA	NA	NA	NA	5.4 J
Molybdenum, dissolved,# ug/L	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium, ug/L	NA	NA	NA	NA	NA	NA	NA	NA	20000
Sodium, ug/L	NA	NA	NA	NA	NA	NA	NA	NA	46000
Bicarbonate Alkalinity, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	52
Carbonate Alkalinity, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	82
Total Alkalinity, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	130

Parameter Name	MW-307 10/16/2017	MW-307 5/9/2018	MW-307 8/14/2018	MW-307 10/10/2018	MW-307 3/11/2019	MW-307 4/3/2019	MW-307 10/11/2019	MW-307 6/4/2020	MW-307 10/15/2020	MW-307A 9/9/2020	MW-307A 10/14/2020
Appendix III											
Boron, ug/L	3,920	3,910	4,090	3,720	NA	3,400	3,700	3,600	3400	3,900	4100
Calcium, mg/L	31.3	27.3	27.2	27.6	NA	29	31	37	36	10	11
Chloride, mg/L	20.8	20.1	20.1	21.6	NA	21	19	21	17	34	31
Fluoride, mg/L	0.13 J	0.11 J	0.094 J	<0.19	NA	0.51	<0.23	<0.23	<0.23	<0.23	<0.23
Field pH, Std. Units	10.46	10.3	10.12	9.88	9.71	10.39	10.14	10.03	10.05	7.83	7.8
Sulfate, mg/L	126	119	119	143	NA	120	130	180	160	110	110
Total Dissolved Solids, mg/L	341	347	340	336	NA	420	340	390	370	370	360
Appendix IV											
Antimony, ug/L	NA	0.50 J	0.58 J	0.62 J	NA	<0.53	<0.53	<0.58	0.56 J	<0.51	<0.51
Arsenic, ug/L**	NA	54.3	52.3	52.8	NA	43	47	47	47	<0.88	<0.88
Barium, ug/L	NA	32.3	29	31.1	NA	29	31	36	39	45	47
Beryllium, ug/L	NA	<0.012	<0.12	<0.089	NA	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27
Cadmium, ug/L	NA	0.12 J	<0.070	0.068 J	NA	<0.077	<0.039	0.044 J	<0.049	0.058 J	0.052 J
Chromium, ug/L	NA	0.27 J,B	0.36 J	0.15 J	NA	<0.98	<0.98	<1.1	<1.1	<1.1	<1.1
Cobalt, ug/L	NA	0.033 J	<0.15	<0.062	NA	<0.091	<0.091	<0.091	<0.091	0.11 J	0.15 J
Fluoride, mg/L	NA	0.11 J	0.094 J	<0.19	NA	0.51	<0.23	<0.23	<0.23	<0.23	<0.23
Lead, ug/L	NA	0.39 J	0.43 J	0.49 J,B	NA	0.37 J	0.41 J	<0.27	0.19 J	0.69	0.63
Lithium, ug/L	NA	47.8	56.1	45.4	50.7	50	48	48	51	6.8 J	8.3 J
Mercury, ug/L	NA	<0.090	NA	<0.090	NA	<0.10	NA	0.12 J	<0.10	<0.10	<0.10
Molybdenum, ug/L	NA	154	155	159	156	100	130	130	140	110	120
Selenium, ug/L	NA	0.36 J	0.41 J	0.36 J	NA	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Thallium, ug/L	NA	<0.036	NA	<0.099	NA	<0.27	NA	<0.26	NA	<0.26	NA
Radium 226/228 Combined, pCI/L	NA	0.0587	0.415	1.43	NA	0.447	0.232	0.277	Pending	0.605	Pending
Additional Parameter Collected for Selection of Remedy											
Lithium, dissolved,# ug/L	NA	NA	NA	NA	NA	NA	NA	NA	50.0	NA	NA
Iron, dissolved,# ug/L	NA	NA	NA	NA	NA	NA	NA	NA	<50.0	NA	460
Iron, ug/L	NA	NA	NA	NA	NA	NA	NA	NA	<50.0	NA	610
Magnesium, dissolved,#	NA	NA	NA	NA	NA	NA	NA	NA		NA	
Magnesium, ug/L	NA	NA	NA	NA	NA	NA	NA	NA	<100	NA	1,700
Manganese, dissolved,# ug/L	NA	NA	NA	NA	NA	NA	NA	NA	6.60 J	NA	420
Manganese, ug/L	NA	NA	NA	NA	NA	NA	NA	NA	6.40 J	NA	430
Molybdenum, dissolved,# ug/L	NA	NA	NA	NA	NA	NA	NA	NA	140	NA	120
Potassium, ug/L	NA	NA	NA	NA	NA	NA	NA	NA	36,000	NA	3,100
Sodium, ug/L	NA	NA	NA	NA	NA	NA	NA	NA	54,000	NA	####
Bicarbonate Alkalinity, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	<1.90	NA	110
Carbonate Alkalinity, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	79.0	NA	<1.9
Total Alkalinity, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	84.0	NA	110

4.4	Blue highlighted cell indicates the compliance well result exceeds the UPL (background) and the LOQ.
30.8	Yellow highlighted cell indicates the compliance well result exceeds the GPS.
17	Grayscale indicates Additional Parameters sampled for selection of remedy and evaluation of Monitored Natural Attenuation.

See page 5 for Notes and Abbreviations

Table 3. Groundwater Analytical Results Summary - Assessment Monitoring
Burlington Generating Station, Burlington, IA / SCS Engineers Project #25220066.00

Parameter Name	UPL Method	UPL	GPS	Compliance Wells MW-308									MW-309								MW-312				MW-313				MW-313A	
				10/17/2017	5/9/2018	8/13/2018	10/10/2018	3/12/2019	4/3/2019	10/10/2019	6/4/2020	10/14/2020	10/17/2017	5/9/2018	8/14/2018	10/10/2018	4/3/2019	10/11/2019	6/3/2020	10/14/2020	6/6/2019	10/10/2019	6/3/2020	10/15/2020	6/6/2019	10/10/2019	6/3/2020	10/15/2020	9/9/2020	########
Appendix III																														
Boron, ug/L	NP	2,950		4,850	5,030	5,070	4,710	NA	4,300	4,500	4,700	4500	4,400	4,720	4,930	4,720	4,200	4,300	4,400	4400	6,100	6,600	6,700	6500	7,400	8,500	8,600	7600	4,300	4200
Calcium, mg/L	P	210		32.6	28.7	28.7	28.5	NA	32	30	34	37	101	83.6	74.1	72.4	73	68	82	59	67	71	74	78	110	120	120	110	48	44
Chloride, mg/L	P	209		38.2	36.2	36.7	35.9	NA	38	40	58	45	85.4	112	111	105	100	74	84	64	27	25	36	23	85	51	83	50	210	200
Fluoride, mg/L	P	0.427		0.17 J	0.17 J	0.16 J	<0.19	NA	0.37 J	<0.23	0.37 J	<0.23	0.47	0.40	0.43	0.40	0.71	0.29 J	0.58	<0.23	1.1	0.25 J	0.57	<0.23	0.33 J	0.28 J	0.52	<0.23	<0.23	<0.23
Field pH, Std. Units	P	8.17		9.75	9.75	9.86	9.82	7.72	9.97	9.42	9.65	9.7	8.50	7.25	7.39	7.46	7.45	7.19	7.09	7.61	6.99	7.19	7.13	7.37	6.94	7.06	7.03	7.16	7.6	7.64
Sulfate, mg/L	P	457		177	164	167	193	NA	170	160	190	160	149	107	98.9	111	78	160	180	160	220	230	200	210	210	210	230	170	200	190
Total Dissolved Solids, mg/L	P	1,113		472	494	468	440	NA	490	400	470	460	671	688	668	650	650	610	730	550	540	510	670	560	700	520	830	640	730	660
Appendix IV		UPL	GPS																											
Antimony, ug/L	P*	0.17	6	NA	0.32 J	0.32 J	0.36 J	NA	<0.53	<0.53	<0.58	<0.51	NA	<0.026	<0.15	<0.078	<0.53	<0.53	<0.58	<0.51	<0.53	<0.53	<0.58	<0.51	<0.53	<0.53	<0.58	<0.51	<0.51	<0.51
Arsenic, ug/L**	P	114.9	114.9	NA	79.1	82.5	79.5	NA	78	72	76	69	NA	28.2	33.3	35.6	30	34	34	33	14	15	22	19	5.5	6.3	6.9	5.5	<0.88	<0.88
Barium, ug/L	P	1,147	2,000	NA	64.3	67.1	66.5	NA	70	70	66	74	NA	154	180	194	130	180	260	220	160	150	190	200	510	490	680	610	270	270
Beryllium, ug/L	NP*	0.036	4	NA	<0.012	<0.12	<0.089	NA	<0.27	<0.27	<0.27	<0.27	NA	0.012 J	<0.12	<0.089	<0.27	<0.54	<0.27	<0.27	<0.27	<0.54	<0.27	<0.27	<0.27	<1.1	<0.27	<0.27	<0.27	<0.27
Cadmium, ug/L	NP*	0.025	5	NA	0.020 J	<0.070	0.058 J	NA	<0.077	<0.039	0.044 J	<0.049	NA	0.021 J	<0.070	<0.033	<0.077	<0.039	<0.039	<0.049	<0.077	0.044 J	0.095 J	0.066 J	<0.077	<0.039	0.039 J	<0.049	<0.049	<0.049
Chromium, ug/L	P*	0.090	100	NA	0.25 J,B	<0.19	0.16 J	NA	<0.98	<0.98	<1.1	<1.1	NA	0.32 J,B	0.22 J	0.18 J	<0.98	<0.98	<1.1	<1.1	<0.98	<0.98	<1.1	<1.1	<0.98	<0.98	<1.1	<1.1	<1.1	<1.1
Cobalt, ug/L	P	3.87	6	NA	0.057 J	<0.15	0.074 J	NA	<0.091	<0.091	<0.091	<0.091	NA	4.9	0.82 J	0.68 J	1.3	0.52	0.57	0.33 J	0.65	0.36 J	0.67	0.5	0.41 J	0.32 J	0.23 J	0.19 J	<0.091	<0.091
Fluoride, mg/L	P	0.427	4	NA	0.17 J	0.16 J	<0.19	NA	0.37 J	<0.23	0.37 J	<0.23	NA	0.40	0.43	0.40	0.71	0.29 J	0.58	<0.23	1.1	0.25 J	0.57	<0.23	0.33 J	0.28 J	0.52	<0.23	<0.23	<0.23
Lead, ug/L	NP*	0.64	15	NA	0.25 J	0.27 J	0.45 J,B	NA	<0.27	<0.27	0.40 J	0.15 J	NA	0.045 J	<0.12	<0.13	<0.27	<0.27	<0.27	<0.11	0.54	<0.27	<0.27	<0.11	<0.27	0.31 J	<0.27	<0.11	<0.11	<0.11
Lithium, ug/L	NP*	7.7	40	NA	46.0	52.0	43.6	48.9	50	52	48	51	NA	<4.6	<4.6	<4.6	3.3 J	<5.4	2.4 J	<2.5	24	27	22	27	43	62	52	51	13	13
Mercury, ug/L	DQ	DQ	2	NA	<0.090	NA	<0.090	NA	<0.10	NA	0.13 J	<0.10	NA	<0.090	NA	<0.090	<0.10	NA	<0.10	<0.10	<0.10	NA	<0.10	<0.10	<0.10	NA	0.13 J	<0.10	<0.10	<0.10
Molybdenum, ug/L	NP	14.7	100	NA	140	140	145	135	110	120	120	110	NA	43.4	52.8	71.8	47	90	87	100	290	280	320	290	130	110	130	100	120	120
Selenium, ug/L	P*	0.28	50	NA	0.31 J	0.43 J	0.4 J	NA	<1.0	<1.0	<1.0	<1.0	NA	0.30 J	0.31 J	0.29 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Thallium, ug/L	NP*	0.35	2	NA	<0.036	NA	<0.099	NA	<0.27	NA	<0.26	NA	NA	<0.036	NA	<0.099	<0.27	NA	<0.26	NA	<0.27	NA	<0.26	NA	<0.27	NA	<0.26	NA	<0.26	NA
Radium 226/228 Combined, pCI/L	P	3.36	5	NA	0.283	0.0726	0.334	NA	0.328	0.288	0.268	Pending	NA	0.218	0.96	1.05	0.42	0.596	0.296	Pending	0.875	0.438	0.543	Pending	0.987	1.70	1.81	Pending	1.5	Pending
Additional Parameter Collected for Selection of Remedy																														
Lithium, dissolved,# ug/L	UPL or GPS not applicable			NA	NA	NA	NA	NA	NA	NA	NA	53.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	53.0	NA	NA
Iron, dissolved,# ug/L				NA	NA	NA	NA	NA	NA	NA	NA	<50.0	NA	NA	NA	NA	NA	NA	NA	11,000	NA	NA	NA	11,000	NA	NA	NA	14,000	NA	1,700
Iron, ug/L				NA	NA	NA	NA	NA	NA	NA	NA	<50.0	NA	NA	NA	NA	NA	NA	NA	12,000	NA	NA	NA	11,000	NA	NA	NA	15,000	NA	1,600
Magnesium, dissolved,#				NA	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA		NA	NA	NA		NA	NA	NA		NA	
Magnesium, ug/L				NA	NA	NA	NA	NA	NA	NA	NA	1,700	NA	NA	NA	NA	NA	NA	NA	18,000	NA	NA	NA	12,000	NA	NA	NA	21,000	NA	4,300
Manganese, dissolved,# ug/L				NA	NA	NA	NA	NA	NA	NA	NA	290	NA	NA	NA	NA	NA	NA	NA	3,400	NA	NA	NA	8,200	NA	NA	NA	6,300	NA	680
Manganese, ug/L				NA	NA	NA	NA	NA	NA	NA	NA	280	NA	NA	NA	NA	NA	NA	NA	3,200	NA	NA	NA	7,900	NA	NA	NA	6,100	NA	670
Molybdenum, dissolved,# ug/L				NA	NA	NA	NA	NA	NA	NA	NA	110	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	300	NA	NA	NA	100	NA	120
Potassium, ug/L				NA	NA	NA	NA	NA	NA	NA	NA	35,000	NA	NA	NA	NA	NA	NA	NA	1,800	NA	NA	NA	11,000	NA	NA	NA	14,000	NA	12,000
Sodium, ug/L				NA	NA	NA	NA	NA	NA	NA	NA	84,000	NA	NA	NA	NA	NA	NA	NA	90,000	NA	NA	NA	73,000	NA	NA	NA	58,000	NA	####
Bicarbonate Alkalinity, mg/L				NA	NA	NA	NA	NA	NA	NA	NA	54.0	NA	NA	NA	NA	NA	NA	NA	190	NA	NA	NA	240	NA	NA	NA	380	NA	88.0
Carbonate Alkalinity, mg/L				NA	NA	NA	NA	NA	NA	NA	NA	89.0	NA	NA	NA	NA	NA	NA	NA	<3.8	NA	NA	NA	<3.80	NA	NA	NA	<3.80	NA	<1.9
Total Alkalinity, mg/L				NA	NA	NA	NA	NA	NA	NA	NA	140	NA	NA	NA	NA	NA	NA	NA	190	NA	NA	NA	240	NA	NA	NA	380	NA	88.0

4.4	Blue highlighted cell indicates the compliance well result exceeds the UPL (background) and the LOQ.
30.8	Yellow highlighted cell indicates the compliance well result exceeds the GPS.
17	Grayscale indicates Additional Parameters sampled for selection of remedy and evaluation of Monitored Natural Attenuation.

See page 5 for Notes and Abbreviations

Table 3. Groundwater Analytical Results Summary - Assessment Monitoring
Burlington Generating Station, Burlington, IA / SCS Engineers Project #25220066.00

Abbreviations:

UPL = Upper Prediction Limit
NA = Not Analyzed
mg/L = milligrams per liter
GPS = Groundwater Protection Standard
DQ = Double Quantification Rule (not detected in background)
NP = Nonparametric UPL (highest background value) with 1-of2- retesting
LOD = Limit of Detection
LOQ = Limit of Quantification
P = Parametric UPL with 1-of-2 retesting

J = Estimated concentration at or above the LOD and below the LOQ.

* = UPL is below the LOQ for background sampling. For compliance wells, only results confirmed above the LOQ are evaluated as potential SSIs above background.
** = UPL for arsenic is greater than the MCL and will be used as the GPS.
*% = Monitoring well is located near the MW-310 background well but more date is needed to confirm if this monitoring well is representative of background groundwater conditions.
# = Dissolved parameter samples collected for MNA data review

Notes:

1. An individual result above the UPL or GPS does not constitute a statistically significant increase (SSI) above background or statistically significant level above the GPS. See the accompanying letter text for identification of statistically significant results.
2. GPS is the United States Environmental Protection Agency (US EPA) Maximum Contamination Level (MCL), if established, or the value from 40 CFR 257.95(h)(2), or the background UPL if it is higher.
3. Interwell UPLs calculated based on results from background wells MW-310 and MW-311.

Created by:	NDK	Date:	5/1/2018
Last revision by:	NDK	Date:	11/15/2020
Checked by:	ACW	Date:	11/17/2020
Scientist or Proj Mgr QA/QC:	TK	Date:	11/19/2020

Table 4. Groundwater Field Parameters - CCR Program - Assessment Monitoring
Burlington Generating Station / SCS Project # 25219168.00
October 2017 - October 2020

Well	Sample Date	Field Temperature (deg C)	Field pH (Std. Units)	Oxygen, Dissolved (mg/L)	Field Specific Conductance (umhos/cm)	Oxidation-Reduction Potential (mV)	Turbidity (NTU)	Groundwater Elevation (feet)
MW-301	10/16/2017	13.8	7.58	0.12	1065	38	1.26	522.13
	5/9/2018	12.9	7.40	0.08	601	-167	4.23	525.51
	8/13/2018	16.8	7.91	0.35	1400	-145	5.78	520.19
	10/9/2018	17.2	7.34	0.24	892	-64	8.43	528.01
	3/12/2019	12.6	6.38	2.61	1055	-73	17.1	523.38
	4/3/2019	12.4	7.53	0.59	1213	-145	21.1	528.15
	10/10/2019	13.9	6.85	0.23	1063	-163	12.55	--
	6/3/2020	13.4	6.99	0.25	1167	37	20.15	523.94
	10/16/2020	13.7	7.07	0.09	1503	-188	3.41	519.26
MW-302	10/17/2017	13.9	8.72	0.09	1165	-49.7	2.04	522.20
	5/9/2018	13.0	8.19	1.0	1268	-217.2	2.25	525.81
	8/13/2018	14.9	9.32	0.15	1226	-237	3.75	519.87
	10/9/2018	15.2	7.89	0.3	1334	-198	6.48	528.08
	3/12/2019	12.2	6.94	2.68	792	-70.3	22.1	522.83
	4/3/2019	11.4	8.70	0.58	1164	-215.8	18.8	528.21
	10/10/2019	14.5	7.49	0.28	1249	-186.8	1.16	--
	6/3/2020	12.9	7.88	0.18	1245	36.7	25.27	523.98
	10/16/2020	12.9	7.87	0.08	1168	-237.1	0.07	518.94
MW-302A	9/9/2020	13.3	7.31	--	1013	-142	0.01	519.71
	10/16/2020	13.1	7.26	0.19	951	-175.3	3.82	518.79

Table 4. Groundwater Field Parameters - CCR Program - Assessment Monitoring
Burlington Generating Station / SCS Project # 25219168.00
October 2017 - October 2020

Well	Sample Date	Field Temperature (deg C)	Field pH (Std. Units)	Oxygen, Dissolved (mg/L)	Field Specific Conductance (umhos/cm)	Oxidation-Reduction Potential (mV)	Turbidity (NTU)	Groundwater Elevation (feet)
MW-303	10/17/2017	14.5	8.59	0.13	613	21.3	2.79	522.23
	5/9/2018	13.8	7.51	0.11	536	-165.5	0.97	525.80
	8/13/2018	16.8	8.03	0.24	748	-153	14.26	519.78
	10/10/2018	15.6	7.10	1.0	774	-132	17.3	528.78
	3/12/2019	13.6	6.46	2.38	549	-68.1	19.4	522.74
	4/3/2019	12.6	7.79	0.67	711	-122.8	18.2	528.22
	10/10/2019	14.9	7.13	0.26	767	-161	5.36	--
	6/3/2020	14.8	7.12	0.18	934	58.1	16.03	523.97
	10/16/2020	13.7	7.19	0.12	902	-185.6	2.03	518.78
MW-304	10/17/2017	15.1	9.52	0.1	756	5.9	1.89	522.32
	5/9/2018	13.5	8.51	1.4	906	-273	2.84	525.85
	8/13/2018	18.1	7.60	0.09	836	-202	4.26	519.81
	10/10/2018	17.4	9.01	0.23	780	-100.2	1.36	528.82
	3/12/2019	13.9	6.94	2.11	460	-73.8	9.28	522.80
	4/3/2019	13.0	8.56	0.39	658	-216.7	6.22	528.27
	10/10/2019	15.6	7.17	0.28	934	-157.5	1.18	--
	6/3/2020	14.6	7.23	0.15	1087	52.4	18.18	524.02
	10/15/2020	14.7	8.46	0.08	1062	-282.6	0.02	518.69
MW-305	10/16/2017	15.1	7.78	0.14	759	44.9	0.71	522.48
	5/9/2018	15.2	7.72	1.4	733	-146.8	0.64	526.06
	8/13/2018	16.3	7.81	0.35	901	-134	3.85	520.29
	10/10/2018	16.2	7.29	0.2	846	-140	4.94	528.97
	4/3/2019	14.5	7.80	0.59	733	-133.5	3.88	528.36
	10/11/2019	14.3	7.36	0.2	795	-132.9	3.02	--
	6/3/2020	15.9	7.12	0.14	972	39.8	13.46	524.12
	10/15/2020	14.6	7.23	0.37	987	-175	0.02	519.00

Table 4. Groundwater Field Parameters - CCR Program - Assessment Monitoring
Burlington Generating Station / SCS Project # 25219168.00
October 2017 - October 2020

Well	Sample Date	Field Temperature (deg C)	Field pH (Std. Units)	Oxygen, Dissolved (mg/L)	Field Specific Conductance (umhos/cm)	Oxidation-Reduction Potential (mV)	Turbidity (NTU)	Groundwater Elevation (feet)
MW-306	10/16/2017	14.8	10.66	0.37	448	286.2	0.35	522.72
	5/9/2018	14.7	6.80	0.05	354	-104.3	0.71	526.00
	8/14/2018	15.9	10.33	0.3	447	-265	2.88	520.14
	10/10/2018	17.3	6.04	0.38	478	58.1	2.67	528.95
	3/11/2019	14.3	6.27	0.8	343	-88.9	0.56	523.21
	4/3/2019	13.4	6.69	0.69	4711	-92.8	0.81	528.40
	10/11/2019	14.3	10.53	0.21	473	-165.1	1.84	--
	6/4/2020	14.4	10.48	0.16	482	59	15.96	524.45
	10/15/2020	14.1	10.00	0.11	454	-273.7	0.02	519.05
MW-307	10/16/2017	14.7	10.46	0.18	486	-78.9	0.32	522.55
	5/9/2018	14.4	10.30	1.1	500	-168.6	1.87	526.06
	8/14/2018	15.6	10.12	0.49	512	-221	5.09	520.46
	10/10/2018	15.6	9.88	0.22	497	-87.3	1.85	529.08
	3/11/2019	14.4	9.71	1.07	367	-78.3	1.05	523.49
	4/3/2019	13.6	10.39	0.68	500	-167.8	3.1	528.63
	10/11/2019	14.4	10.14	0.24	536	-126.3	3.23	--
	6/4/2020	14.8	10.03	0.3	586	60.2	14.33	524.62
	10/15/2020	14.0	10.05	0.11	565	-269.7	0.02	519.33
MW-307A	9/9/2020	14.4	7.83	--	585	-154.2	0	519.97
	10/14/2020	14.6	7.80	0.18	554	-189.9	2.96	519.00

Table 4. Groundwater Field Parameters - CCR Program - Assessment Monitoring
Burlington Generating Station / SCS Project # 25219168.00
October 2017 - October 2020

Well	Sample Date	Field Temperature (deg C)	Field pH (Std. Units)	Oxygen, Dissolved (mg/L)	Field Specific Conductance (umhos/cm)	Oxidation-Reduction Potential (mV)	Turbidity (NTU)	Groundwater Elevation (feet)
MW-308	10/17/2017	14.6	9.75	0.09	689	-109.4	0.6	522.46
	5/8/2018	14.4	9.75	1.5	698	-158.2	1.26	525.62
	8/13/2018	15.4	9.86	0.11	710	-238	4.63	520.22
	10/10/2018	15.3	9.82	0.2	709	-201	1.35	528.98
	3/12/2019	14.1	7.72	2.57	500	-60.7	1.68	523.13
	4/3/2019	14.0	9.97	1.16	681	-142.3	1.66	528.39
	10/10/2019	14.6	9.42	0.21	671	-82.6	2.93	--
	6/4/2020	15.4	9.65	0.23	713	28	13.38	524.10
	10/14/2020	14.7	9.70	0.1	682	-264.6	0.15	519.02
MW-309	10/17/2017	14.6	8.50	0.08	1058	-31	3.08	522.67
	5/8/2018	13.5	7.25	0.05	813	-139.2	6.49	525.54
	8/14/2018	14.2	7.39	0.14	1093	-143	12.67	520.22
	10/10/2018	15.7	7.46	0.18	1038	-53.5	34.45	528.93
	4/4/2019	12.6	7.45	0.51	997	-99.4	20.1	528.40
	10/11/2019	13.7	7.19	0.21	1040	-165.6	8.93	--
	6/3/2020	14.8	7.09	0.23	1086	37	18.88	524.06
	10/14/2020	14.3	7.61	0.14	851	-208.4	18.9	519.28
MW-310	10/16/2017	16.6	7.92	0.16	791	-63.6	2.86	525.49
	5/8/2018	11.1	7.46	0.14	595	-198.8	12.81	525.79
	8/14/2018	15.0	7.44	0.05	840	-194	3.11	523.69
	10/10/2018	17.0	7.20	0.1	938	-166	0	529.00
	4/4/2019	10.8	7.84	1.12	1034	-175.8	16.7	528.62
	10/11/2019	15.9	6.95	0.28	961	-189.7	5.23	--
	6/2/2020	12.8	7.30	0.13	881	38.6	17.82	525.36
	10/14/2020	16.4	7.34	0.08	711	-223.6	3.79	523.81

Table 4. Groundwater Field Parameters - CCR Program - Assessment Monitoring
Burlington Generating Station / SCS Project # 25219168.00
October 2017 - October 2020

Well	Sample Date	Field Temperature (deg C)	Field pH (Std. Units)	Oxygen, Dissolved (mg/L)	Field Specific Conductance (umhos/cm)	Oxidation-Reduction Potential (mV)	Turbidity (NTU)	Groundwater Elevation (feet)
MW-310A	9/9/2020	14.2	7.33	--	1026	145.3	714.3	509.16
	10/16/2020	--	--	--	--	--	--	489.84
MW-311	10/16/2017	14.7	8.27	0.25	972	308.3	2.19	523.44
	5/8/2018	11.5	7.26	1.6	1282	-143.3	1.48	525.08
	8/14/2018	14.8	7.33	0.12	1177	-158	12.3	521.06
	10/10/2018	16.4	7.49	0.45	1003	-62.2	17.8	528.49
	4/4/2019	11.4	7.64	0.78	1422	145.8	10.8	528.20
	10/11/2019	14.2	7.07	0.3	1088	-163.4	13.4	--
	6/2/2020	12.3	7.10	0.16	1464	-1.1	17.95	524.05
	10/14/2020	14.5	7.41	0.1	1041	-194	2.36	520.59
MW-312	6/6/2019	14.4	6.99	0.12	783	-146.4	2.86	--
	10/10/2019	15.6	7.19	8.75	785	-163.8	2.56	--
	6/3/2020	14.7	7.13	0.17	878	53.3	21.16	524.05
	10/15/2020	15.1	7.37	0.13	854	-203.1	0.02	518.68
MW-313	6/6/2019	14.9	6.94	0.07	1059	-141.6	7.23	--
	10/10/2019	16.0	7.06	0.37	1007	-163.4	11.03	--
	6/3/2020	17.2	7.03	0.29	1099	50.9	50.81	524.02
	10/15/2020	15.3	7.16	0.14	999	-183.3	14.3	518.70
MW-313A	9/9/2020	15.3	7.60	--	1243	-164.4	0	515.36
	10/15/2020	14.8	7.64	0.1	1133	-190.1	0.02	518.61

Table 5. Preliminary Evaluation of Corrective Measure Alternatives
Burlington Generating Station / SCS Engineers Project #25219168.00

	Alternative #1 No Action	Alternative #2 Close and Cap in place with MNA	Alternative #3 Consolidate on Site and Cap with MNA	Alternative #4 Excavate and Dispose on site with MNA	Alternative #5 Excavate and Dispose in Off-site Landfill	Alternative #6 Consolidate and Cap with Chemical Amendment	Alternative #7 Consolidate and Cap with Groundwater Collection	Alternative #8 Consolidate and Cap with Barrier Wall
CORRECTIVE ACTION ASSESSMENT - 40 CFR 257.97(b)								
257.97(b)(1) Is remedy protective of human health and the environment?	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
257.97(b)(2) Can the remedy attain the groundwater protection standard?	Unlikely	Yes	Yes	Yes	Yes	Yes	Yes	Yes
257.97(b)(3) Can the remedy 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?	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
257.97(b)(4) Can the remedy remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible?	Not Applicable - No release of CCR	Not Applicable - No release of CCR	Not Applicable - No release of CCR	Not Applicable - No release of CCR	Not Applicable - No release of CCR	Not Applicable - No release of CCR	Not Applicable - No release of CCR	Not Applicable - No release of CCR
257.97(b)(5) Can the remedy comply with standards for management of wastes as specified in §257.98(d)?	Not Applicable	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LONG- AND SHORT-TERM EFFECTIVENESS - 40 CFR 257.97(c)(1)								
257.97(c)(1)(i) Magnitude of reduction of existing risks	No reduction of existing risk	Existing risk reduced by achieving GPS	Same as Alternative #2	Same as Alternative #2	Same as Alternative #2	Similar to Alternative #2. Long-term risk may be reduced with additional source control and in-situ stabilization/fixation of CCR that may be in contact with groundwater.	Similar to Alternative #2. Groundwater extraction and treatment presents an additional risk and potential exposure pathways via surface release or disruption of treatment processes.	Similar to Alternative #2. Long-term risk may be reduced with additional containment offered by barrier wall.
257.97(c)(1)(ii) Magnitude of residual risks in terms of likelihood of further releases due to CCR remaining following implementation of a remedy	No reduction of existing risk. Residual risk is limited for all alternatives due to limited extent of impacts and lack of receptors.	Magnitude of residual risk of further releases is lower than current conditions due to final cover eliminating infiltration through CCR; Residual risk is limited for all alternatives due to limited extent of impacts and lack of receptors	Same as Alternative #2 with potential further reduction in release risk due to CCR material footprint; However, limited to no overall risk reduction is provided due to lack of current/anticipated future receptors for groundwater impacts	Same as Alternative #3 with potential further reduction in release risk due to composite liner and cover; However, limited to no overall risk reduction is provided due to lack of current/anticipated future receptors for groundwater impacts	Same as Alternative #3 with potential further reduction in release risk due to removal of CCR from site; However, limited to no overall risk reduction is provided due to lack of current/anticipated future receptors for groundwater impacts	Same as Alternative #2 with potential further reduction in release risk due to CCR material footprint; Residual risk is further reduced by way of chemical / physical alteration of the source of impacts. However, limited to no overall risk reduction is provided due to lack of current/anticipated future receptors for groundwater impacts.	Same as Alternative #2 with potential further reduction in release risk due to CCR material footprint; Residual risk is potentially reduced by way of the ability to respond to potential future/ongoing releases from CCR that might be in contact with groundwater following closure. However, limited to no overall risk reduction is provided due to lack of current/anticipated future receptors for groundwater impacts.	Same as Alternative #2 with potential further reduction in release risk due to CCR material footprint; Residual risk of source material in contact with groundwater is further reduced by the containment of groundwater impacts provided by barrier walls; However, limited to no overall risk reduction is provided due to lack of current/anticipated future receptors for groundwater impacts.
257.97(c)(1)(iii) The type and degree of long-term management required, including monitoring, operation, and maintenance	Not Applicable	30-year post-closure groundwater monitoring; Groundwater monitoring network maintenance and as-needed repair/replacement; Final cover maintenance (e.g., mowing and as-needed repair); Periodic final cover inspections; Additional corrective action as required based on post-closure groundwater monitoring	Same as Alternative #2	Same as Alternative #2	No on-site long-term management required; Limited on-site post-closure groundwater monitoring until GPS are achieved; Receiving disposal facility will have same/similar long-term monitoring, operation, and maintenance requirements as Alternative #2	Same as Alternative #2	Same as Alternative #2 with additional effort for groundwater pump operation and maintenance (O&M), groundwater treatment system O&M, and treatment system discharge monitoring/reporting.	Same as Alternative #2 with additional monitoring of wall performance.

Table 5. Preliminary Evaluation of Corrective Measure Alternatives
Burlington Generating Station / SCS Engineers Project #25219168.00

	Alternative #1 No Action	Alternative #2 Close and Cap in place with MNA	Alternative #3 Consolidate on Site and Cap with MNA	Alternative #4 Excavate and Dispose on site with MNA	Alternative #5 Excavate and Dispose in Off-site Landfill	Alternative #6 Consolidate and Cap with Chemical Amendment	Alternative #7 Consolidate and Cap with Groundwater Collection	Alternative #8 Consolidate and Cap with Barrier Wall
LONG- AND SHORT-TERM EFFECTIVENESS - 40 CFR 257.97(c)(1) (continued)								
257.97(c)(1)(iv) Short-term risks - Implementation								
Excavation	None	Limited risk to community and environment due to limited amount of excavation (<100K cy) required to establish final cover subgrades and no off-site excavation	Same as Alternative #2 with increased risk to environment due to increased excavation volumes (>100K cy, <300K cy) required for consolidation	Same as Alternative #3 with increased risk to environment due to increased excavation volumes (>1M cy) and temporary CCR storage during disposal site construction required for removal and on-site re-disposal	Same as Alternative #4 with reduced risk to environment from excavation due to limited on-site storage	Similar to Alternative #3 with some increased potential risk due to exposure during the application of the chemical amendment.	Similar to Alternative #3 with some increased construction risk due to drilling, trenching, and excavation for groundwater pumping and treatment system construction.	Similar to Alternative #3 with some increased construction risk due to excavation or installation of the barrier wall.
Transportation	None	No risk to community or environment from off-site CCR transportation; Typical risk due to construction traffic delivering final cover materials to site	Same as Alternative #2 with reduced risk from construction traffic due to reduced final cover material requirements (smaller cap footprint)	Same as Alternative #2 with increased risk from construction traffic due to increased material import requirements (liner and cap construction required)	Highest level of community and environmental risk due to CCR volume export (>1M cy)	Similar to Alternative #3 with increased risk from importing chemical material for stabilization/treatment.	Similar to Alternative #3 with increased risk from importing groundwater pumping and treatment system materials.	Similar to Alternative #3 with increased risk from importing barrier wall system materials.
Re-Disposal	None	Limited risk to community and environment due to limited volume of CCR re-disposal (<100K cy)	Same as Alternative #2 with increased risk to environment due to increased excavation volumes (>100K cy, <300K cy) required for consolidation	Same as Alternative #3 with increased risk to environment due to increased excavation volumes (>1M cy) and temporary CCR storage during disposal site construction required for removal and on-site re-disposal	Same as Alternative #4 with increased risk to community and environment due to re-disposal of large CCR volume (>1M cy) at another facility; Re-disposal risks are managed by the receiving disposal facility	Similar to Alternative #3 with some increased potential risk due to exposure during the application of the chemical amendment.	Same as Alternative #3	Same as Alternative #3
257.97(c)(1)(v) Time until full protection is achieved	Unknown	To be evaluated further during remedy selection. Closure and capping anticipated by end of 2022. Groundwater protection timeframe to reach GPS potentially 2 to 10 years following closure construction, achievable within 30-year post-	Similar to Alternative #2. Potential for increase in time to reach GPS due to significant source disturbance during construction. Potential for decrease in time to reach GPS due to consolidation of CCR.	Similar to Alternative #2. Potential for increase in time to reach GPS due to significant source disturbance during construction. Potential decrease in time to reach GPS due to source isolation within liner/cover system.	Similar to Alternative #2. Potential for increase in time to reach GPS due to significant source disturbance during construction. Potential decrease in time to reach GPS due to impounded CCR source removal.	Similar to Alternative #2. Potential for reduction in time to reach GPS due to chemical/physical stability of CCR.	Similar to Alternative #2. Potential decrease in time to reach GPS at property line from implementation of groundwater pumping.	Similar to Alternative #2. Potential decrease in time to reach GPS upon implementation of barrier wall.
257.97(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	No change in potential exposure	Potential for exposure is low. Remaining waste is capped.	Same as Alternative #2	Same as Alternative #2	No potential for on-site exposure to remaining waste since no waste remains on site; Risk of potential exposure is transferred to receiving disposal facility and is likely similar to Alternative #2	Same as Alternative #2	Similar to Alternative #2 with potential for secondary impacts from releases of extracted groundwater or disruption in treatment.	Same as Alternative #2
257.97(c)(1)(vii) Long-term reliability of the engineering and institutional controls	Not Applicable	Long-term reliability of cap is good; Significant industry experience with methods/ controls; Capping is common practice/industry standard for closure in place for remediation and solid waste management	Same as Alternative #2 with potentially increased reliability due to smaller footprint and reduced maintenance	Same as Alternative #3	Success of remedy at BGS does not rely on long-term reliability of engineering or institutional controls; Overall success relies on reliability of the engineering and institutional controls at the receiving facility.	Same as Alternative #3.	Same as Alternative #3. Remedy relies upon active equipment that will require additional operations and maintenance.	Same as Alternative #3. Remedy relies on continued hydraulic conductivity of the selected barrier. Breaches or short circuiting can develop and must be monitored.
257.97(c)(1)(viii) Potential need for replacement of the remedy	Not Applicable	Limited potential for remedy replacement if maintained; Some potential for remedy enhancement due to residual groundwater impacts following source control	Same as Alternative #2 with reduced potential need for remedy enhancement with consolidated/smaller closure area footprint	Same as Alternative #2 with further reduction in potential need for remedy enhancement composite with liner	No on-site potential for remedy replacement; Limited potential for remedy enhancement due to residual groundwater impacts following source control	Similar to Alternative #3, with further reduction in potential need for remedy enhancement due to stabilized/solidified CCR material.	Similar to Alternative #2, with reduced potential of remedy replacement, but added expectation for pump, conveyance system and treatment system replacement.	Similar to Alternative #2, with reduced potential of remedy replacement, but added expectation for potential replenishment of consumptive barrier product.

Table 5. Preliminary Evaluation of Corrective Measure Alternatives
Burlington Generating Station / SCS Engineers Project #25219168.00

	Alternative #1 No Action	Alternative #2 Close and Cap in place with MNA	Alternative #3 Consolidate on Site and Cap with MNA	Alternative #4 Excavate and Dispose on site with MNA	Alternative #5 Excavate and Dispose in Off-site Landfill	Alternative #6 Consolidate and Cap with Chemical Amendment	Alternative #7 Consolidate and Cap with Groundwater Collection	Alternative #8 Consolidate and Cap with Barrier Wall
SOURCE CONTROL TO MITIGATE FUTURE RELEASES - 40 CFR 257.97(c)(2)								
257.97(c)(2)(i) The extent to which containment practices will reduce further releases	No reduction in further releases	Cap will reduce further releases by minimizing infiltration through CCR	Same as Alternative #2 with further reduction due to consolidated/smaller closure footprint	Same as Alternative #3 with further reduction due to composite liner and 5-foot groundwater separation required by CCR Rule	Removal of CCR prevents further releases at BGS; Receiving disposal site risk similar to Alternative #3	Similar to Alternative #3 with further reduction due to lower mobility of contaminants in residual source material as a result of chemical amendment.	Similar to Alternative #3 with the added ability to contain or restore groundwater impacts if MNA mechanisms are not active or site attenuation capacity is not adequate.	Similar to Alternative #3 with the added ability to contain groundwater impacts if MNA mechanisms are not active or site attenuation capacity is not adequate.
257.97(c)(2)(ii) The extent to which treatment technologies may be used	Alternative does not rely on treatment technologies	Alternative does not rely on treatment technologies	Alternative does not rely on treatment technologies	Alternative does not rely on treatment technologies	Alternative does not rely on treatment technologies	Alternative relies on the identification and availability of a suitable chemical amendment. Implementation of and contact with physical/chemical stabilizing agent will require specialized field implementation methods and health and safety measures.	This alternative relies on conventional pump and treat remediation.	Alternative relies on the identification and availability of a suitable barrier wall technology (e.g., permeable reactive barrier material or slurry wall). Implementation of and contact with barrier wall materials will require specialized field implementation methods and health and safety measures.
IMPLEMENTATION - 40 CFR 257.97(c)(3)								
257.97(c)(3)(i) Degree of difficulty associated with constructing the technology	Not Applicable	Low complexity construction; Potentially lowest level of dewatering effort - dewatering required for cap installation only	Low complexity construction; Moderate degree of logistical complexity; Moderate to low level of dewatering effort - dewatering required for material excavation/placement and capping	Moderate complexity construction due to composite liner and cover; High degree of logistical complexity due to excavation and on-site storage of >1M cy of CCR while new lined disposal area is constructed; Moderate to high level of dewatering effort - dewatering required for excavation of full CCR volume	Low complexity construction; High degree of logistical complexity including the excavation and off-site transport of >1M cy of CCR and permitting/development of off-site disposal facility airspace; Moderate to high level of dewatering effort - dewatering required for excavation of full CCR volume	Moderate complexity construction due to the equipment required to apply the selected amendment; requirements to ensure consistent contact and dosing of amendment; Medium degree of logistical complexity involving the import of specialty chemicals; Moderate to low level of dewatering effort - dewatering required for material excavation/placement and capping	Low complexity construction; Moderate degree of logistical complexity; Moderate to low level of dewatering effort - dewatering required for material excavation/placement and capping. Moderate complexity construction for the installation of extraction wells and conveyance to a site-specific groundwater treatment plant.	High complexity construction; Barrier walls require specialty installation equipment and knowledge. Highly specialized and experience contractors required to achieve proper installation. Moderate degree of logistical complexity; Moderate to low level of dewatering effort - dewatering required for material excavation/placement and capping.
257.97(c)(3)(ii) Expected operational reliability of the technologies	Not Applicable	High reliability based on historic use of capping as corrective measure	Same as Alternative #2	Same as Alternative #2	Success at BGS does not rely on operational reliability of technologies; Overall success relies on off-site disposal facility, which is likely same/similar to Alternative #2	Similar to Alternative #2; however, success at BGS relies on the successful application of specialty chemicals.	Similar to Alternative #2; however, success of this remedy relies on the successful operation of a site-specific groundwater treatment plant.	Similar to Alternative #2; however, success this remedy relies on continued hydraulic conductivity of the selected barrier. Breaches or short circuiting can develop and must be monitored.
IMPLEMENTATION - 40 CFR 257.97(c)(3) (continued)								
257.97(c)(3)(iii) Need to coordinate with and obtain necessary approvals and permits from other agencies	Not Applicable	Need is moderate in comparison to other alternatives State Closure Permit required; Federal/State/Local Floodplain permitting required; State and local erosion control/construction stormwater management permits required; Federal/State wetland permitting potentially required	Need is lowest in comparison to other alternatives; State Closure Permit required; State and local erosion control/construction stormwater management permits required; Federal/State/Local Floodplain permitting likely required	Need is high in comparison to other alternatives State Closure Permit required; State Landfill Permit may be required; Federal/State/Local Floodplain permitting likely required; State and local erosion control/construction stormwater management permits required; Federal/State wetland permitting likely required	Need is highest in comparison to other alternatives; State Closure Permit required; State and local erosion control/construction stormwater management permits required; Approval of off-site disposal site owner required; May require State solid waste comprehensive planning approval; Federal/State/Local Floodplain permitting likely required; Federal/State wetland permitting likely required; Local road use permits likely required	Need is moderate in comparison to other alternatives; State Closure Permit required; Underground Injection Control Permit may be required if chemical materials placed within groundwater. State and local erosion control/construction stormwater management permits required; Federal/State/Local Floodplain permitting likely required.	Need is moderate in comparison to other alternatives; State Closure Permit required; Well permitting for extraction well installation; NPDES Permit for groundwater treatment and discharge; State and local erosion control/construction stormwater management permits required; Federal/State/Local Floodplain permitting likely required.	Need is moderate in comparison to other alternatives; State Closure Permit required; Well permitting for barrier wall monitoring; Federal/State/Local Floodplain permitting required; State and local erosion control/construction stormwater management permits required; Federal/State wetland permitting potentially required
257.97(c)(3)(iv) Availability of necessary equipment and specialists	Not Applicable	Necessary equipment and specialists are highly available; Highest level of demand for cap construction material	Same as Alternative #2; Lowest level of demand for cap construction material	Same as Alternative #2; Moderate level of demand for liner and cap construction material	Availability of necessary equipment to develop necessary off-site disposal facility airspace and transport >1M cy of CCR to new disposal facility will be a limiting factor in the schedule for executing this alternative; No liner or cover material demands for on-site implementation of remedy	Similar to Alternative #3; Moderate level of demand for liner and cap construction material. Specialized mixing equipment likely required to apply chemical amendment and achieve required dosing.	Similar to Alternative #3; Moderate level of demand for liner and cap construction material. A site-specific, trained employee will be required to operate the groundwater treatment system.	Similar to Alternative #3; Moderate level of demand for liner and cap construction material; Availability of the necessary specialized equipment and extensive experience required for barrier installation is potentially low or in high demand.
257.97(c)(3)(v) Available capacity and location of needed treatment, storage, and disposal services	Not Applicable	Capacity and location of treatment, storage, and disposal services is not a factor for this alternative	Capacity and location of treatment, storage, and disposal services is unlikely to be a factor for this alternative	Available temporary on-site storage capacity for >1M cy of CCR while composite liner is constructed is significant limiting factor	off-site disposal capacity, facility logistical capacity, or the time required to develop the necessary off-site disposal and logistical capacity is a significant limiting factor.	Capacity and location of treatment, storage, and disposal services is unlikely to be a factor for this alternative	Capacity and location of treatment, storage, and disposal services is unlikely to be a factor for this alternative	Capacity and location of treatment, storage, and disposal services is unlikely to be a factor for this alternative
COMMUNITY ACCEPTANCE - 40 CFR 257.97(c)(4)								
257.97(c)(4) The degree to which community concerns are addressed by a potential remedy (Anticipated)	Not Applicable	No comments were received during the public meeting held on October 14, 2020. Assume all alternatives are acceptable to interested/affected parties.	No comments were received during the public meeting held on October 14, 2020. Assume all alternatives are acceptable to interested/affected parties.	No comments were received during the public meeting held on October 14, 2020. Assume all alternatives are acceptable to interested/affected parties.	No comments were received during the public meeting held on October 14, 2020. Assume all alternatives are acceptable to interested/affected parties.	To be determined. Alternative added after public meeting held on October 14, 2020.	To be determined. Alternative added after public meeting held on October 14, 2020.	To be determined. Alternative added after public meeting held on October 14, 2020.

NOTES:

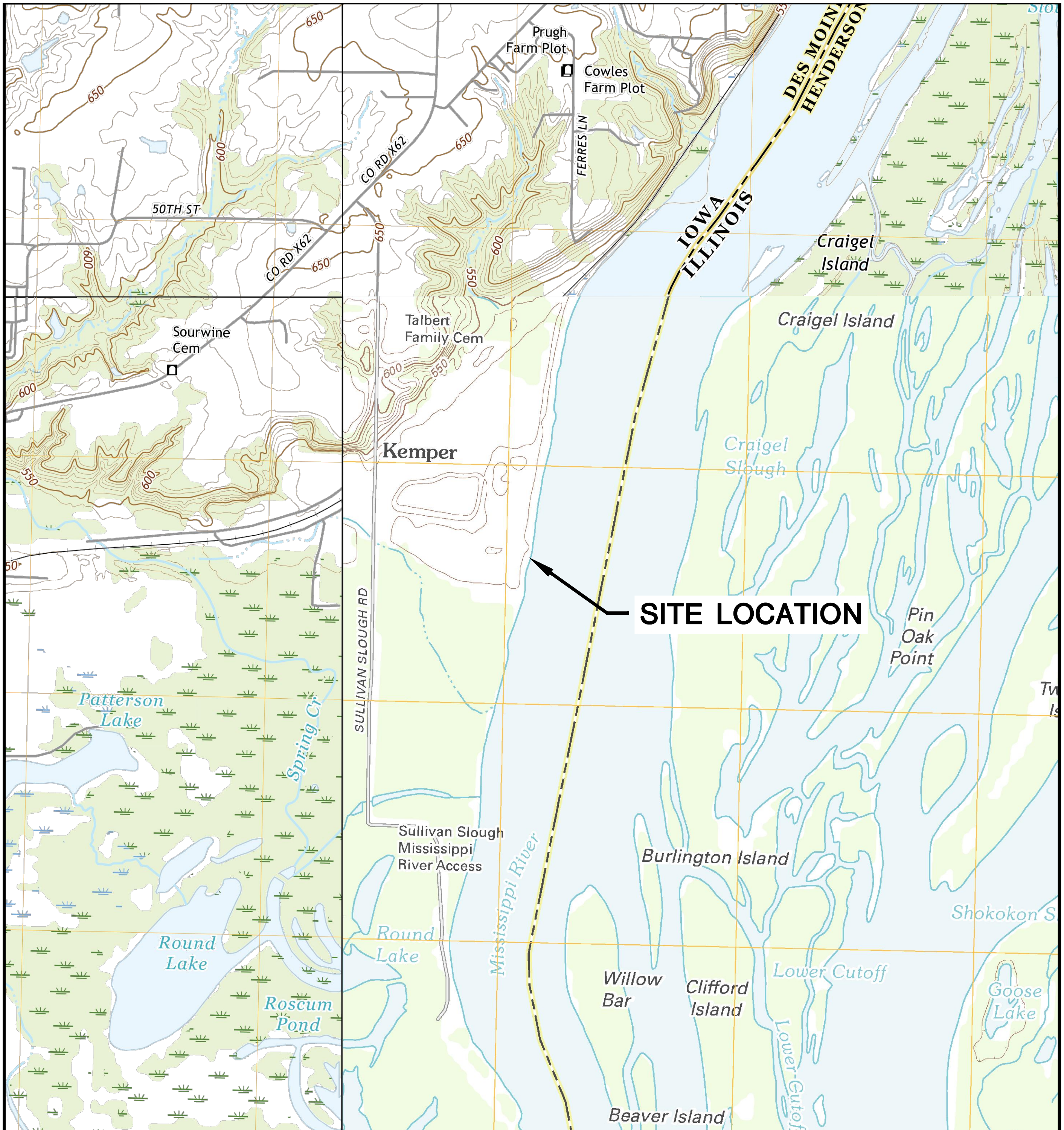
1) Alternatives #1 through #5 were developed and submitted within the Assessment of Corrective Measures Report (ACM), dated September 2019
2) Alternatives #6 through #8 were added in November 2020 as part of Addendum #1 to the September 2020 ACM Report

Created by: LAB/SK Date: 6/20/2019
Last revision by: SKK Date: 11/18/2020
Checked by: EJN Date: 11/19/2020

I:\25219168.00\Deliverables\ACM Addendum\Tables\[Table 5_Evaluation of Assessment of Corrective Measure_BGS.xlsx]BGS_Evaluation Matrix

Figures

1 Site Location Map
2 Site Plan and Monitoring Well Locations
3 Potentiometric Surface Map – April 2019
4 High Potentiometric Surface Map – June 2020
5 Low Potentiometric Surface Map – September 2020
6 Geologic Cross Section



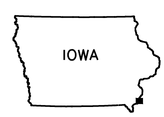
LOMAX QUADRANGLE

IOWA–ILLINOIS

7.5 MINUTE SERIES (TOPOGRAPHIC)

2012

SCALE: 1" = 2,000'



CLIENT	ALLIANT ENERGY 4902 N. BILTMORE LANE, #1000 MADISON, WI 53718	SITE	ALLIANT ENERGY BURLINGTON GENERATING STATION BURLINGTON, IOWA

SITE LOCATION MAP

PROJECT NO.	25219066.00	DRAWN BY:	AHB	ENGINEER	SCS ENGINEERS 2830 DAIRY DRIVE MADISON, WI 53718-6751 PHONE: (608) 224-2830
DRAWN:	05/29/15	CHECKED BY:	KAK		
REVISED:	06/19/19	APPROVED BY:	TK 09/10/19		

FIGURE 1

I:\25219066.00\Drawings\Site Loc.dwg, 9/10/2019 11:50:53 AM

LEGEND

- EXISTING CCR RULE MONITORING WELL
- EXISTING CCR RULE PIEZOMETER
- CCR UNITS

NOTES:

1. MONITORING WELLS MW-303 THROUGH MW-308 WERE INSTALLED BY CASCADE DRILLING, LLP. UNDER THE SUPERVISION OF SCS ENGINEERS ON DECEMBER 15-17, 2015.
2. MONITORING WELLS MW-301, MW-302, AND MW-309 THROUGH MW-311 WERE INSTALLED BY DIRECT PUSH ANALYTICAL SERVICES CORP. UNDER THE SUPERVISION OF SCS ENGINEERS FROM FEBRUARY 29, 2016 TO MARCH 1, 2016.
3. MONITORING WELLS MW-312 AND MW-313 WERE INSTALLED BY ROBERTS ENVIRONMENTAL DRILLING IN MAY 2019.
4. 2018 AERIAL PHOTOGRAPH SOURCES: ESRI, DIGITALGLOBE, GEOEYE, I-CUBED, USDA FSA, USGS, AEX, GETMAPPING, AEROGRID, IGN, IGP, SWISSTOPO, AND THE GIS USER COMMUNITY.

N

300 0 300

SCALE: 1" = 300'

PROJECT NO.	25220081.00	DRAWN BY:	RJG
DRAWN:	11/14/2019	CHECKED BY:	MDB/EJN
REVISED:	10/16/2020	APPROVED BY:	TK

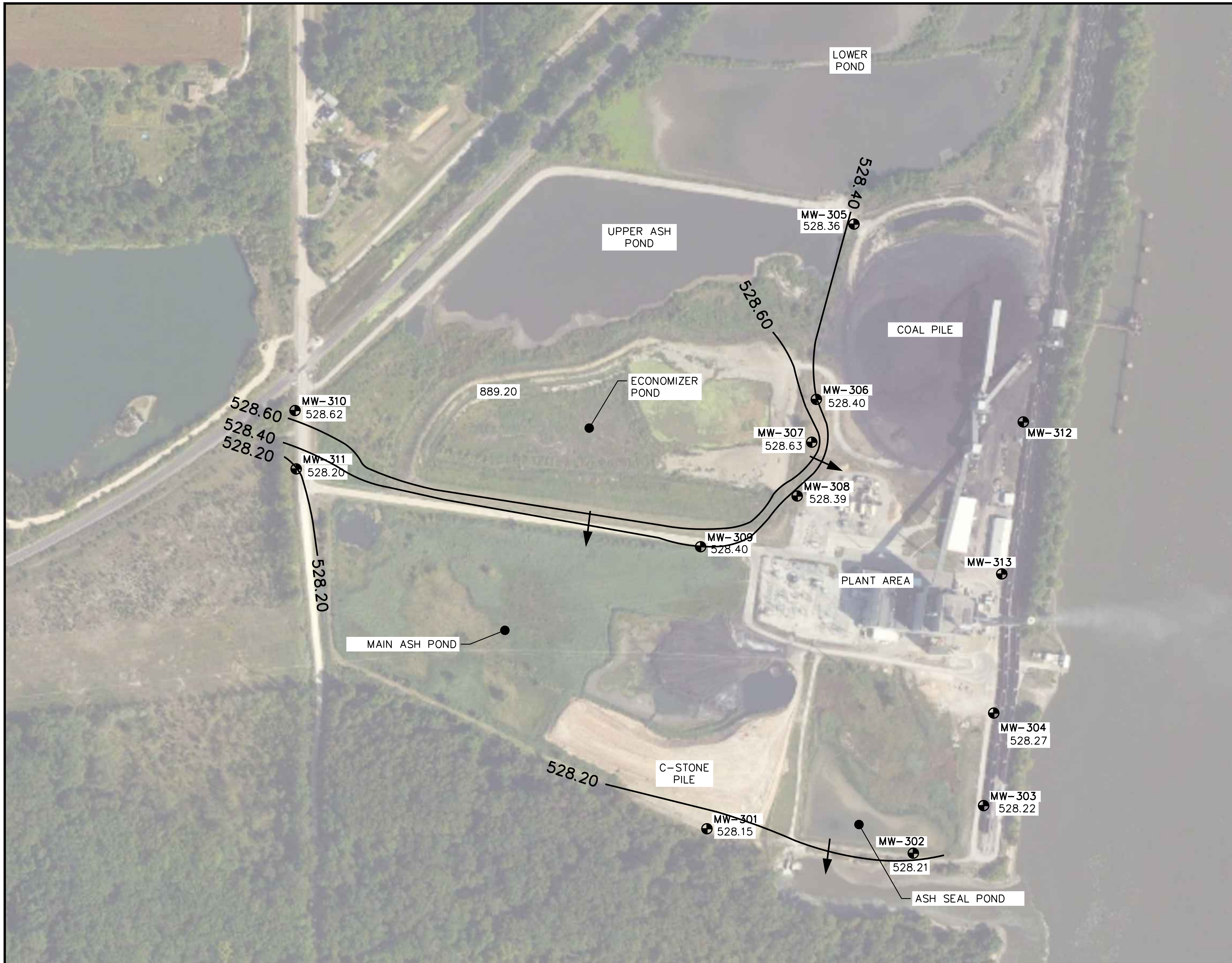
ENGINEER: SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830

CLIENT: ALLIANT ENERGY
4902 N. BILTMORE LANE, #1000
MADISON, WI 53718

SITE: ALLIANT ENERGY
BURLINGTON GENERATING STATION
BURLINGTON, IOWA

SITE PLAN AND MONITORING WELL LOCATIONS

FIGURE 2



LEGEND

- EXISTING MONITORING WELL LOCATION
- WATER TABLE ELEVATION CONTOUR
- APPROXIMATE FLOW DIRECTION

NOTES:

1. MONITORING WELLS MW-303 THROUGH MW-308 WERE INSTALLED BY CASCADE DRILLING, LLP. UNDER THE SUPERVISION OF SCS ENGINEERS ON DECEMBER 15-17, 2015.
2. MONITORING WELLS MW301, MW302, AND MW309-MW311 WERE INSTALLED BY DIRECT PUSH ANALYTICAL SERVICES CORP. UNDER THE SUPERVISION OF SCS ENGINEERS FROM FEBRUARY 29, 2016 TO MARCH 1, 2016.
3. MONITORING WELLS MW-301 THROUGH MW-311 WERE SURVEYED BY FRENCH-RENEKER ASSOCIATES OF FRANKLIN, IA ON MARCH 16, 2016.
4. MONITORING WELLS MW-312 AND MW-313 WERE INSTALLED BY ROBERTS ENVIRONMENTAL DRILLING IN MAY 2019.
5. WATER TABLE ELEVATION ESTIMATED BASED ON MONITORING WELLS SCREENED BELOW THE WATER TABLE IN THE SAND UNIT.

PROJECT NO.	25219066.00	DRAWN BY:	BSS/LEC
DRAWN:	06/18/19	CHECKED BY:	NK
REVISED:	07/17/19	APPROVED BY:	TK 09/10/19

ENGINEER: SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830

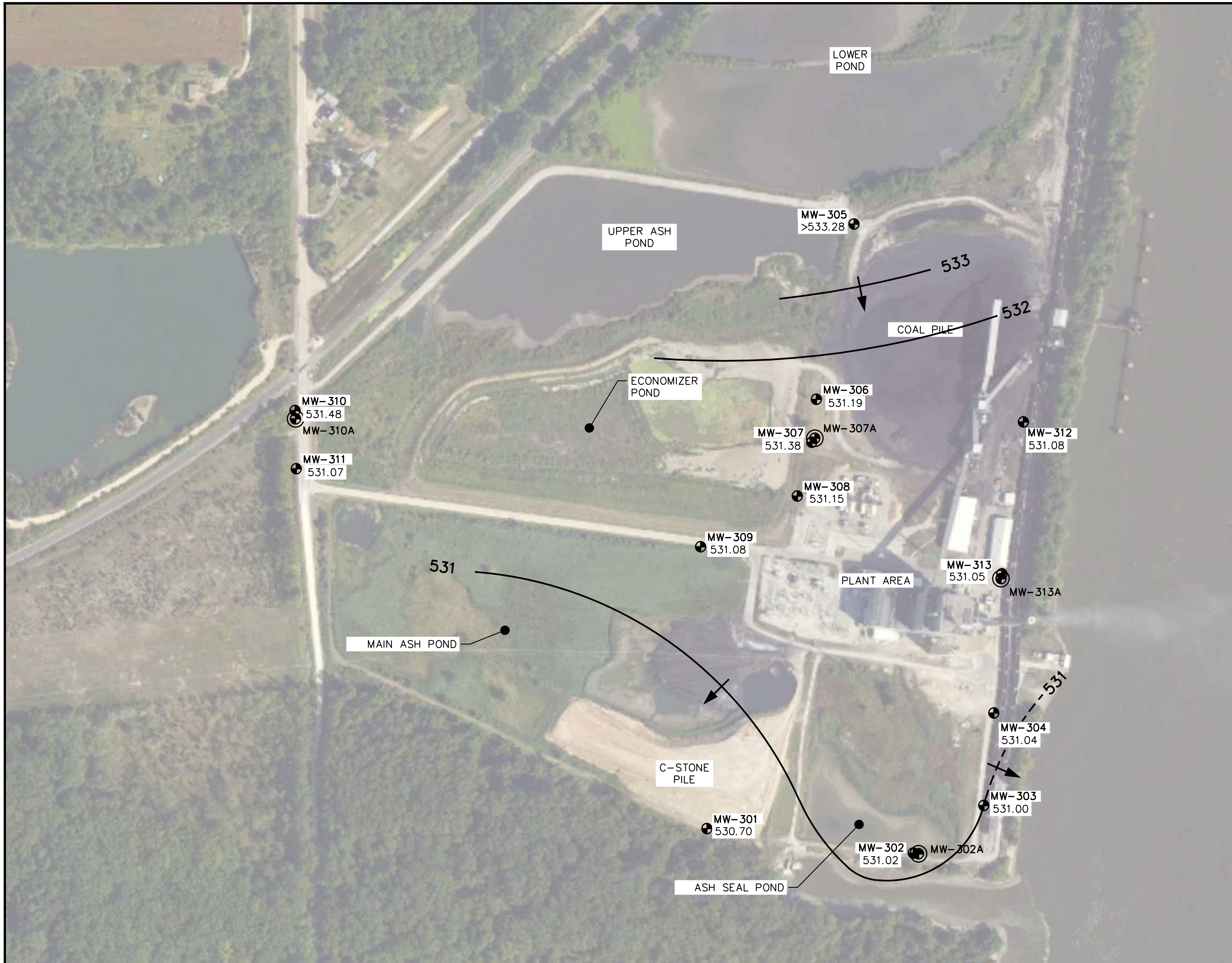
CLIENT: ALLIANT ENERGY
4902 N. BILTMORE LANE, #1000
MADISON, WI 53718

SITE: ALLIANT ENERGY
BURLINGTON GENERATING STATION
BURLINGTON, IOWA

POTENTIOMETRIC SURFACE MAP
APRIL 3, 2019

FIGURE 3

I:\25219066.00\Drawings\WTBL Map.dwg, 11/19/2020 5:27:21 PM



LEGEND

- MONITORING WELL
- DEEP PIEZOMETER
- WATER TABLE ELEVATION CONTOUR (DASHED WHERE INFERRED)
- APPROXIMATE FLOW DIRECTION

NOTES:

1. MONITORING WELLS MW-303 THROUGH MW-308 WERE INSTALLED BY CASCADE DRILLING, LLP. UNDER THE SUPERVISION OF SCS ENGINEERS ON DECEMBER 15-17, 2015.
2. MONITORING WELLS MW301, MW302, AND MW309-MW311 WERE INSTALLED BY DIRECT PUSH ANALYTICAL SERVICES CORP. UNDER THE SUPERVISION OF SCS ENGINEERS FROM FEBRUARY 29, 2016 TO MARCH 1, 2016.
3. MONITORING WELLS MW-301 THROUGH MW-311 WERE SURVEYED BY FRENCH-RENEKER ASSOCIATES OF FRANKLIN, IA ON MARCH 16, 2016.
4. MONITORING WELLS MW-312 AND MW-313 WERE INSTALLED BY ROBERTS ENVIRONMENTAL DRILLING IN MAY 2019.
5. DEEP PIEZOMETERS MW-302A, MW-307A, MW-310A, AND MW-313A WERE INSTALLED BY ROBERTS ENVIRONMENTAL DRILLING IN JUNE-JULY 2020.
6. GROUNDWATER ELEVATION ESTIMATED BASED ON MONITORING WELLS SCREENED BELOW THE POTENTIOMETRIC SURFACE IN THE SAND UNIT.

N

300 0 300

SCALE: 1" = 300'

PROJECT NO.	252191680	DRAWN BY:	BSS/KP
DRAWN:	09/18/2020	CHECKED BY:	MDB
REVISED:	09/24/2020	APPROVED BY:	TK 10/21/20

ENGINEER: SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830

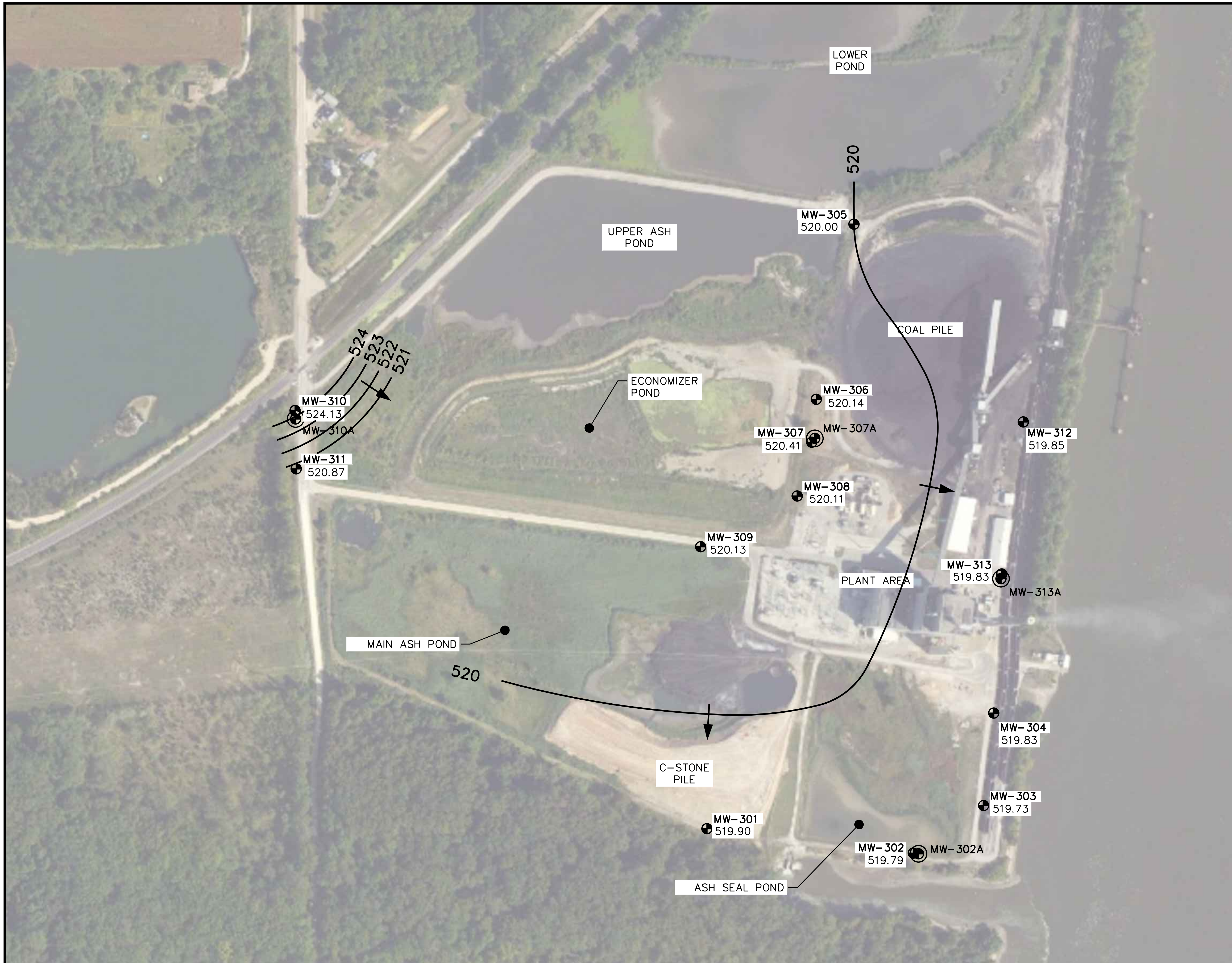
CLIENT: ALLIANT ENERGY
4902 N. BILTMORE LANE, #1000
MADISON, WI 53718

SITE: ALLIANT ENERGY
BURLINGTON GENERATING STATION
BURLINGTON, IOWA

HIGH POTENTIOMETRIC SURFACE MAP
JUNE 6, 2019

FIGURE
4

I:\25219168.00\Drawings\EPA Closure\PZ.dwg, 10/21/2020 11:41:17 AM



NOTES:

1. MONITORING WELLS MW-303 THROUGH MW-308 WERE INSTALLED BY CASCADE DRILLING, LLP. UNDER THE SUPERVISION OF SCS ENGINEERS ON DECEMBER 15–17, 2015.
2. MONITORING WELLS MW301, MW302, AND MW309–MW311 WERE INSTALLED BY DIRECT PUSH ANALYTICAL SERVICES CORP. UNDER THE SUPERVISION OF SCS ENGINEERS FROM FEBRUARY 29, 2016 TO MARCH 1, 2016.
3. MONITORING WELLS MW-301 THROUGH MW-311 WERE SURVEYED BY FRENCH-RENEKER ASSOCIATES OF FRANKLIN, IA ON MARCH 16, 2016.
4. MONITORING WELLS MW-312 AND MW-313 WERE INSTALLED BY ROBERTS ENVIRONMENTAL DRILLING IN MAY 2019.
5. DEEP PIEZOMETERS MW-302A, MW-307A, MW-310A, AND MW-313A WERE INSTALLED BY ROBERTS ENVIRONMENTAL DRILLING IN JUNE-JULY 2020.
6. GROUNDWATER ELEVATION ESTIMATED BASED ON MONITORING WELLS SCREENED BELOW THE POTENTIOMETRIC SURFACE IN THE SAND UNIT.

PROJECT NO.	252191680	DRAWN BY:	BSS/KP
DRAWN:	09/18/2020	CHECKED BY:	MDB
REVISED:	09/24/2020	APPROVED BY:	TK 10/21/20

ENGINEER: SCS ENGINEERS, 2830 DAIRY DRIVE MADISON, WI 53718-6751, PHONE: (608) 224-2830

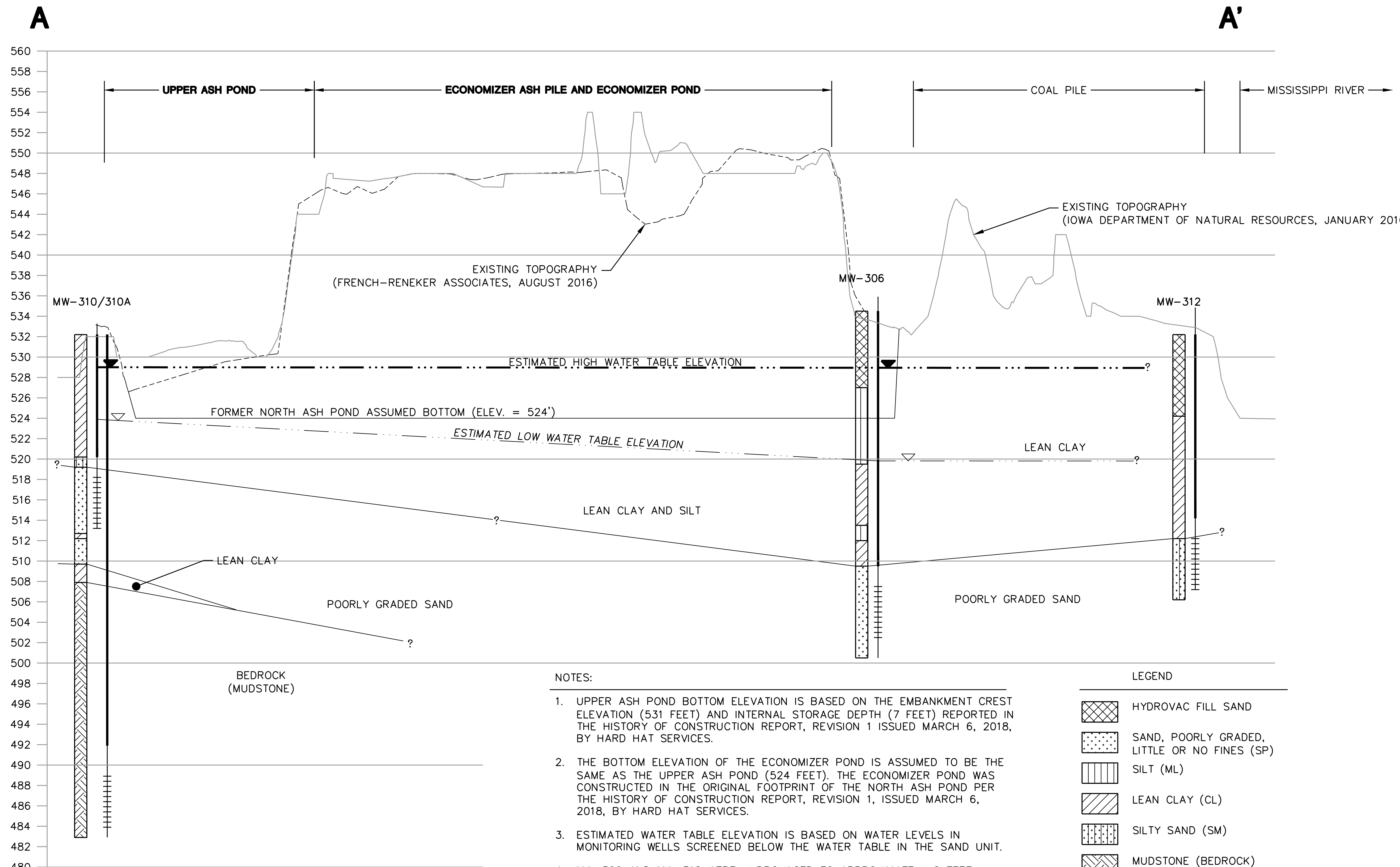
CLIENT: ALLIANT ENERGY, 4902 N. BILTMORE LANE, #1000, MADISON, WI 53718

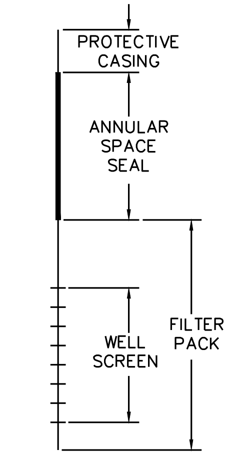
SITE: ALLIANT ENERGY, BURLINGTON GENERATING STATION, BURLINGTON, IOWA

LOW POTENTIOMETRIC SURFACE MAP
SEPTEMBER 9, 2020

FIGURE 5

I:\25219168.00\Drawings\EPA Closure\PZ.dwg, 11/19/2020 5:27:47 PM





WELL DETAIL

NOTES:

1. UPPER ASH POND BOTTOM ELEVATION IS BASED ON THE EMBANKMENT CREST ELEVATION (531 FEET) AND INTERNAL STORAGE DEPTH (7 FEET) REPORTED IN THE HISTORY OF CONSTRUCTION REPORT, REVISION 1 ISSUED MARCH 6, 2018, BY HARD HAT SERVICES.
2. THE BOTTOM ELEVATION OF THE ECONOMIZER POND IS ASSUMED TO BE THE SAME AS THE UPPER ASH POND (524 FEET). THE ECONOMIZER POND WAS CONSTRUCTED IN THE ORIGINAL FOOTPRINT OF THE NORTH ASH POND PER THE HISTORY OF CONSTRUCTION REPORT, REVISION 1, ISSUED MARCH 6, 2018, BY HARD HAT SERVICES.
3. ESTIMATED WATER TABLE ELEVATION IS BASED ON WATER LEVELS IN MONITORING WELLS SCREENED BELOW THE WATER TABLE IN THE SAND UNIT.
4. MW-306 AND MW-312 WERE HYDROVACED TO APPROXIMATELY 8 FEET. HYDROVACING IS PERFORMED TO DETERMINE IF UNDERGROUND UTILITIES ARE PRESENT. HIGH PRESSURE WATER AND A VACUUM ARE USED TO CLEAR THE BOREHOLE. AFTER HYDROVACING WAS COMPLETE THE BOREHOLE WAS FILLED WITH SAND TO COMPLETE THE BOREHOLE DRILLING PROCESS.

LEGEND

- HYDROVAC FILL SAND
- SAND, POORLY GRADED, LITTLE OR NO FINES (SP)
- SILT (ML)
- LEAN CLAY (CL)
- SILTY SAND (SM)
- MUDSTONE (BEDROCK)
- WATER LEVEL AT MONITORING WELL, APRIL 2019
- WATER LEVEL AT MONITORING WELL, AUGUST 2017

HORIZONTAL SCALE: 1" = 200'
VERTICAL SCALE: 1" = 10'
VERTICAL EXAGGERATION = 20X

PROJECT NO.	25219168.00	DRAWN BY:	KP
DRAWN:	06/12/2019	CHECKED BY:	MDB
REVISED:	09/24/2020	APPROVED BY:	TK

ENGINEER: SCS ENGINEERS, 2830 DAIRY DRIVE MADISON, WI 53718-6751, PHONE: (608) 224-2830

CLIENT: ALLIANT ENERGY, 4902 N. BILTMORE LANE, #1000, MADISON, WI 53718

SITE: ALLIANT ENERGY, BURLINGTON GENERATING STATION, BURLINGTON, IOWA

GEOLOGIC CROSS SECTION

FIGURE 6

I:\2521916□.00\Drawings\□□A□os□re\□ross Section.dwg, 9/2□/2020 9:□9:□2 AM

Appendix A

Regional Geologic and Hydrogeologic Information

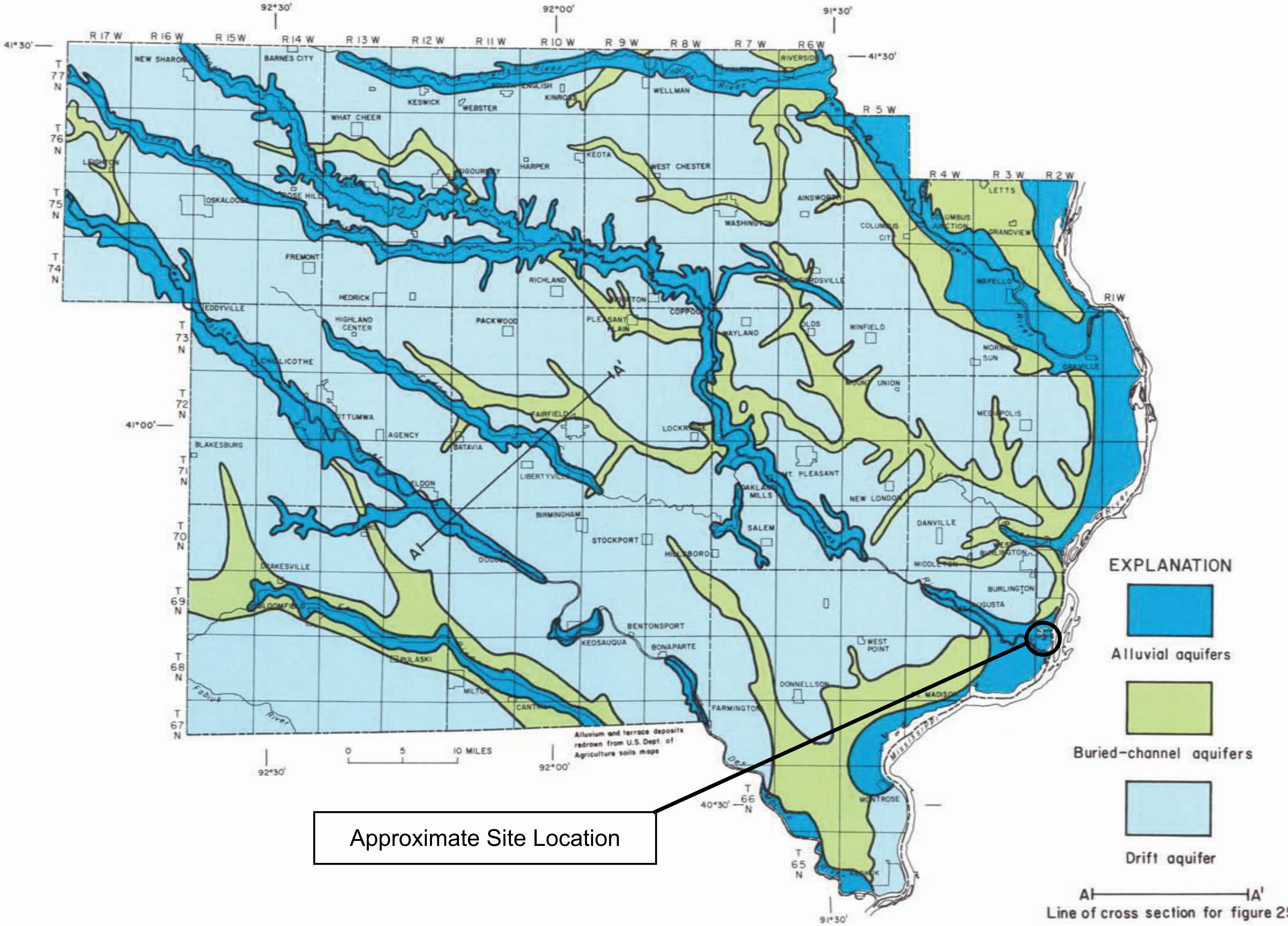


Figure 24.—Areal distribution of surficial aquifers

Source: Coble, R.W., The Water Resources of Southeast Iowa, Iowa Geological Survey Water Atlas Number 4, 1971.

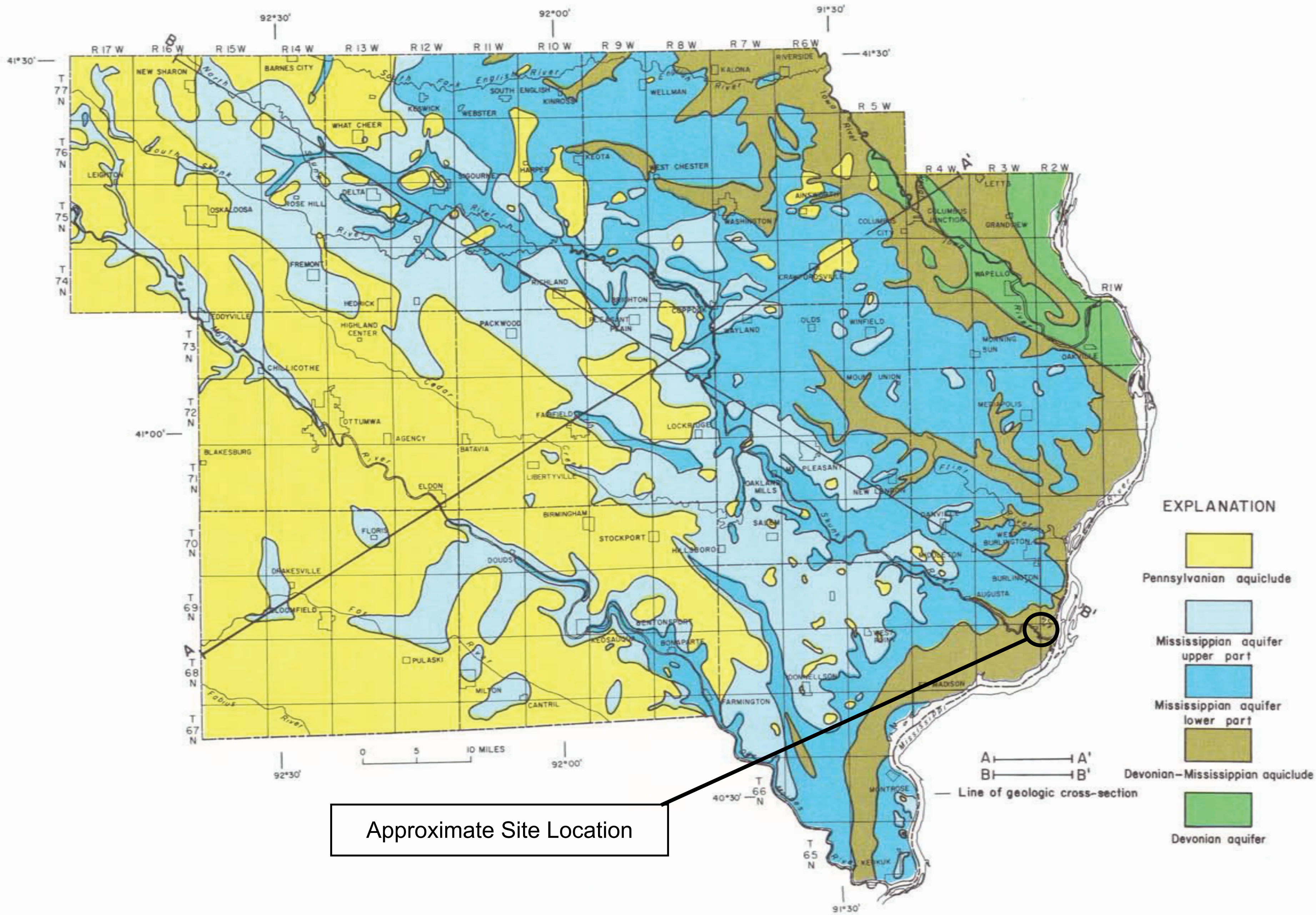


Figure 27.—Bedrock hydrogeologic map

Source: Coble, R.W., The Water Resources of Southeast Iowa, Iowa Geological Survey Water Atlas Number 4, 1971.

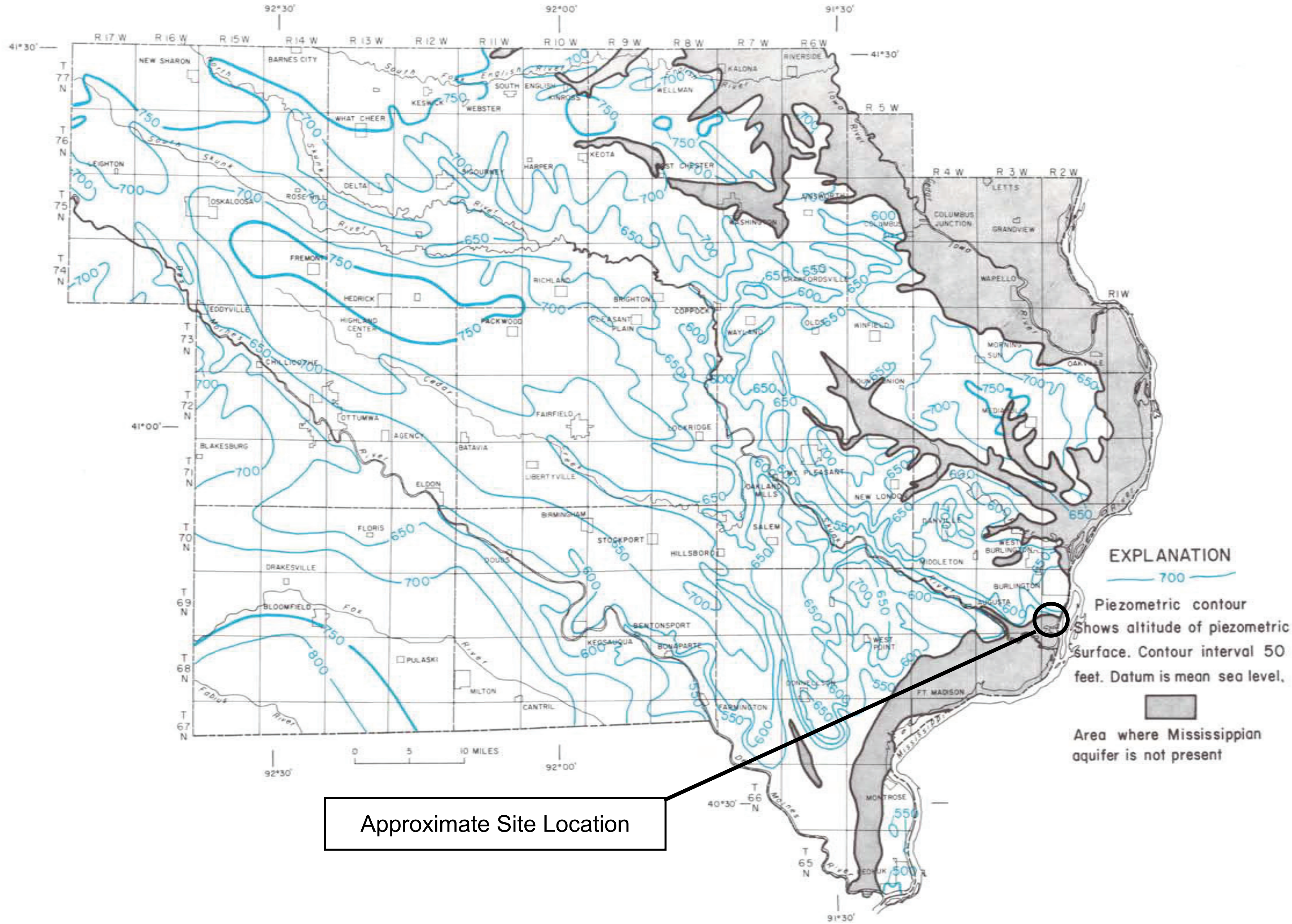


Figure 41.—Altitude of the water levels in wells tapping the Mississippian aquifer

Source: Coble, R.W., The Water Resources of Southeast Iowa, Iowa Geological Survey Water Atlas Number 4, 1971.

Appendix B

Boring Logs

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL- Burlington Generating Station SCS#: 25215135.80		MW-301

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Kevin Collins Direct Push Analytical	2/29/2016	2/29/2016	Direct Push 4-1/2/HSA

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-301	Feet	536.0 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 278,382 N, 2,300,041 E S/C/N
SW 1/4 of SW 1/4 of Section 29, T 69 N, R 2 W

Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "

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

Facility ID	County	Civil Town/City/ or Village
	Des Moines	Burlington

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–10	FILL, boring location was cleared to 10' bgs by hydrovac, then back filled.	FILL									
			10	LEAN CLAY WITH SAND, very dark gray (10YR 3/1).	CL									
S1	16		11							W				
S2	45		14							W				
			15											

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

Signature	Firm	
[signature]	SCS Engineers 2830 Dairy Drive Madison, WI 53718	Tel: 608-224-2830 Fax:

Boring Number MW-301

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			16, 17	LEAN CLAY WITH SAND, very dark gray (10YR 3/1). *(continued)*	CL									
S3	37		18, 19	POORLY GRADED SAND, very dark gray (10YR 3/1).	SP					W				
			20	SILT WITH SAND, very dark gray (10YR 3/1).	ML									
			21	POORLY GRADED SAND, very dark gray (10YR 3/1).	SP									
S4	24		22, 23	SANDY SILT, very dark gray (10YR 3/1).	MLS					W				
S5	NA		24, 25, 26, 27, 28, 29	POORLY GRADED SAND, very dark gray (10YR 3/1).	SP					W				Recovery NA sleeve stuck in discrete sampler.
				End of Boring at 29.50 feet bgs.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL- Burlington Generating Station SCS#: 25215135.80		MW-302

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Kevin Collins Direct Push Analytical	2/29/2016	2/29/2016	Direct Push 4-1/2/HSA

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-302	Feet	533.2 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 278,310 N, 2,300,647 E S/C/N
SE 1/4 of SW 1/4 of Section 29, T 69 N, R 2 W
Lat ° ' " Long ° ' "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Des Moines	Burlington

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–10	FILL, boring location was cleared to 10' bgs by hydrovac, then back filled.	FILL									
S1	15		10–12	POORLY GRADED SAND WITH SILT, medium grained, very dark gray (10YR 3/1).	SP-SM					W				
S2	15		12–15	POORLY GRADED SAND, medium grained, very dark gray (10YR 3/1).	SP					W				

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

Signature	Firm	
[signature]	SCS Engineers 2830 Dairy Drive Madison, WI 53718	Tel: 608-224-2830 Fax:

Boring Number MW-302

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
				POORLY GRADED SAND, medium grained, very dark gray (10YR 3/1). *(continued)*	SP									
			16											
			17	LEAN CLAY, very dark gray (10YR 3/1).										
S3	17		18		CL					W				
			19											
			20	POORLY GRADED SAND, coarse grained, very dark gray (10YR 3/1).										
			21											
S4	15		22							W				
			23											
			24		SP									
			25											
S5	16		26							W				
			27											
			28	End of Boring at 28 feet bgs.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL- Burlington Generating Station SCS#: 25215135.80		MW-303

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mike Mueller Cascade Drilling	12/15/2015	12/15/2015	4-1/2 hollow stem auger

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-303	Feet	531.0 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 278,450 N, 2,300,854 E S/C/N
SE 1/4 of SW 1/4 of Section 29, T 69 N, R 2 W

Lat ° ' "
Long ° ' "

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

Facility ID	County	Civil Town/City/ or Village
	Des Moines	Burlington

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–10	FILL, boring location was cleared to 10' bgs by hydrovac, then back filled.	FILL									
			10	LEAN CLAY, dark gray (10YR 3/1).	CL									
S1	0	4 6 8 8	10–12											Rock in the end of shoe.
S2	14	2 4 4 5	12.5–14.5							W				

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

Signature [signature]

Firm SCS Engineers
2830 Dairy Drive Madison, WI 53718
Tel: 608-224-2830
Fax:

Boring Number MW-303

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
				LEAN CLAY, dark gray (10YR 3/1). *(continued)*	CL									
S3	15	2 2 4 6	16							W				
S4	3	1 2 3 8	18–19							W				Rock in the end of shoe.
			20	POORLY GRADED SAND, coarse grained, very dark gray (2.5Y 3/1), some gravel.	SP									
S5	10	4 8 9 9	21							W				
			22.5	POORLY GRADED SAND, very dark gray (2.5Y 3/1), medium grained.	SP									
S6	14	1 2 8 9	24							W				
				same as above except, coarse grained.										
S7	8	4 6 8 10	26							W				
			27	End of Boring at 27.50 ft bgs.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL- Burlington Generating Station SCS#: 25215135.80		MW-304

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mike Mueller Cascade Drilling	12/15/2015	12/15/2015	4-1/2 hollow stem auger

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-304	Feet	532.2 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 278,721 N, 2,300,883 E S/C/N
SE 1/4 of SW 1/4 of Section 29, T 69 N, R 2 W
Lat ___° ___' ___"
Long ___° ___' ___"
Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

Facility ID	County	Civil Town/City/ or Village
	Des Moines	Burlington

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–10	FILL, boring location was cleared to 10' bgs by hydrovac, then back filled.	FILL									
			10–15	FAT CLAY, dark gray (10YR 3/1).	CH									
S1	12	3 4 11 14	11							W				
S2		2 3 5 5	14							W				

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

Signature	Firm	
[signature]	SCS Engineers 2830 Dairy Drive Madison, WI 53718	Tel: 608-224-2830 Fax:

Boring Number MW-304

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
S3	14	1 1 2 4	16 17	SANDY SILT, very dark gray (2.5Y 3/1), fine grained.	ML					W				
S4	14	1 2 3	18 19 20	POORLY GRADED SAND, very dark gray (2.5Y 3/1), medium grained.	SP					W				
S5	24	2 3 5 8	21 22							W				
S6	12	3 5 6 7	23 24 25	Same as above except, coarse grained.						W				
S7	12	3 6 11 16	26 27							W				
				End of boring at 27 feet bgs.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL- Burlington Generating Station SCS#: 25215135.80		MW-305

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mike Mueller Cascade Drilling	12/17/2015	12/17/2015	4-1/2 hollow stem auger

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-305	Feet	530.9 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 280,157 N, 2,300,473 E S/C/N
NE 1/4 of SW 1/4 of Section 29, T 69 N, R 2 W
Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "
Local Grid Location ☐ N Feet ☐ S ☐ E Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Des Moines	Burlington

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–5	FILL, boring location was cleared to 5' bgs by hydrovac, then back filled.	FILL									
			5–10	SILT, ash, black (2.5Y 2.5/1), (fill).	ML									
S1	14	13 30 20 12	6							M				
S2	6	3 4 2 1	8.5							M				
			10–15	LEAN CLAY, olive (5Y 4/4).	CL									
S3	5	4 4 6 7	11							M				
			13	same as above except, black (2.5Y 2.5/1).										
S4	10	2 4 6 8	13.5							M				

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

Signature	Firm	
(signature)	SCS Engineers 2830 Dairy Drive Madison, WI 53718	Tel: 608-224-2830 Fax:

Boring Number MW-305

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
				LEAN CLAY, olive (5Y 4/4). *(continued)*										
S5	14	1 1 2 3	16											
			17		CL									
			18	same as above except, very dark gray (10YR 3/1).										
S6	16	1 1 2 2	19											
			20	POORLY GRADED SAND, very dark gray (10YR 3/1), coarse grained.										
S7	12	1 2 4 5	21							W				
			22											
			23											
S8	12	1 1 2 3	24		SP					W				
			25											
S9	8		26							W				
			27											
				End of Boring at 27.50 ft bgs.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name			License/Permit/Monitoring Number		Boring Number
IPL- Burlington Generating Station SCS#: 25215135.80					MW-306
Boring Drilled By: Name of crew chief (first, last) and Firm			Date Drilling Started	Date Drilling Completed	Drilling Method
Mike Mueller Cascade Drilling			12/16/2015	12/17/2015	4-1/2 hollow stem auger
Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-306	Feet	534.5 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 279,643 N, 2,300,362 E S/C/N
NE 1/4 of SW 1/4 of Section 29, T 69 N, R 2 W
Lat ° ' " Long ° ' "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Des Moines	Burlington

Sample: Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–7.5	FILL, boring location was cleared to 7.5' bgs by hydrovac, then back filled.	FILL									
			7.5–15	SANDY SILT, very dark gray (2.5Y 3/1), fine grained sand.	ML									
S1	22	6 8 12 12	~8–9											
S2	22	7 2 2 2	~10.5–11.5							W				
S3	12	4 9 19 21	~13–14							W				

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

Signature [signature]

Firm SCS Engineers
2830 Dairy Drive Madison, WI 53718
Tel: 608-224-2830
Fax:

Boring Number MW-306

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
S4	10	2 2 2 2	16	LEAN CLAY, black (2.5Y 2.5/1).						W				
			17											
S5	10	1 1 1 2	18–19		CL					W				
			20											
S6	22	3 4 5	21–22	SANDY SILT, very dark gray (2.5 3/1), fined grained sand.	ML					W				
S7	10	1 1 1 2	23–24	LEAN CLAY, black (2.5Y 2.5/1).	CL					W				
S8	20	2 3 6 10	25–26	POORLY GRADED SAND, very dark gray (2.5Y 3/1), coarse grained.						W				
			27											
S9	10	1 3 3 5	28–29		SP					W				
			30											
S10	10	2 2 3 8	31							W				
			32–33											
			34	End of boring at 34 ft bgs.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name		License/Permit/Monitoring Number	Boring Number
IPL- Burlington Generating Station SCS#: 25215135.80			MW-307

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mike Mueller Cascade Drilling	12/16/2015	12/16/2015	4-1/2 hollow stem auger

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-307	Feet	534.3 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 279,517 N, 2,300,349 E S/C/N
NE 1/4 of SW 1/4 of Section 29, T 69 N, R 2 W
Lat ___° ___' ___"
Long ___° ___' ___"
Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

Facility ID	County	Civil Town/City/ or Village
	Des Moines	Burlington

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–7.5	FILL, boring location was cleared to 7.5' bgs by hydrovac, then back filled.	FILL									
S1	0		7.5–10	SILT, ash, (fill).	ML									
S2	16	13 8 6 11	10–	SANDY SILT, very dark gray (2.5Y 3/1), sand is fine grained.	ML					W				
S3	15	4 9 6 3								W				

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

Signature	Firm	
[signature]	SCS Engineers 2830 Dairy Drive Madison, WI 53718	Tel: 608-224-2830 Fax:

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A

Boring Number MW-307

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
S4	18	1 3 5 5	16, 17	SANDY SILT, very dark gray (2.5Y 3/1), sand is fine grained. *(continued)*	ML					W				
S5	20	1 2 2 2	18, 19	LEAN CLAY, black (10YR 2/1).	CL					W				
S6	16	1 2 4 6	20, 21, 22	POORLY GRADED SAND, very dark gray (2.5Y 3/1), coarse grained.	SP					W				
S7	10	1 2 4 4	23, 24, 25							W				
S8	12	2 2 3 4	26, 27							W				
				End of boring at 27 ft bgs.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name: IPL- Burlington Generating Station SCS#: 25215135.80	License/Permit/Monitoring Number:	Boring Number: MW-308	
Boring Drilled By: Name of crew chief (first, last) and Firm: Mike Mueller, Cascade Drilling	Date Drilling Started: 12/15/2015	Date Drilling Completed: 12/16/2015	Drilling Method: 4-1/2 hollow stem auger
Unique Well No.: / DNR Well ID No.: / Common Well Name: MW-308	Final Static Water Level: Feet	Surface Elevation: 534.9 Feet	Borehole Diameter: 8.5 in
Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒ State Plane 279,359 N, 2,300,306 E S/C/N; NE 1/4 of SW 1/4 of Section 29, T 69 N, R 2 W	Lat ° ' " / Long ° ' "	Local Grid Location: ☐ N / Feet ☐ S; ☐ E / Feet ☐ W	
Facility ID:	County: Des Moines	Civil Town/City/ or Village: Burlington	

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–5	FILL, boring location was cleared to 5' bgs by hydrovac, then back filled.	FILL									
			5	SANDY SILT, olive brown (2.5Y 4/3).	MLS									
S1	14	22 12 13 15	6							W				
S2	18	2 2 4 8	8.5							W				
S3	18	1 2 2 50	11							W				
S4	14	3 15 50	13.5							W				

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

Signature	Firm	
[signature]	SCS Engineers, 2830 Dairy Drive Madison, WI 53718	Tel: 608-224-2830 Fax:

Boring Number MW-308

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				LEAN CLAY, black (2.5Y 2.5/1).	CL									
S5	12	6 4 2 4	16							W				
			17											
			18											
S6	12	5 6 5 10	19							W				
			20	SILT, very dark gray (7.5YR 3/1), trace sand.	ML									
S7	18	1 1 1 2	21							W				
			22											
			23	POORLY GRADED SAND, very dark gray (2.5Y 3/1), coarse grained.	SP									
S8	10	1 12 13 18	24							W				
			25											
S9	12	2 6 8 10	26							W				
			27											
			28											
S10		2 2 6 8	29							W				
				End of Boring at 29.5 ft bgs.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL- Burlington Generating Station SCS#: 25215135.80		MW-309

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Kevin Collins Direct Push Analytical	3/1/2016	3/1/2016	4-1/2 hollow stem auger

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-309	Feet	534.1 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 279,210 N, 2,300,022 E S/C/N
SW 1/4 of SW 1/4 of Section 29, T 69 N, R 2 W
Lat ___° ___' ___"
Long ___° ___' ___"
Local Grid Location ☐ N Feet ☐ S ☐ E Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Des Moines	Burlington

Sample: Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–10	FILL, boring location was cleared to 10' bgs by hydrovac, then back filled.	FILL									
			10	LEAN CLAY, olive brown (2.5Y 4/3).	CL									
S1	14		11							W				
			12	Same as above except, gray (2.5Y 6/1).										
S2	34		14							W				
			15											

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

Signature	Firm	
[signature]	SCS Engineers 2830 Dairy Drive Madison, WI 53718	Tel: 608-224-2830 Fax:

Boring Number MW-309

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
				LEAN CLAY, olive brown (2.5Y 4/3). *(continued)*										
			16	Same as above except, very dark gray (2.5Y 3/1).	CL									
			17											
S3	34		18							W				
			19	POORLY GRADED SAND, coarse grained, very dark gray (10YR 3/1).										
			20											
			21											
S4	31		22		SP					W				
			23											
			24											
			25	End of Boring at 25 feet bgs.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL- Burlington Generating Station SCS#: 25215135.80		MW-310

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Kevin Collins Direct Push Analytical	3/1/2016	3/1/2016	Direct Push 4-1/2/HSA

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-310	Feet	532.2 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 279,610 N, 2,298,832 E S/C/N
NE 1/4 of SE 1/4 of Section 30, T 69 N, R 2 W
Lat ___° ___' ___"
Long ___° ___' ___"
Local Grid Location: ☐ N Feet ☐ S ☐ E Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Des Moines	Burlington

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0	LEAN CLAY WITH SAND, dark olive brown (2.5Y 3/3).										
S1	13		2							M				
S2	33		6		CL					M				
			7	Same as above except, very dark gray (2.5Y 3/1).										
S3	22		10	Trace organics.						M				
			12	SILTY SAND, very dark grayish brown (2.5Y 3/2).	SM									
			13	POORLY GRADED SAND, coarse grained, very dark grayish brown (2.5Y 3/2).	SP									
S4	31		14							W				

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

Signature	Firm	
[signature]	SCS Engineers 2830 Dairy Drive Madison, WI 53718	Tel: 608-224-2830 Fax:

Boring Number **MW-310**

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
S5	35		15–19.5	POORLY GRADED SAND, coarse grained, very dark grayish brown (2.5Y 3/2). *(continued)*	SP					W				
			19.5–20	LEAN CLAY, dark gray (2.5Y 4/1).	CL									
S6	NA		20–22.5	POORLY GRADED SAND, very dark grayish brown (2.5Y 3/2).	SP					W				Sample stuck in discrete sampler. Refusal @24'.
			22.5–24	LEAN CLAY, dark gray (2.5Y 4/1), (weathered bedrock).	CL									
			24	End of Boring at 24 feet bgs.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL- Burlington Generating Station SCS#: 25215135.80		MW-311

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Kevin Collins Direct Push Analytical	3/1/2016	3/1/2016	Direct Push 4-1/2/HSA

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-311	Feet	532.7 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 279,439 N, 2,298,835 E S/C/N
NE 1/4 of SE 1/4 of Section 30, T 69 N, R 2 W
Lat ___° ___' ___"
Long ___° ___' ___"
Local Grid Location: ☐ N Feet ☐ S ☐ E Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Des Moines	Burlington

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0	TOPSOIL.	TOPSOIL									
				LEAN CLAY, dark olive brown (2.5Y 3/3).										
S1	14		2		CL					M				
			4	POORLY GRADED SAND, yellowish brown (10YR 5/8), coarse grained.										
S2	8		6		SP					M				
			8	LEAN CLAY, very dark gray (2.5Y 3/1).										
S3	6		10							M				Rock in shoe.
			11.5		CL									
S4	25		14							M				

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

Signature: [signature]

Firm: SCS Engineers
2830 Dairy Drive Madison, WI 53718
Tel: 608-224-2830
Fax:

Boring Number MW-311

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				LEAN CLAY, very dark gray (2.5Y 3/1). *(continued)*	CL									
S5	34		16–19	SILTY SAND, black (2.5Y 2.5/1).	SM					W				
			19–20	POORLY GRADED SAND, very dark grayish brown (2.5Y 3/2).	SP									
S6	40		20–23	SILTY SAND, very dark grayish brown (2.5Y 3/2).	SM					W				
			23–24	SILT, very dark grayish brown (2.5Y 3/2).	ML									
S7	45		24–28	LEAN CLAY, dark gray (2.5Y 4/1), laminated, organics.	CL					W				
			28–29	POORLY GRADED SAND, very dark grayish brown (2.5Y 3/2).	SP									
S8			29–32	LEAN CLAY, dark gray (2.5Y 4/1), laminated, organics. Same as above except, dark greenish gray (5GY 4/1), shells.	CL					W				
			32	End of Boring at 32 feet bgs.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name		License/Permit/Monitoring Number	Boring Number
IP&L - Burlington Generating Station SCS#: 25218220.00			MW313

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jeff Roberts Environmental Drilling	5/21/2019	5/21/2019	4.25" HSA

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW313	Feet	Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☐
State Plane N, E S/C/N
SE 1/4 of SW 1/4 of Section 29, T 69 N, R 2

Lat ___° ___' ___"
Long ___° ___' ___"

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

Facility ID	County	Civil Town/City/ or Village
	Des Moines	Burlington

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–8	Hydrovaced to 8'.										
			8	LEAN CLAY, (GLEY1 4/10Y), trace coarse sand.	CL									
	8	3 1 4 5	9							M				
	8	1 1 3 4	11							M				
			12	Trace organic material										
	8	1 1 2 2	13							M				
			15											

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

Signature	Firm	
[signature]	SCS Engineers 3900 kilroy Airport Way Long Beach, CA 90806	Tel: Fax:

Boring Number MW313

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
	12	1 1 2 2		LEAN CLAY, (GLEY1 4/10Y), trace coarse sand. *(continued)*						M				
			16	Same as above but dark gray, (10YR 2/1).										
		1 1 2 2	17							M				
			18											
		1 1 2 2	19							M				
			20											
	18	1 1 3 4	21		CL					M				
			22											
	24	3 2 3 4	23							M				
			24	Small sand lenses.										
	18	1 1 2 8	25							M				
			26	POORLY GRADED SAND, coarse.										
	4		27							W				
			28											
	10	3 2 4 6	29		SP					W				
			30											
	0	1 3 8 7	31							W				
			32	End of Boring at 32 feet.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IP&L - Burlington Generating Station SCS#: 25218220.00		MW312

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jeff Roberts Environmental Drilling	5/20/2019	5/20/2019	4.25" HSA

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW312	Feet	Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☐
State Plane N, E S/C/N
SE 1/4 of SW 1/4 of Section 29, T 69 N, R 2

Lat ° ' "
Long ° ' "

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

Facility ID	County	Civil Town/City/ or Village
	Des Moines	Burlington

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0	Hydrovaced to 8'.										
	4	3 3 6 7	8–10	LEAN CLAY, teal/blue, (GLEY1 5/10 GY), trace coarse sand.	CL					M				
	18	3 4 5 7	10–12	same as above but dark green, (GLEY1 3/10 GY), with gravel.	CL					M				
	10	1 2 5 8	12–14	trace organic material	CL					M				
			14–15	same as above but dark green, (10YR 2/1).	CL									

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

Signature	Firm	
[signature]	SCS Engineers 3900 kilroy Airport Way Long Beach, CA 90806	Tel: Fax:

Boring Number MW312

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
	24	1 4 5 6		LEAN CLAY, teal/blue, (GLEY1 5/10 GY), trace coarse sand. *(continued)*	CL					M				
			16											
			17							M				
			18											
		2 3 3 4	19							M				
			20	POORLY GRADED SAND, fine to coarse, (2.5YR 3/2).	SP									
	6	0 1 2 3	21							W				
			22											
	6	1 2 4 5	23							W				
			24											
	4		25							W				
			26	End of Boring at 26 feet.										

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Burlington Generating Station SCS#: 25220055.00		MW-302A

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jeff Crank Roberts Environmental Services	6/30/2020	7/1/2020	4.25" HSA

WI Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			11.92 Feet	533.51 Feet MSL	8.0 in.

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 278,310 N, 2,300,647 E S/C/N
SE 1/4 of SW 1/4 of Section 29, T 69 N, R 2 W

Lat ___° ___' ___"
Long ___° ___' ___"

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

Facility ID	County	County Code	Civil Town/City/ or Village
	Des Moines		Burlington

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
	0		0–15	Blind drilled to 28' bgs See boring logs for MW-302 for log information from 0-25'bgs.										

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

Signature	Firm	
	SCS Engineers	Tel: Fax:

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

SOIL BORING LOG INFORMATION SUPPLEMENT

Form 4400-122A

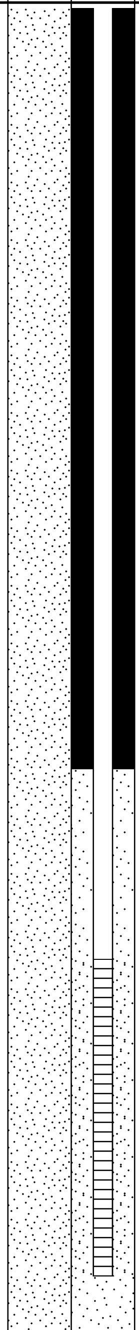
Boring Number MW-302A Use only as an attachment to Form 4400-122.

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			16–24											
S1	14	3 4 7 8	25–27	POORLY GRADED SAND, mostly fine to meium grain, trace coarse grain, gray to dark gray (5y, 4/1) , with clay lense at top of spoon. olive gray, dense.	SP					W				
S2	3	0 2 4 5	30–32	Same, fine grain, trace coarse grain with large piece of limestone.						W				Roberts began using water to keep sand from backing up into augers. Took two jar samples from 25-27' bgs.
S3	0	6 8 7 8	35–37	No returns						W				
			38–40											

SOIL BORING LOG INFORMATION SUPPLEMENT

Form 4400-122A

Boring Number MW-302A Use only as an attachment to Form 4400-122.



Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
S4	6	5 7 8 13	41	POORLY GRADED SAND, fine to coarse grain, with gravel, gray to dark gray (5y, 3/1), with very trace silt (same color).						W				
			42											
			43											
			44											
			45	No returns										
S5	0	4 12 16 14	46							W				Roberts changed spoon catch.
			47											
			48											
			49											
			50	POORLY GRADED SAND, fine to coarse grain, trace gravel, gray to darkish gray brown, 5y, 4/1).	SP									
S6	15	3 8 12 14	51							W				
			52											
			53											
			54											
			55	Same										
S7	14	3 6 12 18	56							W				Took two jar samples from 55-57' bgs.
			57											
			58											
			59											
			60	Same										
S8	24	6 9 13 25	61	End of Boring at 61' below ground surface. Well placed at 60' bgs.						W				Sampled to 62' bgs and augered to 61' bgs.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

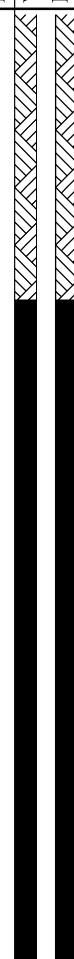
Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Burlington Generating Station SCS#: 25220055.00		MW-307A

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jeff Crank Roberts Environmental Services	6/24/2020	7/1/2020	4.25" HSA

WI Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			12.09 Feet	533.94 Feet MSL	8.0 in.

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 279,517 N, 2,300,349 E S/C/N
NE 1/4 of SW 1/4 of Section 29, T 69 N, R 2 W
Lat ___° ___' ______"
Long ___° ___' ______"
Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
	Des Moines		Burlington

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
	0		0–15	Blind drilled to 20' bgs See boring logs for MW-307 for log information from 0-20'bgs.										

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

Signature	Firm	
[signature]	SCS Engineers	Tel: Fax:

SOIL BORING LOG INFORMATION SUPPLEMENT

Form 4400-122A

Boring Number MW-307A Use only as an attachment to Form 4400-122.

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			16											
			17											
			18											
			19											
			20	SILT, dark gray (2.5y, 2.5/1), with trace sand, fine grain to cousrse.	ML									
S1	19	3 1 0 9	21						0.75	W				Took two jar samples at 20-22' bgs.
			22											
			23											
			24											
			25	Same										
				POORLY GRADED SAND, fine to medium grain, trace coarse grain, dark gray (2.5y, 2.5/1).	SP									
S2	14	5 7 9 11	26							W				Roberts began pumping water down hole to keep sand out of augers.
			27											
			28											
			29											
			30	Same, trace silt.										
S3	8	3 6 7 7	31							W				
			32											
			33											
			34											
			35	Same, fine to medium grain, grayish brown (2.5y, 3/1), trace pieces of gravel, no silt.										
S4	8	3 5 7 8	36							W				
			37											
			38											
			39											
			40											

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A

Boring Number MW-307A Use only as an attachment to Form 4400-122.

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
S5	22	2 3 6 6	41	POORLY GRADED SAND, fine to medium grain, gray (2.5y, 4/1), trace gravel with 6" layer of sticks in middle of spoon.						W				Large amount of sticks in center of spoon.
			42											
			43											
			44											
			45	Same, fine to coarse grain, trace gravel, gray to grayish brown (2.5y, 4/1) with trace sticks.										
S6	20	4 6 11 12	46							W				
			47											
			48											
			49											
			50	Same, no sticks.	SP									
S7	0.5	4 26 16	51							W				Refusal last 6 inches, sand pushed up into augers and locked up spoon.
			52											
			53											
			54											
			55	Same, fine to medium grain, gray to grayish brown (2.5y, 4/1).										
S8	20	4 9 14 19	56							W				Took two jar samples from 55-57' bgs.
			57											
			58											
			59											
			60	End of boring ar 60' below ground surface. Set well from 59' bgs.										

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION
Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Burlington Generating Station SCS#: 25220055.00		MW-310A

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jeff Crank Roberts Environmental Services	6/25/2020	6/26/2020	4.25" HSA

WI Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			9.15 Feet	532.91 Feet MSL	8.0 in.

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 279,610 N, 2,298,832 E S/C/N
NE 1/4 of SE 1/4 of Section 30, T 69 N, R 2 W
Lat ___° ___' ___"
Long ___° ___' ___"
Local Grid Location: Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
	Des Moines		Burlington

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–15	Blind drilled to 20' below ground surface. See logs for MW-310 for log information between 0-20' bgs.										

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

Signature	Firm	
[signature]	SCS Engineers	Tel: Fax:

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A

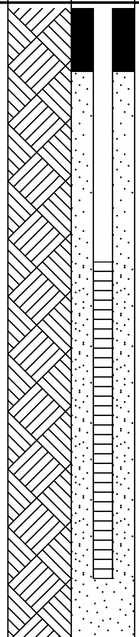
Boring Number MW-310A Use only as an attachment to Form 4400-122.

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			16–19											
S1		0 0 0 0	20	LEAN CLAY, gray (5Y 3/2), dense with trace sand and gravel.	CL									Took three jar samples from 20-24' bgs.
S2		4 7 11 9	22	POORLY GRADED SAND, fine to medium grained, grayish brown.	SP									
S3			25	MUDSTONE (bedrock), 0.25" size pieces and smaller of rock (silt grain size, when broken up), light gray to gray, slightly reactive with acid, with poorly graded sand (overburden), coarse grained, grayish brown.										Bedrock at 25' bgs. Switched to air rotary at 25' bgs.
S4			30	MUDSTONE, gray (bedrock). (Feels like clay once broken up) with much less sand.										
S5			35	Same, trace sand, sampled intermittently between 35-40' bgs.										
			40											

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A

Boring Number MW-310A Use only as an attachment to Form 4400-122.

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
	S6		41, 42, 43, 44	MUDSTONE, mostly mudstone with some poorly graded sand.										
	S7		45, 46, 47, 48, 49, 50	Same, mostly mudstone with more sand and pieces of lean clay, dark gray (most likely overburden).										
	S8			End of Boring at 50' below ground surface. Set well at 49' bgs.										Took two jar samples from 47' bgs.



State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Burlington Generating Station SCS#: 25220055.00		MW-313A

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jeff Crank Roberts Environmental Services	6/23/2020	6/30/2020	4.25" HSA

WI Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			12.13 Feet	529.35 Feet MSL	8.0 in.

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 279,130 N, 2,300,907 E S/C/N
SE 1/4 of SW 1/4 of Section 29, T 69 N, R 2 W

Lat ___° ___' ___"
Long ___° ___' ___"

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

Facility ID	County	County Code	Civil Town/City/ or Village
	Des Moines		Burlington

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–15	Blind drilled to 28' below ground surface. See logs for MW-313 for log information between 0-28' bgs.										

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

Signature	Firm
(signature)	SCS Engineers Tel: Fax:

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

SOIL BORING LOG INFORMATION SUPPLEMENT

Form 4400-122A

Boring Number MW-313A Use only as an attachment to Form 4400-122.

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			16											
			17											
			18											
			19											
			20											
			21											
			22											
			23											
			24											
			25											
			26											
			27											
			28	POORLY GRADED SAND, fine to medium grain, grayish brown.										
S1/S2	12	2 2 6 8	29							W				Took two jar samples from 28-30' bgs. Roberts began pumping water into augers to keep sand from backing up into augers.
			30	Same										
S3	12	5 8 11 12	31							W				
			32	Same, fine to coarse grain, grayish brown, trace gravel and clay.										
S4	14	3 4 5 5	33							W				
			34	Same	SP									
S5	5	1 3 5 6	35							W				Switched to 2' sample every five feet.
			36											
			37											
			38											
			39											
			40											

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A

Boring Number MW-313A Use only as an attachment to Form 4400-122.

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Sample: Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
S6	10	1 6 7 9	41	POORLY GRADED SAND, fine to mostly coarse grain, trace gravel, grayish brown.						W				
			42											
			43											
			44											
S7	12	3 3 8 11	45–46	Same, fine to medium grain, trace coarse grain.						W				
			47											
			48											
			49											
S8	15	3 8 21 15	50–51	Same, fine to coarse grain.	SP					W				
			52											
			53											
			54											
S9	18	1 1 0 1	55–56	Same, mostly fine to medium grain with trace coarse grain and gravel, grayish brown.						W				
			57											
			58											
			59											
S10	16	3 3 6 9	60–61	Same fine to coarse grain, grayish brown.						W				Took two jar samples from 55-57' bgs and 60-62' bgs and combined them
			62	End of boring at 62' below ground surface. Set well at 61' bgs.										

Appendix C

Hydrogeochemical Conceptual Model and Preliminary Summary of Groundwater Contaminant Attenuation

ReSolution Partners, LLC

Subject:	Hydrogeochemical conceptual model and potential remedial actions for groundwater.
From:	Bernd W. Rehm — Date: 22 November 2020
Project:	SCS – Alliant Burlington GS CCR Evaluations — 158-002c

This document provides an update of the Burlington GS site geochemistry. The hydrogeological discussion is unchanged from the September 2020 evaluation.

Hydrogeology

Beneath much of the site on the order of 25 feet of lean clay and silt overlies more than 40 feet of poorly-graded sand with occasional lenses of silt and/or clay. To the west (upgradient) edge of the site, the sand is on the order of 10 feet thick at MW-310 and missing completely at MW-11. Mudstone was encountered at a depth of about 24 feet at MW-310. Bedrock was not encountered by other borings that were on the order of 60 feet deep. The poorly-graded sands form a confined aquifer between the lean clay and the bedrock (mudstone). The Mississippi River bounds the east edge of the site. The depth of the river is unknown, but the confined aquifer is likely in contact with the river.

All the monitoring wells but MW-311 are completed as piezometers within the confined sand aquifer. There are no water table observations.

The potentiometric surface defined by the piezometers at the top of the confined aquifer varies from 531 to 524 feet near the river, to 528 to 524 at the upgradient location MW-310. The variation in elevation is probably the result of changes in Mississippi River stage, which is not known for the period of groundwater observation. During a period of low potentiometric surface (September 2020), groundwater flows from west to east under a low gradient on the order of 0.0006. Such a low gradient suggests the poorly-graded sand has a very high hydraulic conductivity. A time of high potentiometric surface suggests a high area beneath the Economizer Pond and Ash Berm and Upper Ash Ponds with radial flow to the east, south and southeast.

Four piezometers were placed at depths of about 60 feet below ground surface in June 2020. Three of the four piezometers that remained in the confined sand aquifer had vertical downward gradients of 0.002 to 0.01 in September and October 2020. The strongest downward gradient was observed at MW-207/-307A adjacent to the Economizer Pond and Ash Berm. The vertical gradients are on the order of 3 to 16 times greater than the horizontal gradient observed in September 2020. The fourth piezometer pair, MW-310/-310A, were completed in the confined sand aquifer and the underlying aquitard.

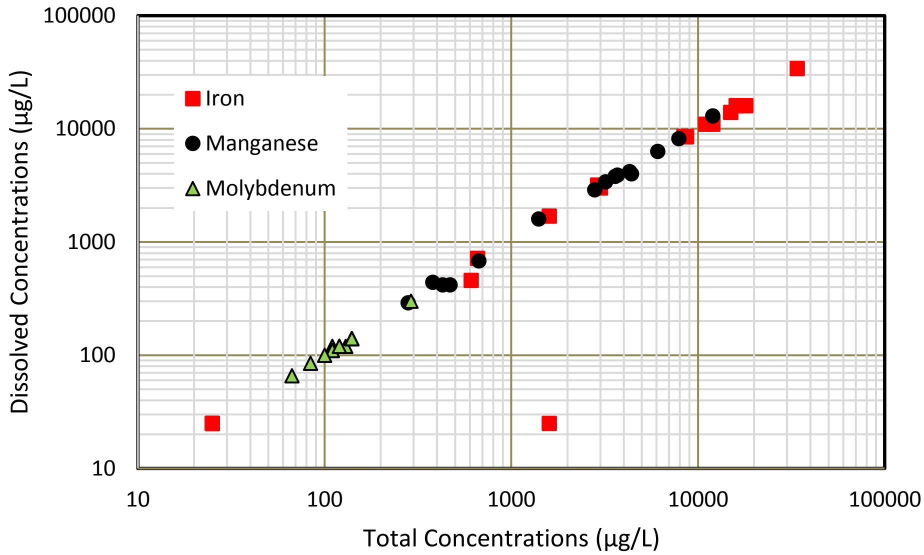
Groundwater Chemistry

Groundwater samples collected in 2019 and 2020 that include both field parameters and laboratory results were reviewed (Table 1). Major cation and trace element results were typically analyzed as total concentrations; the dissolved fraction plus constituents that are part of, or adsorbed to, suspended sediment and may not represent the mobile constituent concentrations. In most cases, suspended sediment loads were relatively low, ranging from 0 to 51 NTU as measured by turbidity. MW-310A was sampled with a bailer and had a turbidity of 710 NTU. These results are especially suspect. The October 2020 sampling event included analysis of dissolved lithium and molybdenum. Dissolved and total iron and manganese were also measured to evaluate the degree to which iron or manganese oxyhydroxides may be adsorbing molybdenum.

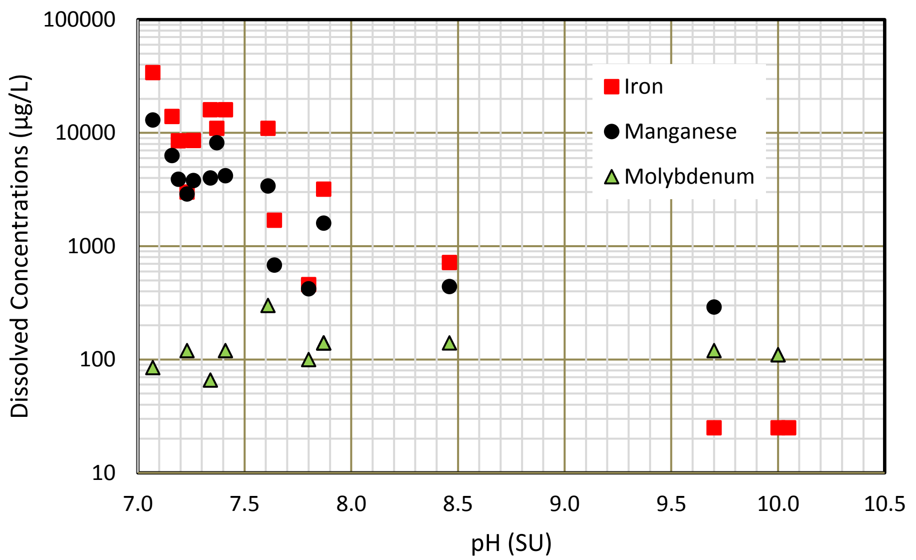
The March 2019 dissolved oxygen (DO) results for MW-301 through -308 appear to be anomalously high and were not used in the evaluation. The oxidation-reduction potential (ORP) is a key parameter controlling the fate of metals and metalloids in groundwater. The ORP was measured in most wells in June and October of 2020. However, for 13 wells the results were approximately 250 to 350 mV lower in October. Three monitoring wells sampled in September 2020 were reported with low ORPs comparable to the October results, suggesting that the low ORP values may be correct. However, most wells showed unchanged or increasing sulfate concentrations, which are not consistent with decreasing ORP values reported as low as -280 mV. It is highly unlikely that the entire aquifer would become reducing in just four months. These inconsistencies make all ORP results suspect pending future sampling and analyses.

Comparison of the total and dissolved concentrations for iron, manganese and molybdenum find the two concentrations equal, indicating that all three elements are present only in dissolved forms defined by the 0.45 µm filtration.

967 Jonathon Drive • Madison, WI • 53713



Plotting these three elements as a function of pH shows a strong negative correlation between pH and the iron and manganese concentration. This reflects the formation and precipitation of iron and manganese oxyhydroxides.



The molybdenum concentration remains constant over pH and as the oxyhydroxides form. This indicates that molybdenum is not being adsorbed by the oxyhydroxides.

Inspection of Table 1 shows that lithium, as expected, is present only in the dissolved form.

The groundwater chemistry in the confined aquifer may reflect contributions from one or more of the Upper Ash Pond, Main Ash Pond, Economizer Pond, Economizer Ash Berm

967 Jonathon Drive · Madison, WI · 53713

and the Coal Pile when compared to the upgradient groundwater chemistry as described in the following paragraphs.

- Upgradient groundwater. The confined aquifer (MW-310) had a near-neutral pH (~7.5 SU) and was suboxic (DO ~0.5 mg/L). Dissolved solids as estimated by specific electrical conductance are relatively low at 900 µS/cm. Lithium and molybdenum are the most reported potential CCR constituents commonly found beneath the facility with concentrations of <2.7 and 4.9 µg/L, respectively, at the upgradient location MW-310. The most recent October 2020 results are comparable to the April 2019 and June 2020 results. The sulfate concentration is variable and averaged 47 mg/L.

  MW-310A is completed in the mudstone below the confined aquifer. MW-311 is nominally upgradient, but its completion in mudstone make its applicability for defining background chemistry for the confined sand aquifer uncertain.

- Economizer Pond and Ash Berm. For most monitoring wells at the top of the confined aquifer the pH and DO are comparable to MW-310. Wells MW-306, -307 and -308 often show pH near or greater than 10 SU. October 2020 lithium and molybdenum concentrations are comparable to earlier results and are elevated above the upgradient concentrations (typically on the order of 40 to 50 µg/L and 80 to 150 µg/L, respectively). Sulfate concentrations range from 70 to 190 mg/L.

  MW-309 is an exception with 2.4 µg/L of lithium, comparable to background. Groundwater flow at this location is not consistently from the Economizer Pond and Ash Berm. MW-313 is an exception with 205 mg/L of sulfate. The high sulfate concentrations approach that of MW-312 located downgradient of the Coal Pile.

  The deeper piezometers (MW-307A and -313A) had comparable molybdenum concentrations but lower lithium than the shallower piezometers. Sulfate at MW-313A was high at 200 mg/L, comparable to MW-313 which is downgradient of the coal pile.

- Ash Seal Pond. Shallow monitoring wells MW-302, -303 and -304 have elevated lithium (36 to 92 µg/L) and molybdenum (45 to 140 µg/L). The deeper piezometer (MW-302A) has comparable molybdenum concentrations but lower

967 Jonathon Drive · Madison, WI · 53713

lithium than the shallower piezometers. Sulfate concentrations are the highest on the site averaging as high as 490 mg/L among the shallow wells and averaging 340 mg/L at depth.

- Upper Ash Pond. MW-305 has slightly elevated lithium concentrations and no detectable molybdenum. Sulfate was also low. The results are comparable to upgradient concentrations.

- Main Ash Pond. MW-301 is downgradient of this pond with mean concentrations of 16 µg/L lithium and 89 µg/L molybdenum. Sulfate concentrations average 250 mg/L.

- Coal Pile and Economizer Pond and Ash Berm. MW-312 has the highest molybdenum concentrations on the site (~300 µg/L), low lithium (25 µg/L) and high sulfate (220 mg/L). This may reflect molybdenum contributions from coal pile leaching.

Overall, the data suggest that lithium and molybdenum have likely been released from one of more sources to the confined sand aquifer beneath the site.

Except as noted below, the following table provides a summary of lithium and molybdenum concentrations below the BGS. Molybdenum are comparable in the shallow and deep aquifers indicating vertical downward gradients within the aquifer have carried molybdenum to depths as much as 60 feet below ground surface. The total depth of molybdenum migration is not known. Lithium concentrations decrease significantly suggesting that some form of attenuation may be present in the upper portions of the confined aquifer.

	Shallow Piezometers		Deep Piezometers	
	Li	Mo	Li	Mo
	µg/L			
Mean	43	99	11	117
Median	48	100	11	120
Std Dev	16	28	3	5
Minimum	10	45	7	110
Maximum	92	140	13	120
Observations	37	33	6	6

The exceptions not included in the statistical summary include:

- MW-305 with low molybdenum concentrations (mean of 1.1 µg/L),
- MW-309 with low lithium concentrations (mean of 2.4 µg/L) and
- MW-312 with high molybdenum concentrations (mean of 295 µg/L).

Masses of 27 and 81 kg of lithium and molybdenum, respectively, dissolved in the groundwater beneath the BGS are estimated assuming:

- approximate plume volume of 2,240,000 m^3 assuming an area of ~159,000 m^2 and thickness of 5 to 20 m,
- total porosity of 0.3 and
- concentrations of 40 and 120 µg/L of lithium and molybdenum, respectively.

Recommendations for Additional Assessment of Site-Specific Monitored Natural Attenuation

The decrease in lithium concentration with depth suggests that natural attenuation may be sequestering lithium. To further evaluate this potential, samples of confined aquifer sand from boring depths where lithium was not detected, or was detected at low concentrations, in monitoring wells screened near those same depths, (e.g. MW-307A or -309) could be subjected to laboratory determination of lithium adsorption capacity.

Given the lack of suspended sediment and equivalence of dissolved and total trace metal concentrations, future sampling and analysis could omit collection and analysis of dissolved concentrations.

Future in-field analyses should pay special attention to the measurement of ORP to resolve the large differences between the June and October 2020 results.

ReSolution Partners, LLC

Table 1. Groundwater chemistry used in the evaluation of the Burlington GS.

			pH	SEC	T	DO	ORP	Turbidity	GW Eleva	Li-T	Li-D	Mo-T	Mo-D	Sulfate
			SU	µS/cm	°C	mg/L	mV	NTU	Ft	µg/L		µ/L		mg/L
Upgradient	MW-310	4/4/2019	7.84	1034	10.8	1.1	---	17	528.62	<2.7	---	5.2	---	21
		6/2/2020	7.30	881	12.8	0.1	**39**	18	525.36	<2.3	---	5.8	---	100
		10/14/2020	7.34	771	16.4	0.1	**-220**	4	523.81	<2.5	---	3.6	---	19
		Mean	7.49	895	13.3	0.5	**???**	13		<2.7	---	4.9	---	47
	MW-310A	9/9/2020	7.33	1026	14.2	4.7	145	714	509.16	32	---	19	---	100
		10/16/2020	---	---	---	---	---	---	489.84	36	---	33	---	130
		Mean	7.33	1026	14.2	4.7	???	714		34	---	26	---	115
	MW-311	4/4/2019	7.64	1422	11.4	0.8	**146**	11	528.20	<2.7	---	8.5	---	230
		6/2/2020	7.10	1464	12.3	0.2	**---**	18	524.05	<2.3	---	11	---	220
		10/14/2020	7.41	1041	14.5	0.1	**-194**	2	520.59	<2.5	---	23	---	110
		Mean	7.38	1309	12.7	0.3	**???**	10		<2.7	---	14	---	187
Main Ash Pond	MW-301	3/12/2019	6.38	1055	12.6	2.6	---	17	523.38	---	---	**63**	---	---
		4/3/2019	7.53	1213	12.4	0.6	---	21	528.15	**13**	---	**77**	---	190
		10/10/2019	6.85	1063	13.9	0.2	---	13	5.26.8	**26**	---	**130**	---	390
		6/3/2020	6.99	1167	13.4	0.3	**37**	20	523.94	**16**	---	**110**	---	250
		10/16/2020	7.07	1503	13.7	0.1	**-187**	3	519.26	**10**	---	**67**	**66**	170
		Mean	6.96	1200	13.2	0.3	**???**	15		**16**	---	**89**	---	250

967 Jonathon Drive • Madison, WI • 53713

ReSolution Partners, LLC

			pH	SEC	T	DO	ORP	Turbidity	GW Eleva	Li-T	Li-D	Mo-T	Mo-D	Sulfate
			SU	µS/cm	^{0}C	mg/L	mV	NTU	Ft	µg/L		µg/L		mg/L
Ash Seal Pond	MW-302	3/12/2019	6.94	792	12.2	2.7	---	22	522.83	**60**	---	**123**	---	---
		4/3/2019	8.70	1164	11.4	0.6	---	19	528.21	**56**	---	**100**	---	510
		10/10/2019	7.49	1249	14.5	0.3	---	1	526.88	**57**	---	**100**	---	510
		6/3/2020	7.88	1245	12.9	0.2	**37**	25	523.98	**55**	---	**140**	---	490
		10/16/2020	7.87	1168	12.9	0.1	**-240**	0	518.94	**64**	**64**	**130**	**120**	460
		Mean	7.78	1124	12.8	0.3	**???**	13		**58**	---	**119**	---	493
	MW-302A	9/9/2020	7.31	1013	13.3	0.3	-142	0	519.71	**11**	---	**120**	---	340
		10/16/2020	7.26	951	13.1	0.2	-180	4	518.79	**11**	---	**110**	**120**	330
		Mean	7.29	982	13.2	0.2	-161	2		**11**	---	**115**	---	335
	MW-303	3/12/2019	6.46	549	13.6	2.4	---	19	522.74	**52**	---	---	---	---
		4/3/2019	7.79	711	12.6	0.7	---	18	528.22	**52**	---	**110**	---	120
		10/10/2019	7.13	767	14.9	0.3	---	5	526.87	**46**	---	**76**	---	84
		6/3/2020	7.12	934	14.8	0.2	**58**	16	523.97	**48**	---	**66**	---	100
		10/16/2020	7.19	902	13.7	0.1	**-190**	2	518.78	**59**	**59**	**84**	**85**	190
		Mean	7.14	773	13.9	0.3	**???**	12		**51**	---	**84**	---	124
	MW-304	3/12/2019	6.94	460	13.9	2.1	---	9	522.80	**36**	---	**47**	---	---
		4/3/2019	8.56	658	13.0	0.4	---	6	528.27	**52**	---	**58**	---	140
		10/10/2019	7.17	934	15.6	0.3	---	1	526.97	**38**	---	**47**	---	220
		6/3/2020	7.23	1087	14.6	0.2	**52**	18	524.02	**47**	---	**45**	---	250
		10/15/2020	8.46	1060	14.7	0.1	**-280**	0	518.69	**92**	**93**	**140**	**140**	420
		Mean	7.67	840	14.4	0.2	**???**	7		**43**	---	**67**	---	**258**
Upper Ash Pond	MW-305	4/3/2019	7.80	733	14.5	0.6	---	4	528.36	**26**	---	<1.1	---	10
		6/3/2020	7.12	972	15.9	0.1	**40**	13	524.12	**28**	---	<1.1	---	33
		10/15/2020	7.23	987	14.6	0.4	**-175**	0	519.00	**34**	---	1.1	---	54
		Mean	7.38	897	15.0	0.4	**???**	6		**27**	---	1.1	---	22

967 Jonathon Drive • Madison, WI • 53713

			pH	SEC	T	DO	ORP	Turbidity	GW Eleva	Li-T	Li-D	Mo-T	Mo-D	Sulfate
			SU	µS/cm	^{0}C	mg/L	mV	NTU	Ft	µg/L		µg/L		mg/L
Economizer Pond and Ash Berm	MW-306	3/11/2019	6.27	343	14.3	0.8	---	1	523.21	**39**	---	---	---	---
		4/3/2019	6.69	4711	13.4	0.7	---	1	528.40	**45**	---	**78**	---	110
		6/4/2020	10.48	482	14.4	0.2	**59**	16	524.45	**43**	---	**86**	---	120
		10/15/2020	10.00	454	14.1	0.1	**-237**	0	519.05	**42**	**42**	**82**	---	71
		Mean	8.36	1498	14.1	0.4	**???**	4		**42**	---	**82**	---	100
	MW-307	3/11/2019	9.71	367	14.4	1.1	---	1	523.49	**51**	---	**156**	---	---
		4/3/2019	10.39	500	13.6	0.7	---	3	528.63	**50**	---	**100**	---	120
		6/4/2020	10.03	586	14.8	0.3	**60**	14	524.62	**48**	---	**130**	---	180
		10/15/2020	10.05	565	14.0	0.1	**-270**	0	519.33	**51**	**50**	**140**	**140**	160
		Mean	10.05	505	14.2	0.4	**???**	5		**50**	---	**132**	---	153
	MW-307A	9/9/2020	7.83	585	14.4	0.2	-154	0	519.97	6.8	---	**110**	---	110
		10/14/2020	7.80	554	14.6	0.2	-190	3	519.00	8.3	---	**120**	**120**	110
		Mean	7.82	570	14.5	0.2	-172	2		**8**	---	**115**	---	110
	MW-308	3/12/2019	7.72	500	14.1	2.6	---	2	523.13	**49**	---	**135**	---	---
		4/3/2019	9.97	681	14.0	1.2	---	2	528.39	**50**	---	**110**	---	170
		10/10/2019	9.42	671	14.6	0.2	---	3	527.08	**52**	---	**120**	---	160
		6/4/2020	9.65	713	15.4	0.2	**28**	13	524.10	**48**	---	**120**	---	190
		10/14/2020	9.70	682	14.7	0.1	**-265**	0	519.02	**51**	**53**	**110**	**110**	160
		Mean	9.29	649	14.6	0.4	**???**	4		**50**	---	**119**	---	170
	MW-309	4/4/2019	7.45	997	12.6	0.5	---	20	528.40	3.3	---	**47**	---	78
		10/11/2019	---	---	---	---	---	---		<5.4	---	**90**	---	160
		6/3/2020	7.09	1086	14.8	0.2	**37**	19	524.06	2.4	---	**87**	---	180
		10/14/2020	7.61	851	14.3	0.1	**-210**	19	519.28	<2.5	---	**100**	---	160
		Mean	7.38	978	13.9	0.3	**???**	19		2.4	---	**75**	---	139

ReSolution Partners, LLC

			pH	SEC	T	DO	ORP	Turbidity	GW Eleva	Li-T	Li-D	Mo-T	Mo-D	Sulfate
			SU	µS/cm	^{0}C	mg/L	mV	NTU	Ft	µg/L		µg/L		mg/L
	MW-313	6/6/2019	6.94	1059	14.9	0.1	---	7	531.01	**43**	---	**130**	---	210
		10/10/2019	7.06	1007	16.0	0.4	---	11	526.97	**62**	---	**110**	---	210
		6/3/2020	7.03	1099	17.2	0.3	**51**	51	524.02	**52**	---	**130**	---	230
		10/15/2020	7.16	999	15.3	0.1	**-180**	14	518.70	**51**	**53**	**100**	**100**	170
		Mean	7.05	1041	15.9	0.2	**???**	21		**52**	---	**118**	---	205
	MW-313A	9/9/2020	7.60	1243	15.3	0.2	-164	0	515.36	**13**	---	**120**	---	200
		10/15/2020	7.64	1133	14.8	0.1	-190	0	518.61	**13**	---	**120**	**120**	190
		Mean	7.62	1188	15.1	0.2	-177	0		**13**	---	**120**	---	195
Coal Pile	MW-312	6/6/2019	6.99	783	14.4	0.1	---	3	531.08	**24**	---	**290**	---	220
		10/10/2019	7.19	785	15.6	8.8	---	3	526.97	**27**	---	**280**	---	230
		6/3/2020	7.13	878	14.7	0.2	**53**	21	524.05	**22**	---	**320**	---	200
		10/15/2020	7.37	854	15.1	0.1	**-200**	0	518.68	**27**	---	**290**	**300**	210
		Mean	7.17	825	15.0	0.1	**???**	7		**25**	---	**295**	---	215

March 2019 DO appear anomalous and not included in means

Measurements in bucket poured from bailer not included in evaluation.

T- Total **12000** Concentrations exceed UPL (Background)

D- Dissolved **130** Concentration exceeds GPS

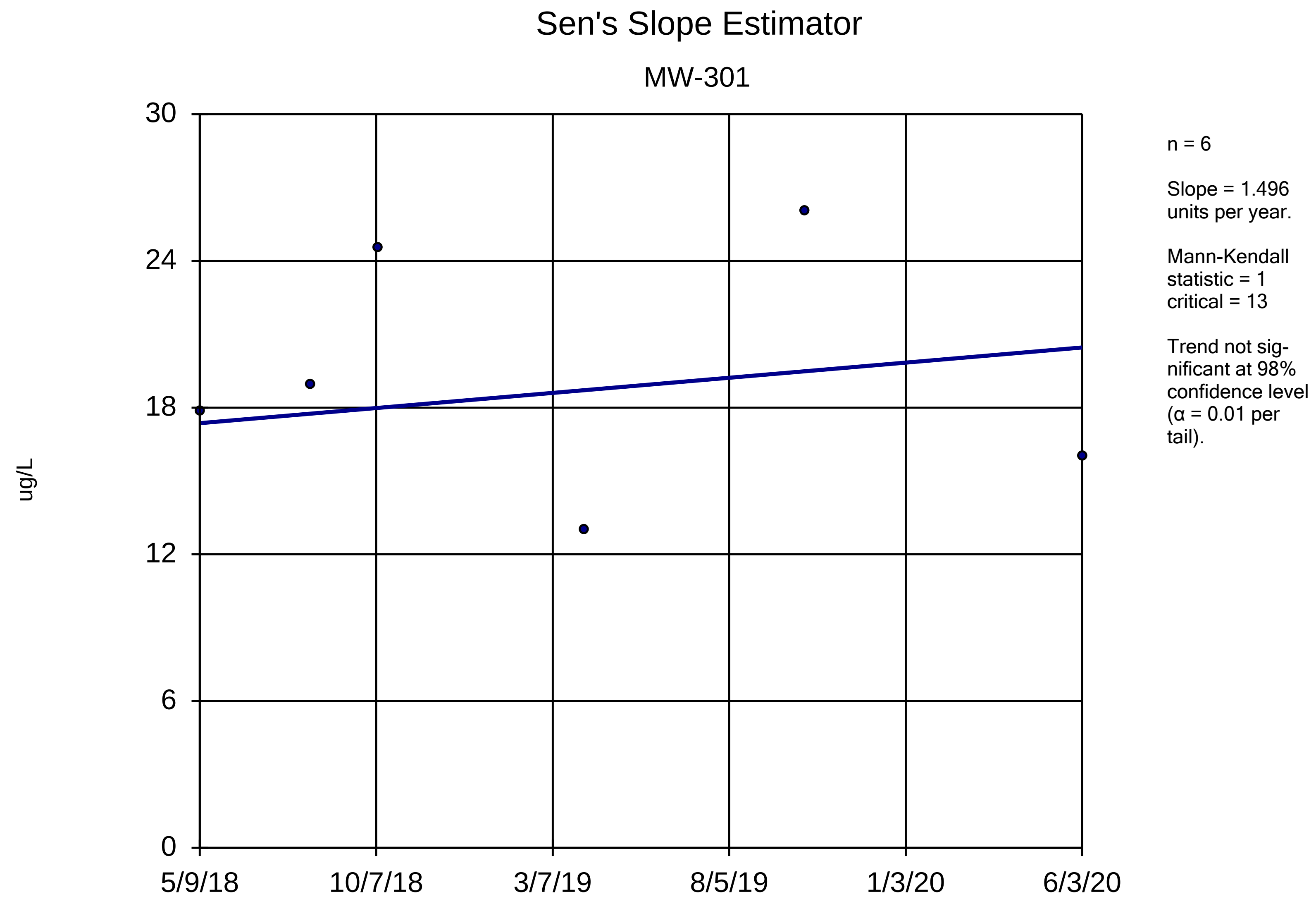
Appendix D

Mann-Kendall Trend Test

Trend Test

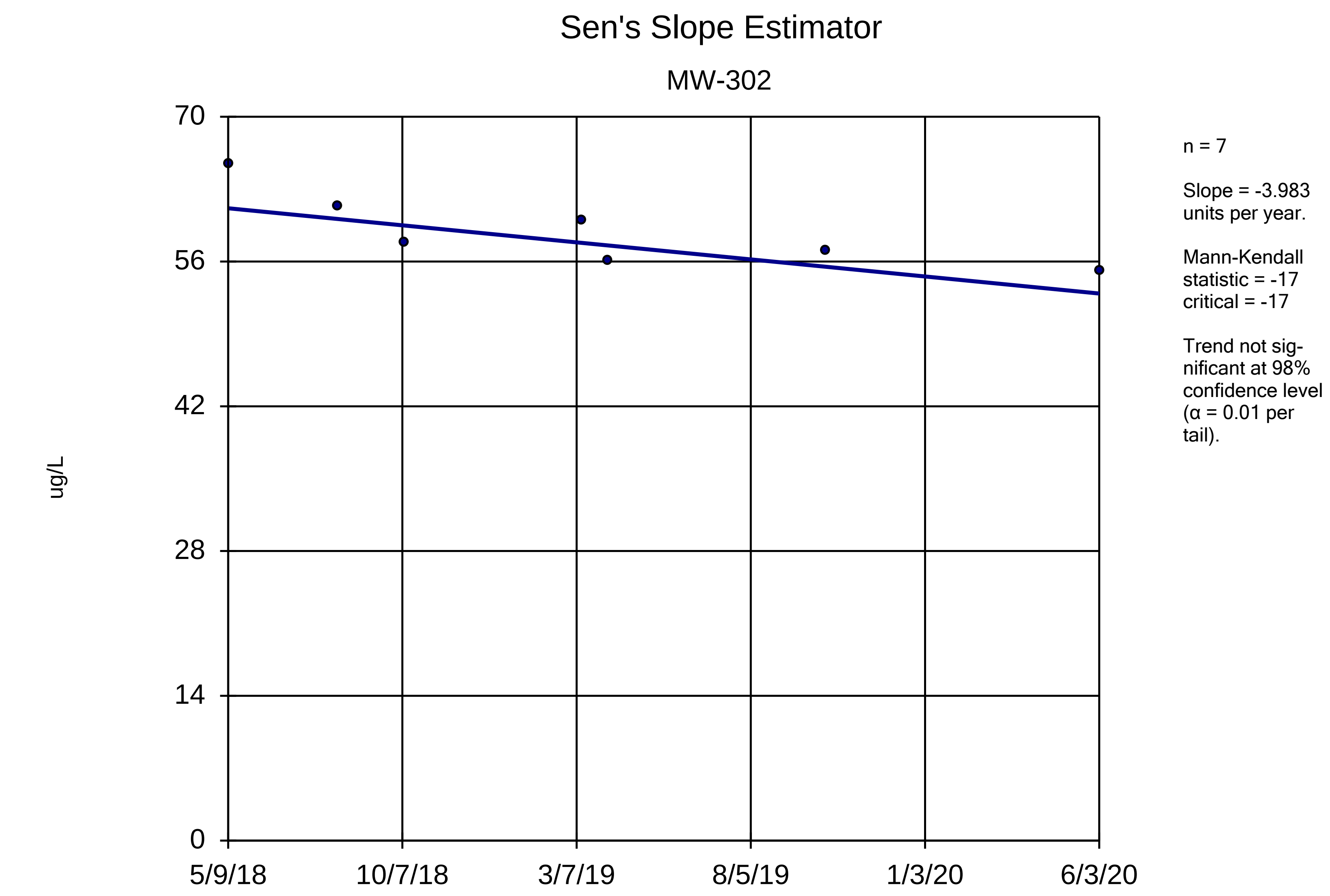
Burlington Generating Station   Client: SCS Engineers   Data: BGS_Export_201121_Rev   Printed 11/21/2020, 6:00 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Lithium (ug/L)	MW-301	1.496	1	13	No	6	0	n/a	n/a	0.02	NP
Lithium (ug/L)	MW-302	-3.983	-17	-17	No	7	0	n/a	n/a	0.02	NP
Lithium (ug/L)	MW-303	1.442	3	17	No	7	0	n/a	n/a	0.02	NP
Lithium (ug/L)	MW-304	-4.274	-1	-17	No	7	0	n/a	n/a	0.02	NP
Lithium (ug/L)	MW-305	-0.8548	-3	-13	No	6	0	n/a	n/a	0.02	NP
Lithium (ug/L)	MW-306	3.075	5	17	No	7	0	n/a	n/a	0.02	NP
Lithium (ug/L)	MW-307	-1.706	-2	-17	No	7	0	n/a	n/a	0.02	NP
Lithium (ug/L)	MW-308	2.663	4	17	No	7	0	n/a	n/a	0.02	NP
Lithium (ug/L)	MW-309	-0.7711	-4	-13	No	6	66.67	n/a	n/a	0.02	NP
Lithium (ug/L)	MW-310 (bg)	-1.397	-11	-13	No	6	83.33	n/a	n/a	0.02	NP
Lithium (ug/L)	MW-311 (bg)	-1.276	-11	-13	No	6	100	n/a	n/a	0.02	NP
Lithium (ug/L)	MW-312	-2.011	NaN	NaN	No	3	0	n/a	n/a	NaN	NP
Lithium (ug/L)	MW-313	9.05	NaN	NaN	No	3	0	n/a	n/a	NaN	NP
Molybdenum (ug/L)	MW-301	9.973	1	17	No	7	0	n/a	n/a	0.02	NP
Molybdenum (ug/L)	MW-302	3.46	4	17	No	7	0	n/a	n/a	0.02	NP
Molybdenum (ug/L)	MW-303	-1.639	-1	-13	No	6	0	n/a	n/a	0.02	NP
Molybdenum (ug/L)	MW-304	-30.81	-17	-17	No	7	0	n/a	n/a	0.02	NP
Molybdenum (ug/L)	MW-305	-0.2246	-10	-13	No	6	50	n/a	n/a	0.02	NP
Molybdenum (ug/L)	MW-306	0.6268	3	13	No	6	0	n/a	n/a	0.02	NP
Molybdenum (ug/L)	MW-307	-13.83	-6	-17	No	7	0	n/a	n/a	0.02	NP
Molybdenum (ug/L)	MW-308	-12.17	-11	-17	No	7	0	n/a	n/a	0.02	NP
Molybdenum (ug/L)	MW-309	21.02	9	13	No	6	0	n/a	n/a	0.02	NP
Molybdenum (ug/L)	MW-310 (bg)	1.103	11	13	No	6	0	n/a	n/a	0.02	NP
Molybdenum (ug/L)	MW-311 (bg)	-0.2897	-1	-13	No	6	0	n/a	n/a	0.02	NP
Molybdenum (ug/L)	MW-312	30.17	NaN	NaN	No	3	0	n/a	n/a	NaN	NP
Molybdenum (ug/L)	MW-313	0	NaN	NaN	No	3	0	n/a	n/a	NaN	NP



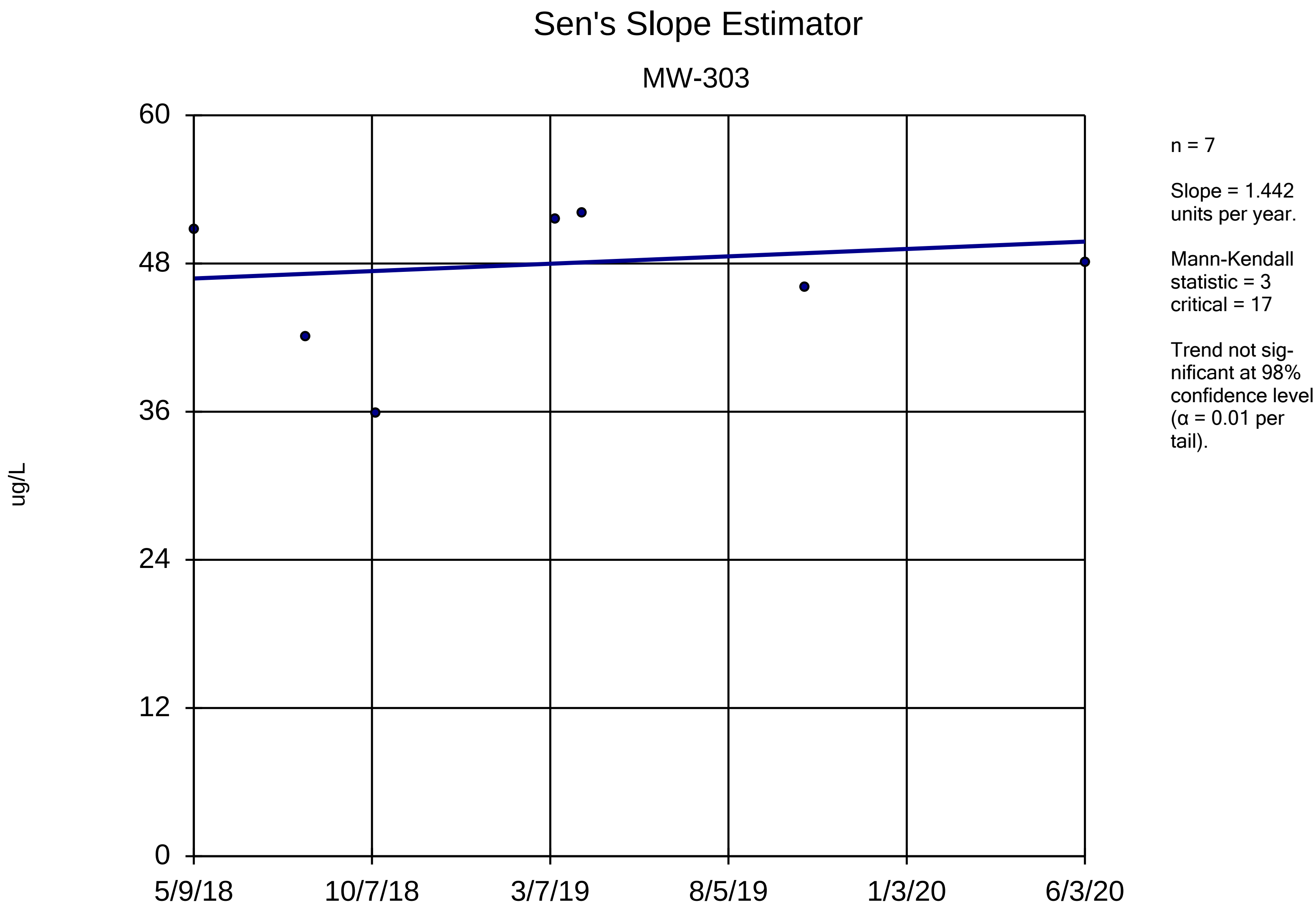
Constituent: Lithium   Analysis Run 11/21/2020 5:57 PM

Burlington Generating Station   Client: SCS Engineers   Data: BGS_Export_201121_Rev



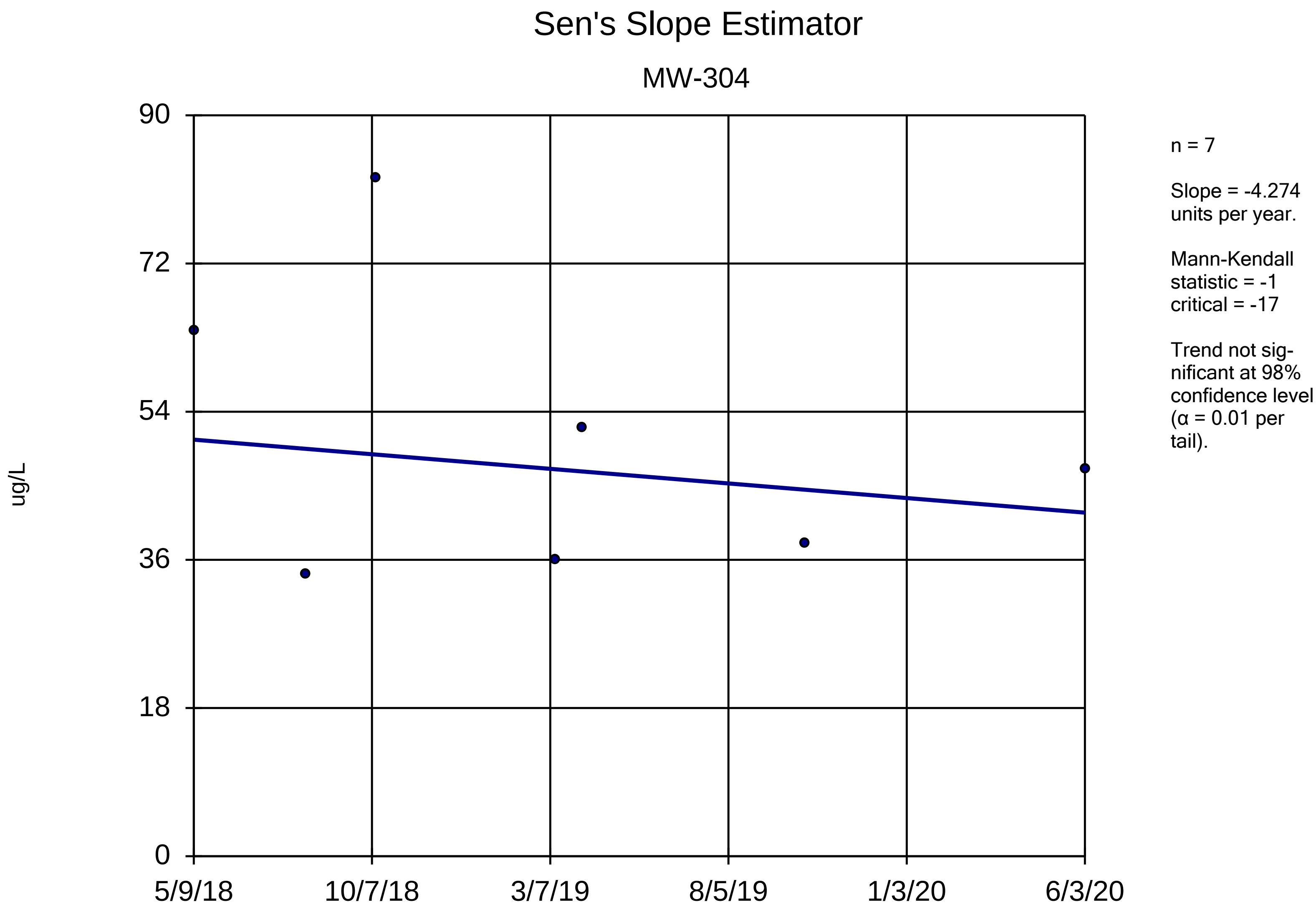
Constituent: Lithium   Analysis Run 11/21/2020 5:57 PM

Burlington Generating Station   Client: SCS Engineers   Data: BGS_Export_201121_Rev



Constituent: Lithium Analysis Run 11/21/2020 5:57 PM

Burlington Generating Station Client: SCS Engineers Data: BGS_Export_201121_Rev



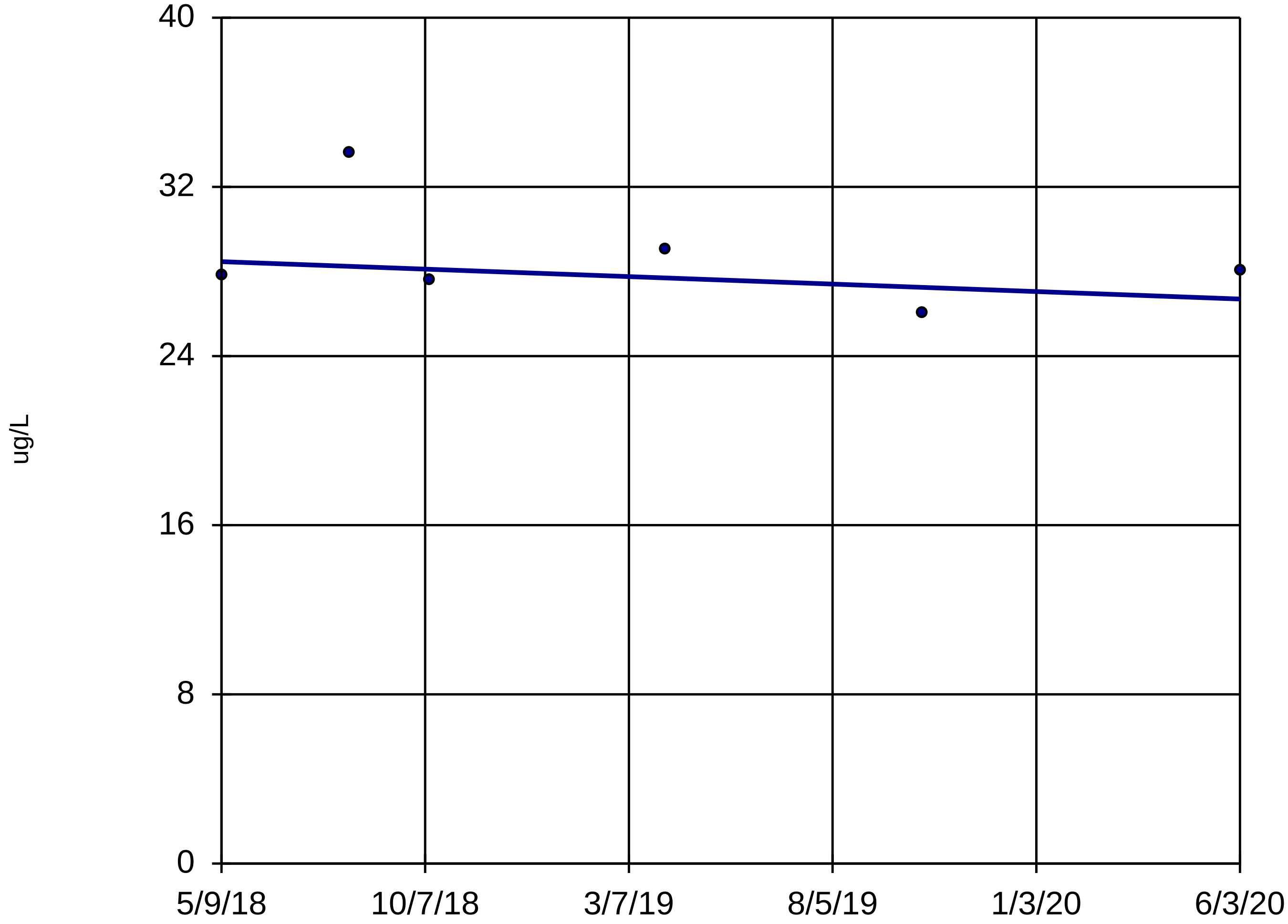
Constituent: Lithium   Analysis Run 11/21/2020 5:57 PM

Burlington Generating Station   Client: SCS Engineers   Data: BGS_Export_201121_Rev

Sanitas™ v.9.6.27 Software licensed to SCS Engineers. UG

Sen's Slope Estimator

MW-305



n = 6

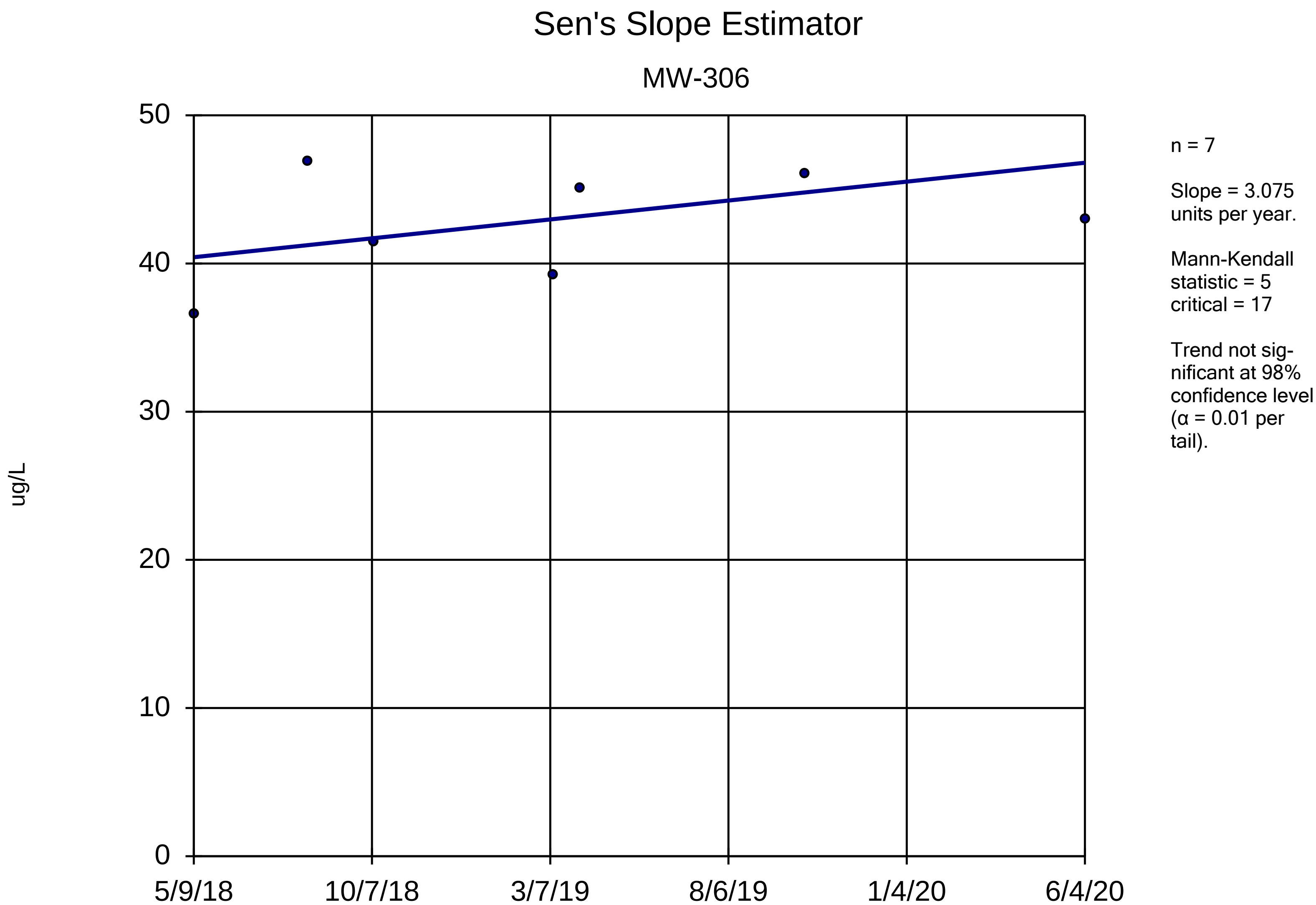
Slope = -0.8548 units per year.

Mann-Kendall statistic = -3 critical = -13

Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: Lithium   Analysis Run 11/21/2020 5:57 PM

Burlington Generating Station   Client: SCS Engineers   Data: BGS_Export_201121_Rev

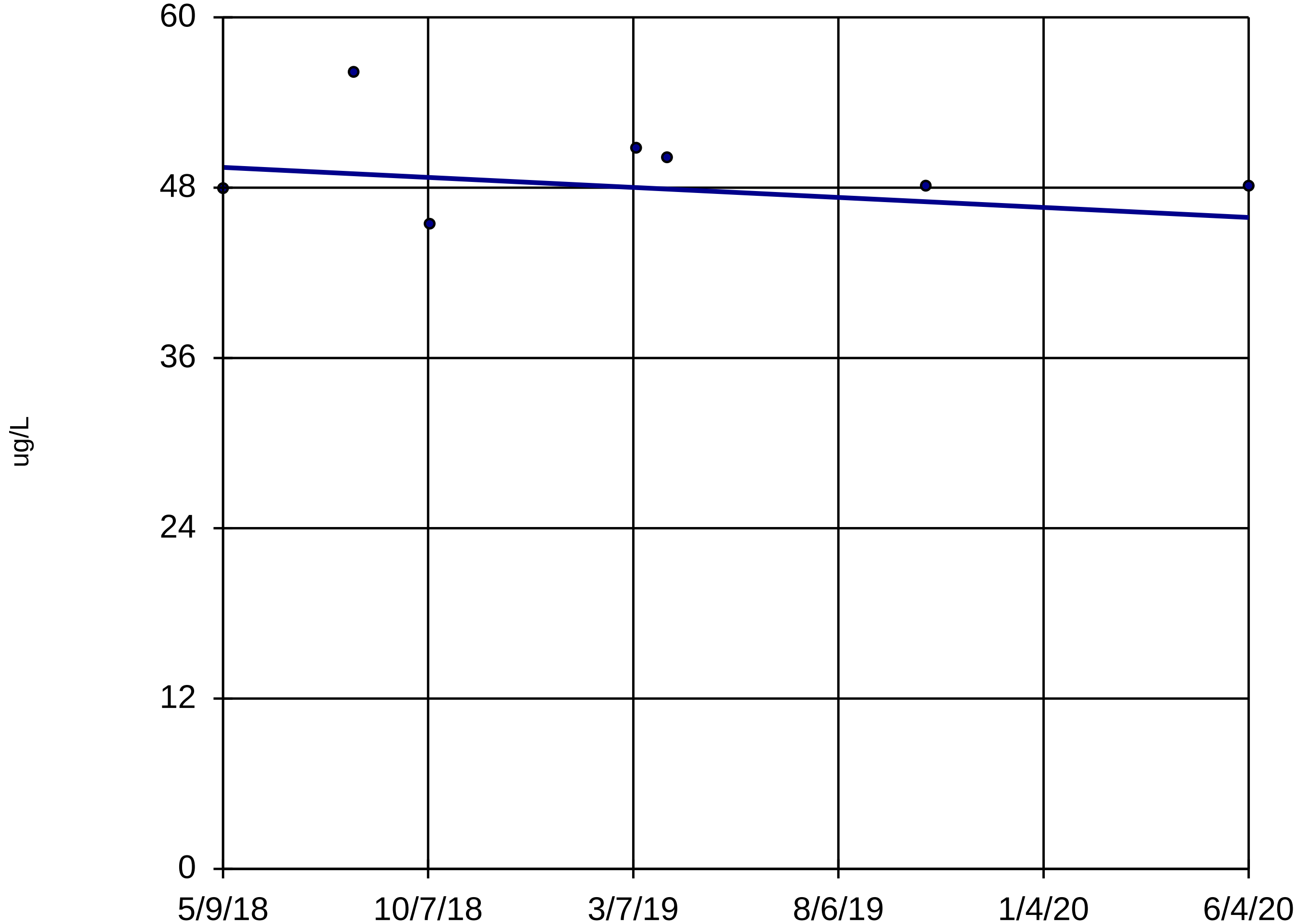


Constituent: Lithium   Analysis Run 11/21/2020 5:57 PM

Burlington Generating Station   Client: SCS Engineers   Data: BGS_Export_201121_Rev

Sen's Slope Estimator

MW-307



n = 7

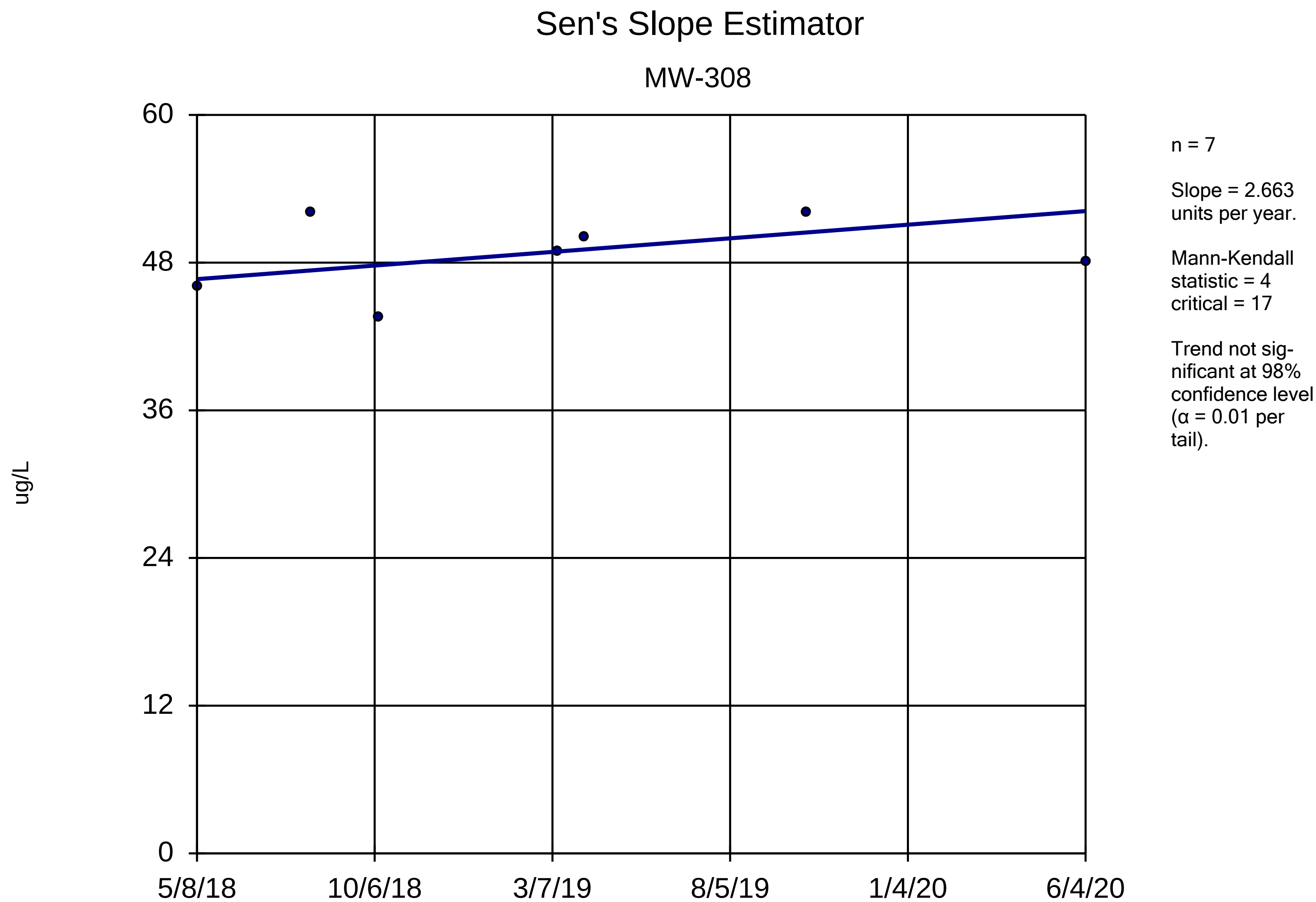
Slope = -1.706 units per year.

Mann-Kendall statistic = -2 critical = -17

Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: Lithium   Analysis Run 11/21/2020 5:57 PM

Burlington Generating Station   Client: SCS Engineers   Data: BGS_Export_201121_Rev

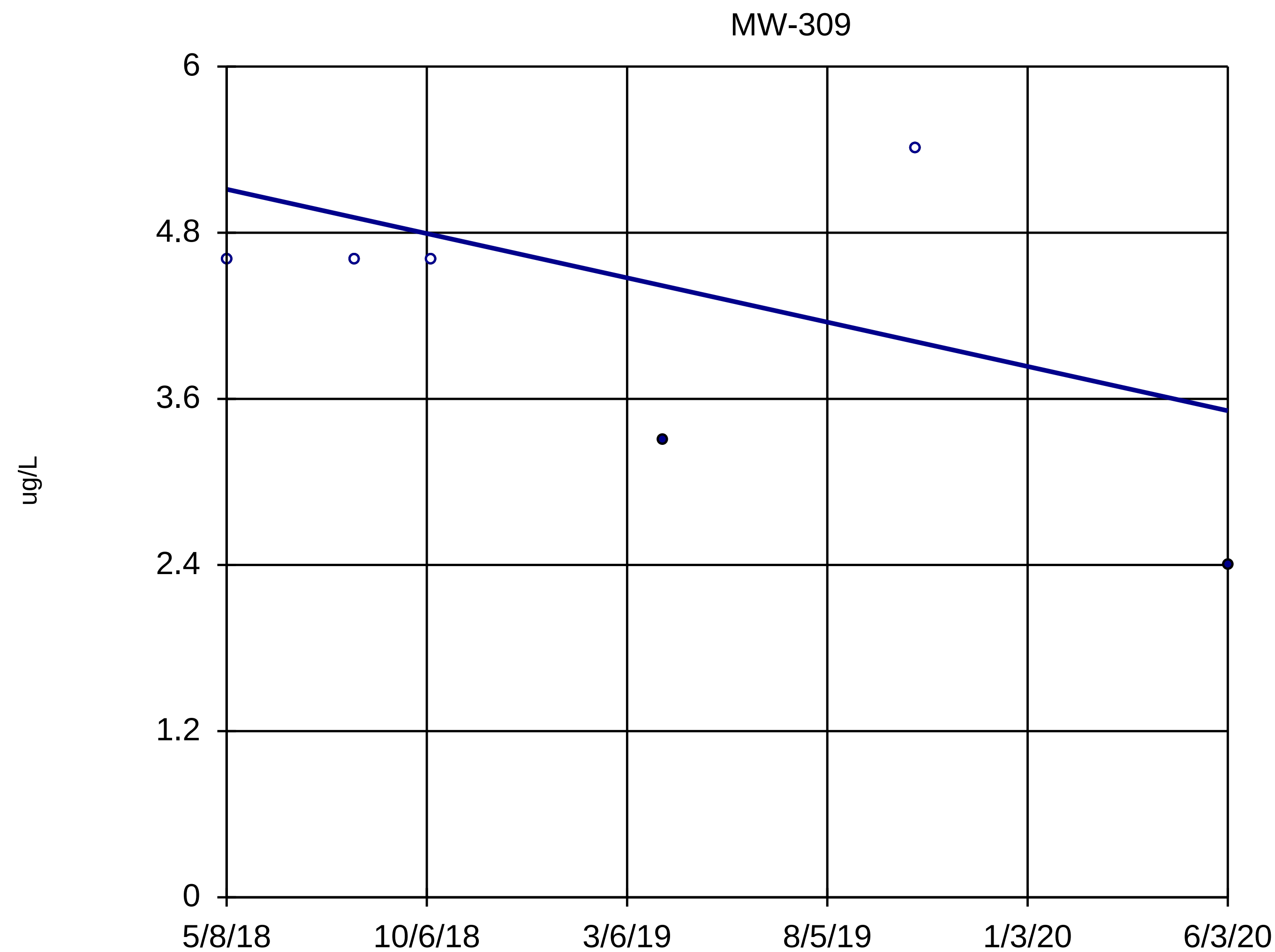


Constituent: Lithium Analysis Run 11/21/2020 5:57 PM

Burlington Generating Station Client: SCS Engineers Data: BGS_Export_201121_Rev

Sanitas™ v.9.6.27 Software licensed to SCS Engineers. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator



n = 6

Slope = -0.7711 units per year.

Mann-Kendall statistic = -4 critical = -13

Trend not significant at 98% confidence level (α = 0.01 per tail).

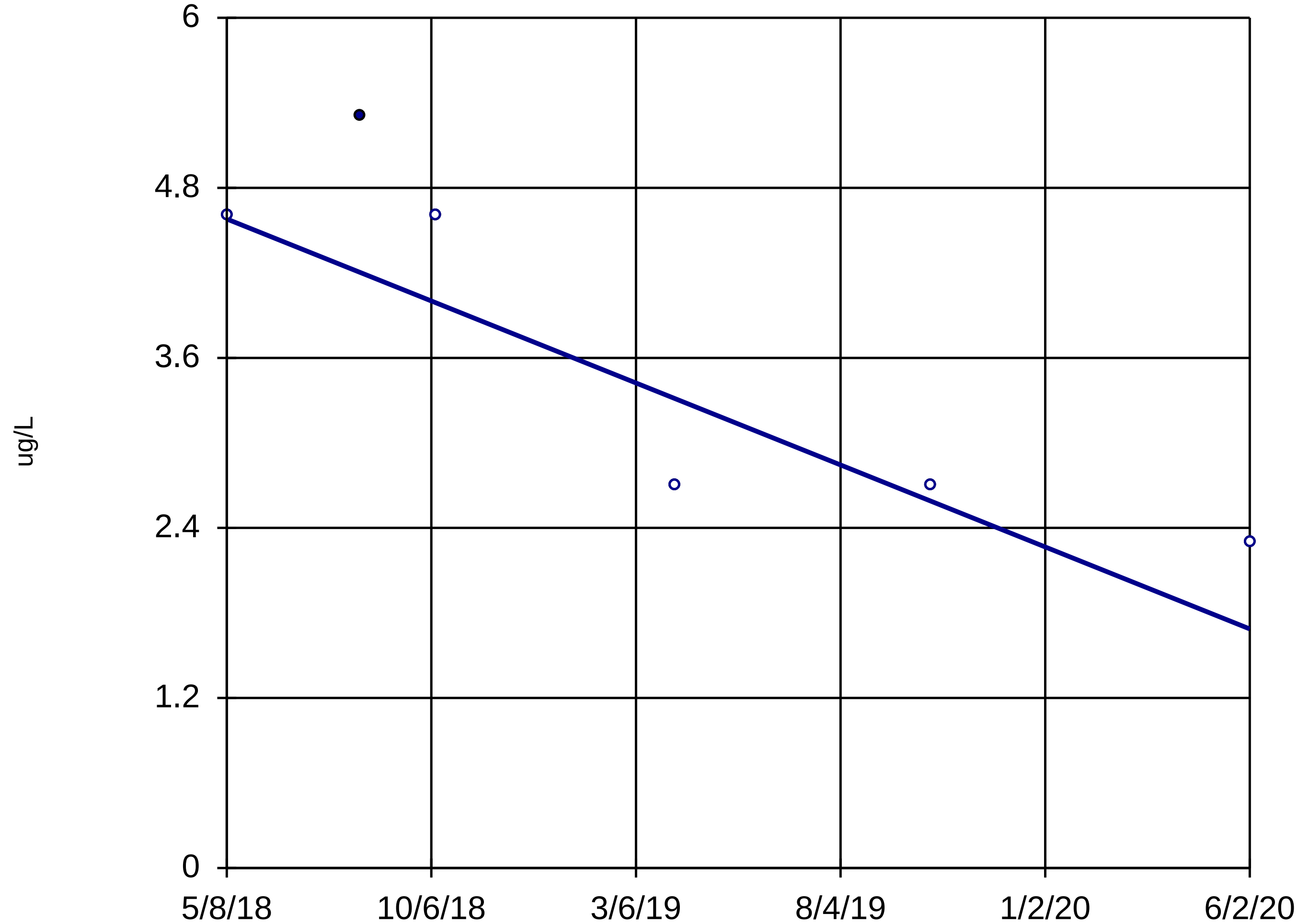
Constituent: Lithium   Analysis Run 11/21/2020 5:57 PM

Burlington Generating Station   Client: SCS Engineers   Data: BGS_Export_201121_Rev

Sanitas™ v.9.6.27 Software licensed to SCS Engineers. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-310 (bg)



n = 6

Slope = -1.397 units per year.

Mann-Kendall statistic = -11 critical = -13

Trend not significant at 98% confidence level (α = 0.01 per tail).

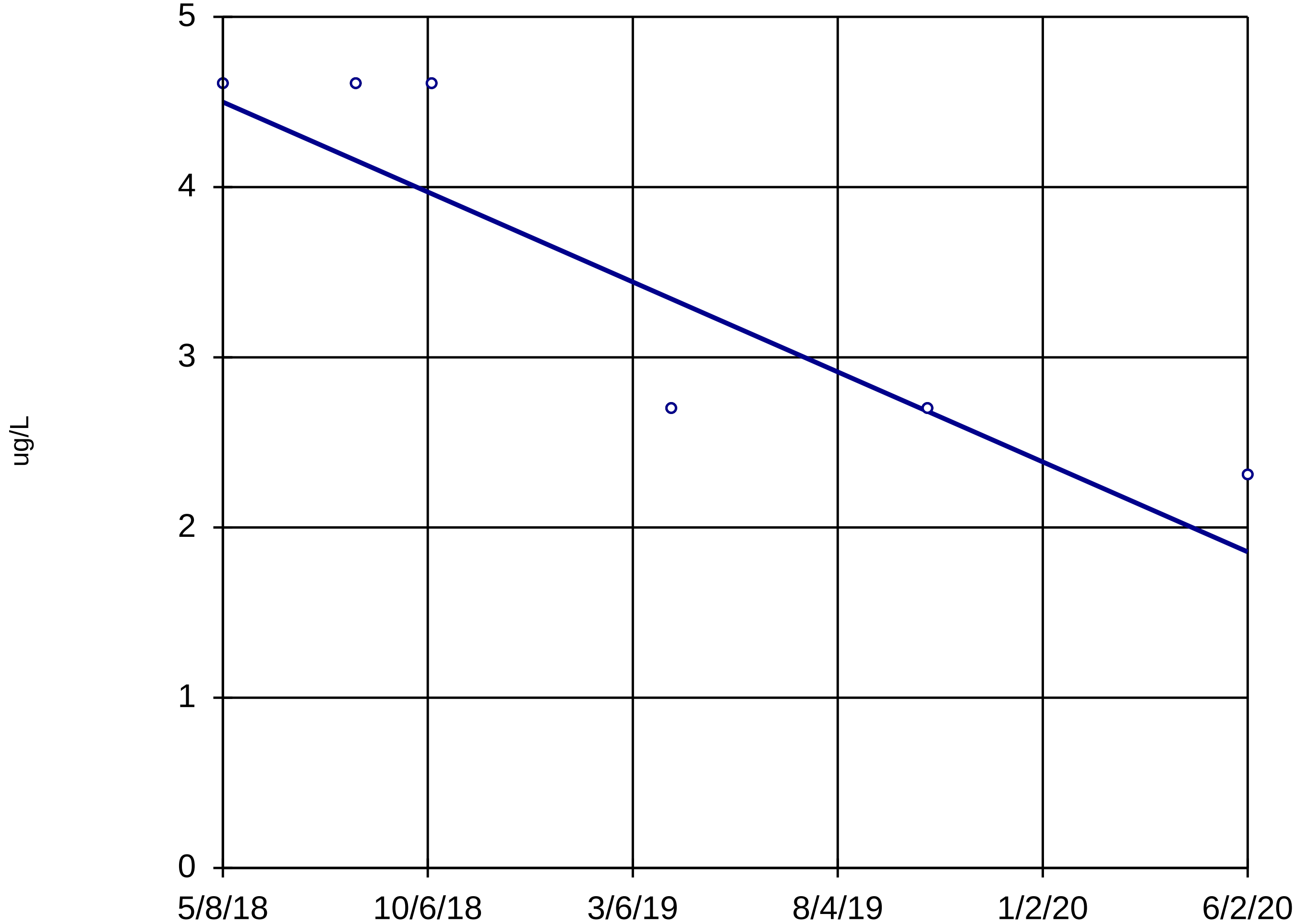
Constituent: Lithium   Analysis Run 11/21/2020 5:57 PM

Burlington Generating Station   Client: SCS Engineers   Data: BGS_Export_201121_Rev

Sanitas™ v.9.6.27 Software licensed to SCS Engineers. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-311 (bg)



n = 6

Slope = -1.276
units per year.

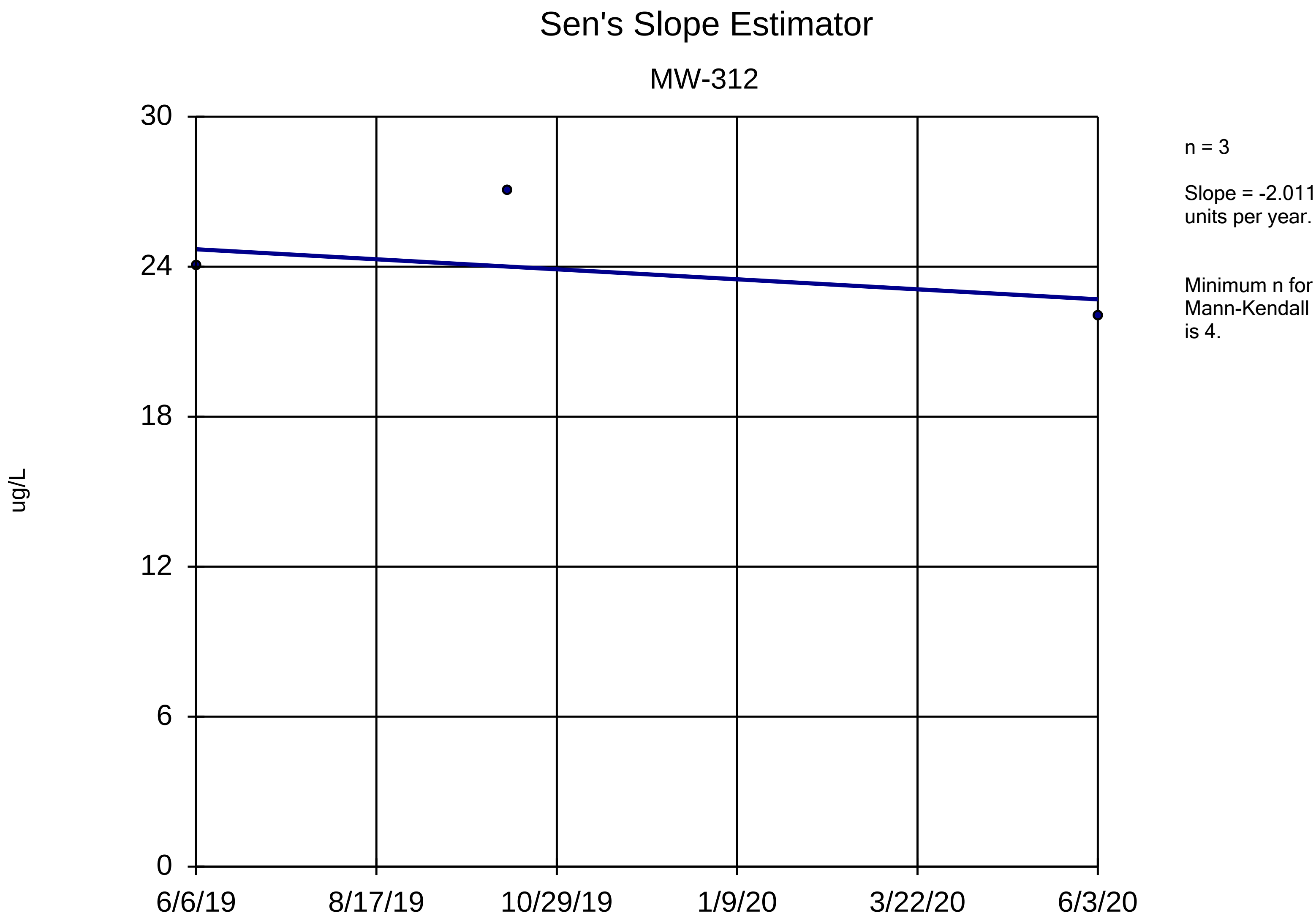
Mann-Kendall
statistic = -11
critical = -13

Trend not sig-
nificant at 98%
confidence level
(α = 0.01 per
tail).

Constituent: Lithium   Analysis Run 11/21/2020 5:57 PM

Burlington Generating Station   Client: SCS Engineers   Data: BGS_Export_201121_Rev

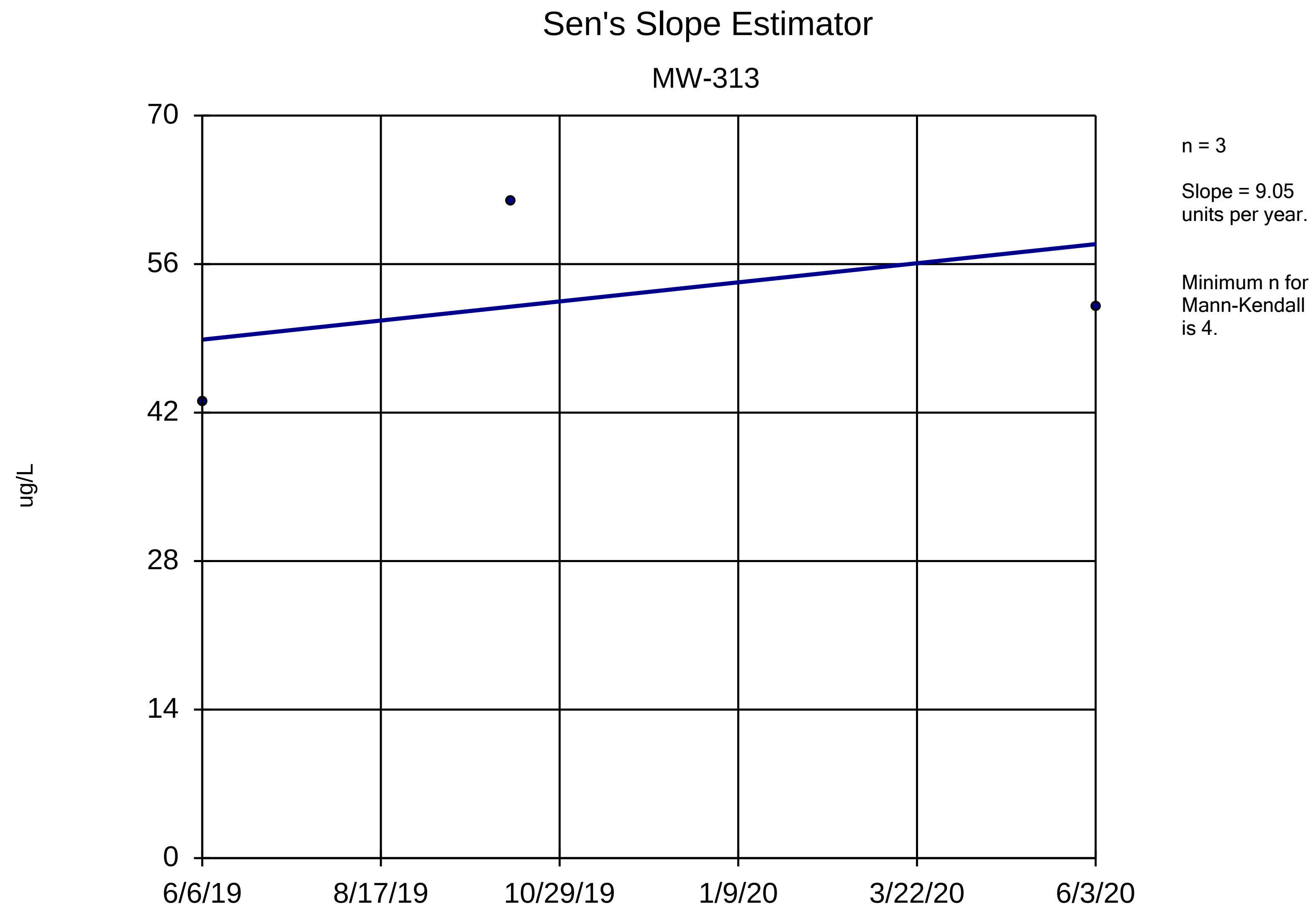
Sanitas™ v.9.6.27 Software licensed to SCS Engineers. UG



Constituent: Lithium   Analysis Run 11/21/2020 5:57 PM

Burlington Generating Station   Client: SCS Engineers   Data: BGS_Export_201121_Rev

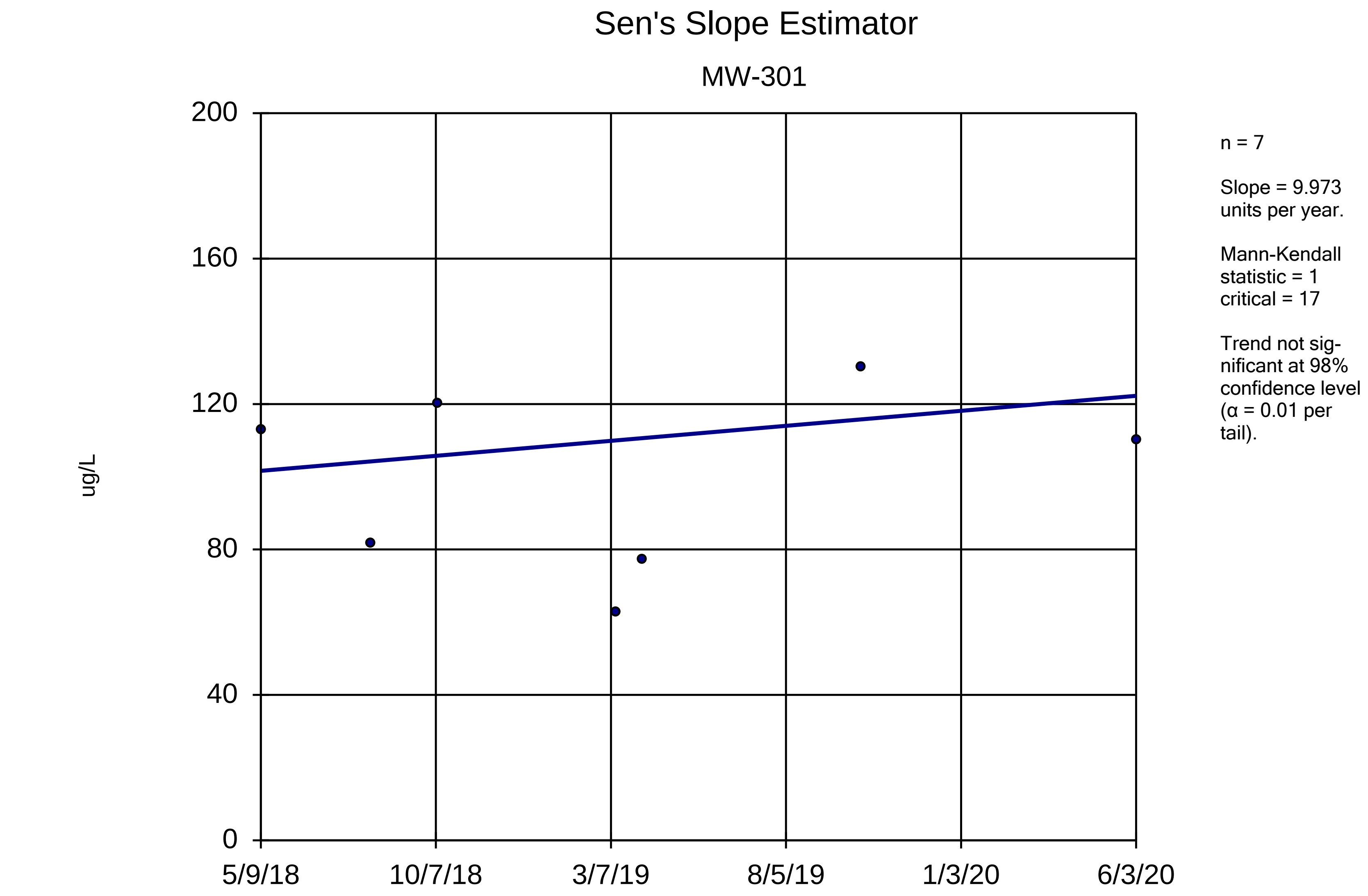
Sanitas™ v.9.6.27 Software licensed to SCS Engineers. UG



Constituent: Lithium Analysis Run 11/21/2020 5:57 PM

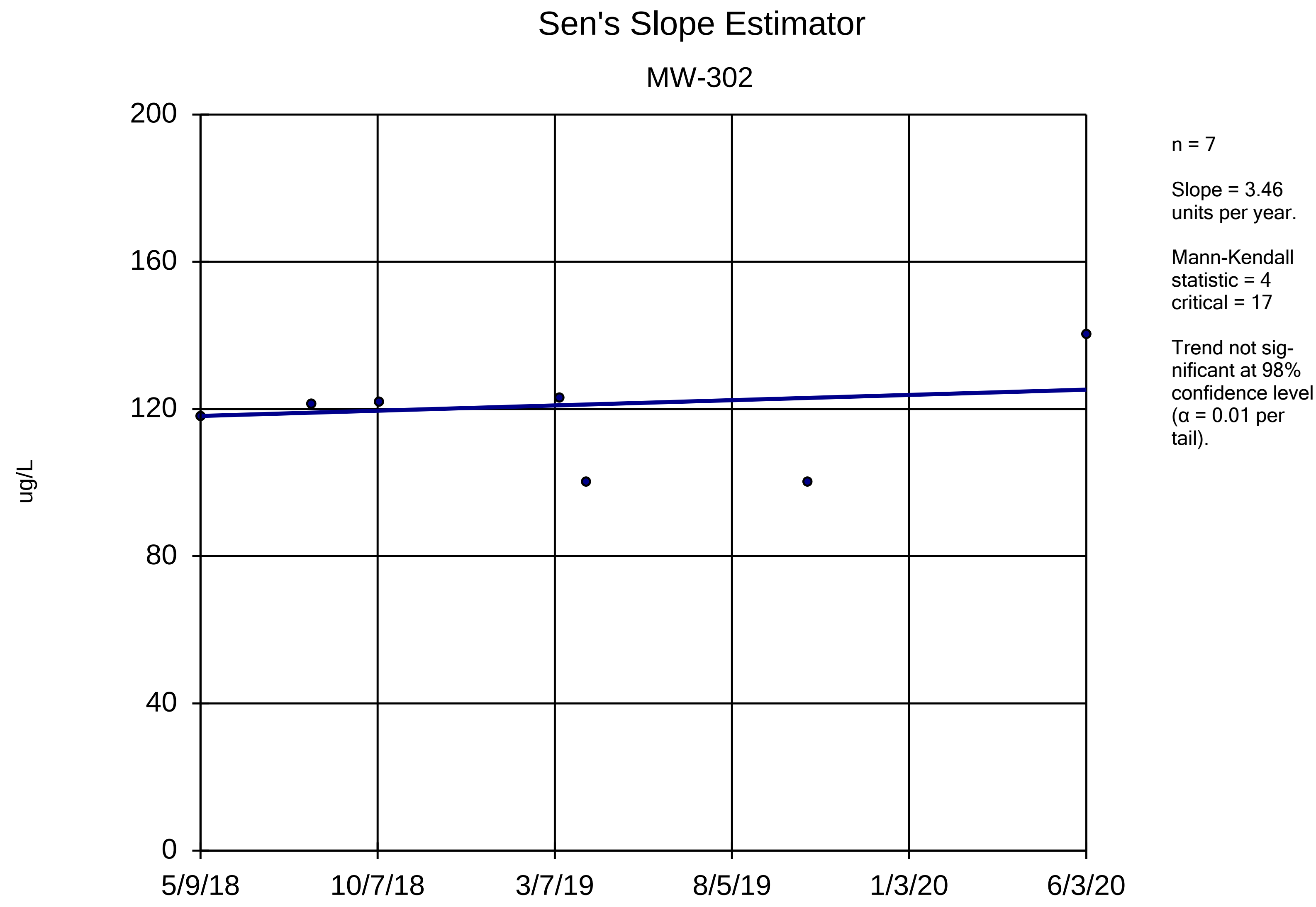
Burlington Generating Station Client: SCS Engineers Data: BGS_Export_201121_Rev

11/25/2020 - Classification: Internal - ECRM7803921



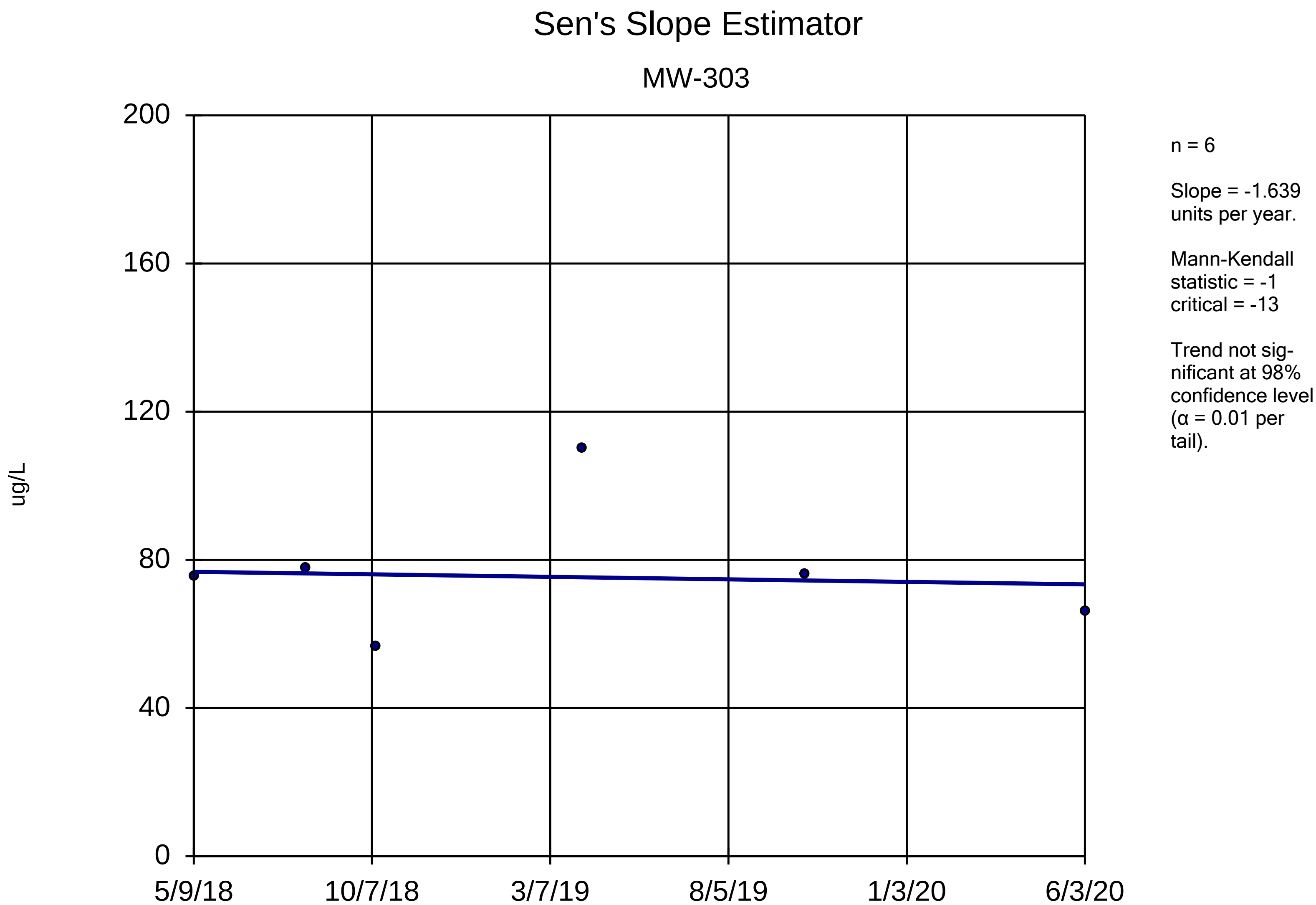
Constituent: Molybdenum   Analysis Run 11/21/2020 5:58 PM

Burlington Generating Station   Client: SCS Engineers   Data: BGS_Export_201121_Rev



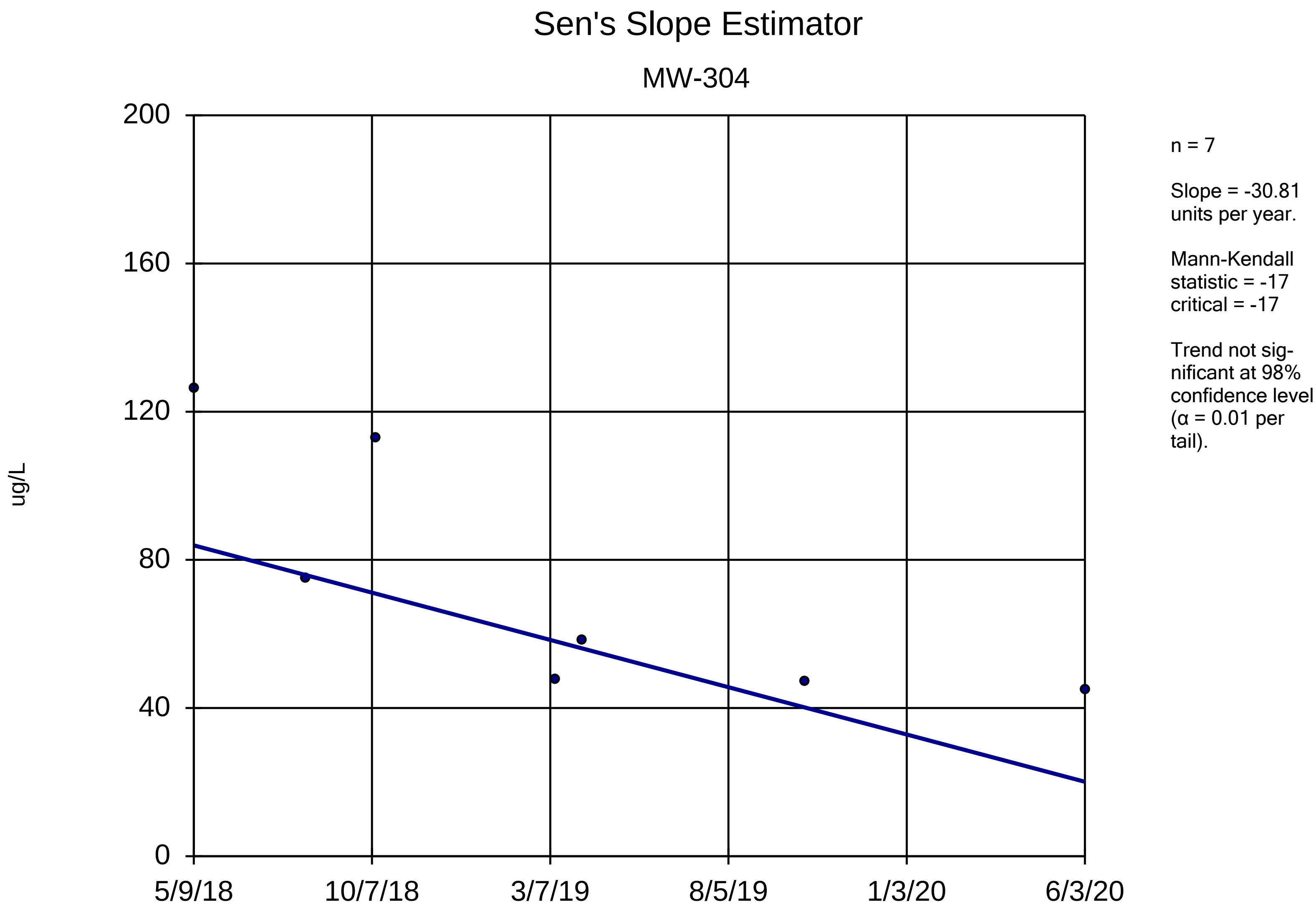
Constituent: Molybdenum   Analysis Run 11/21/2020 5:58 PM

Burlington Generating Station   Client: SCS Engineers   Data: BGS_Export_201121_Rev



Constituent: Molybdenum   Analysis Run 11/21/2020 5:58 PM

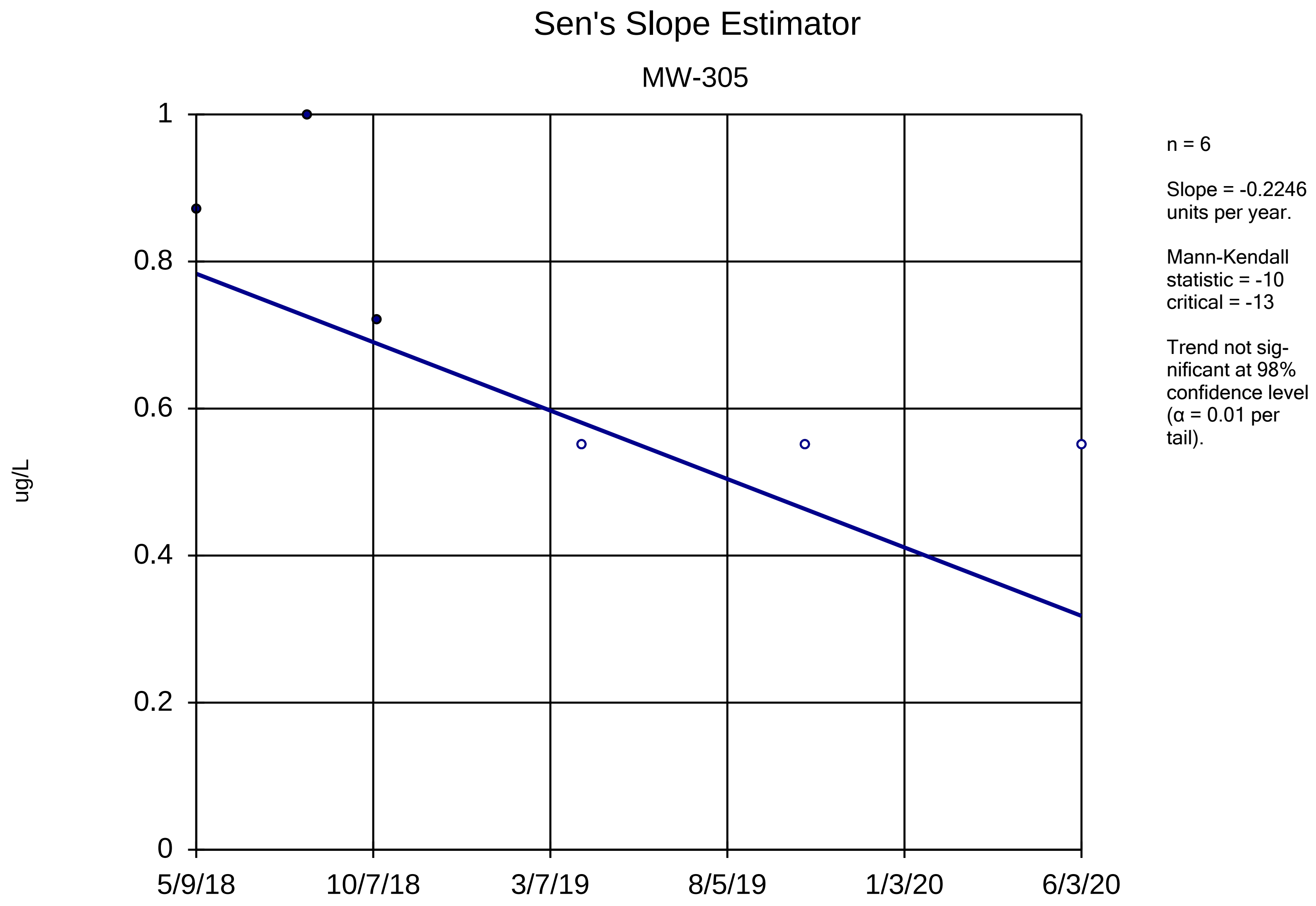
Burlington Generating Station   Client: SCS Engineers   Data: BGS_Export_201121_Rev



Constituent: Molybdenum Analysis Run 11/21/2020 5:58 PM

Burlington Generating Station Client: SCS Engineers Data: BGS_Export_201121_Rev

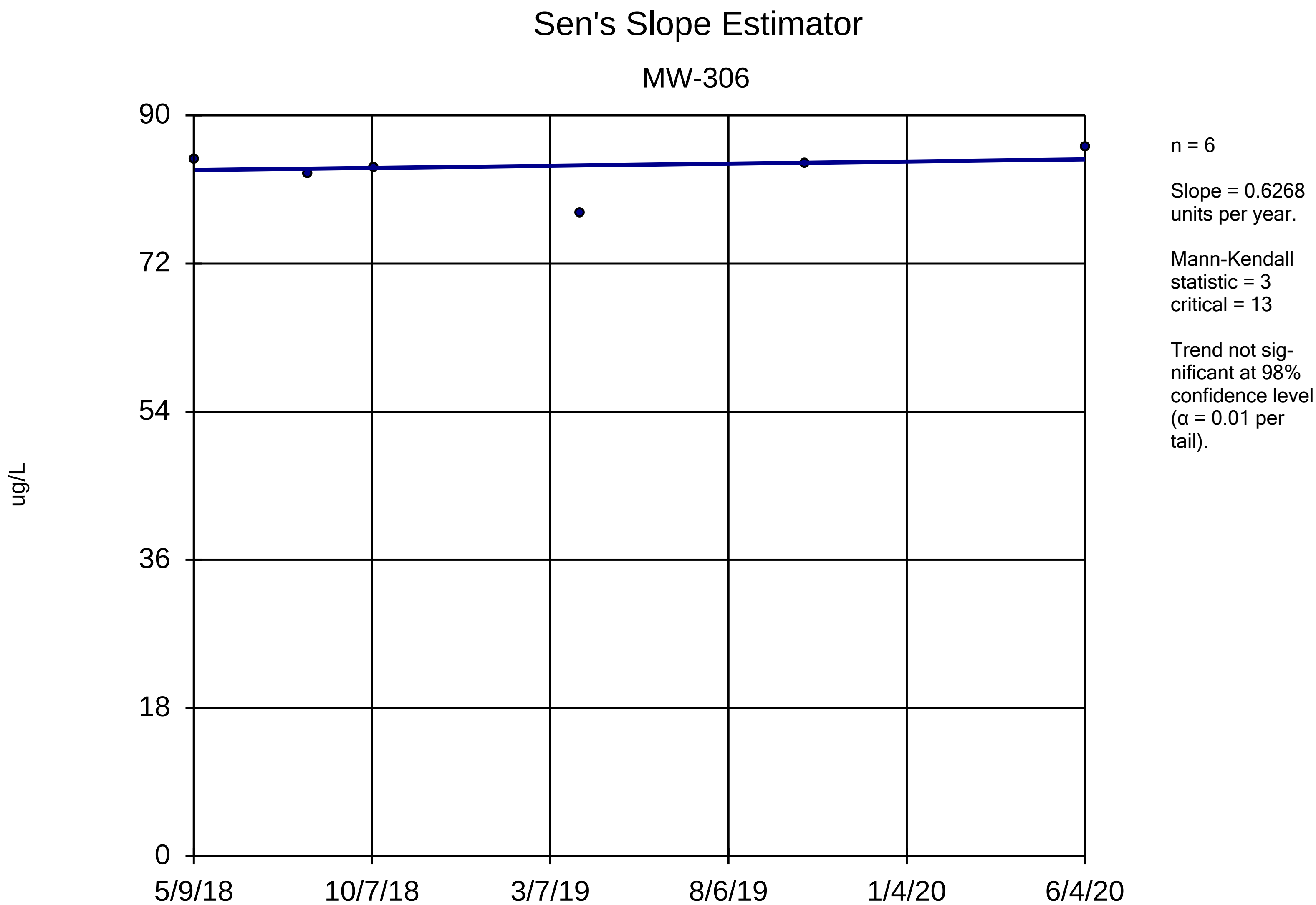
Sanitas™ v.9.6.27 Software licensed to SCS Engineers. UG
Hollow symbols indicate censored values.



Constituent: Molybdenum   Analysis Run 11/21/2020 5:58 PM

Burlington Generating Station   Client: SCS Engineers   Data: BGS_Export_201121_Rev

Sanitas™ v.9.6.27 Software licensed to SCS Engineers. UG

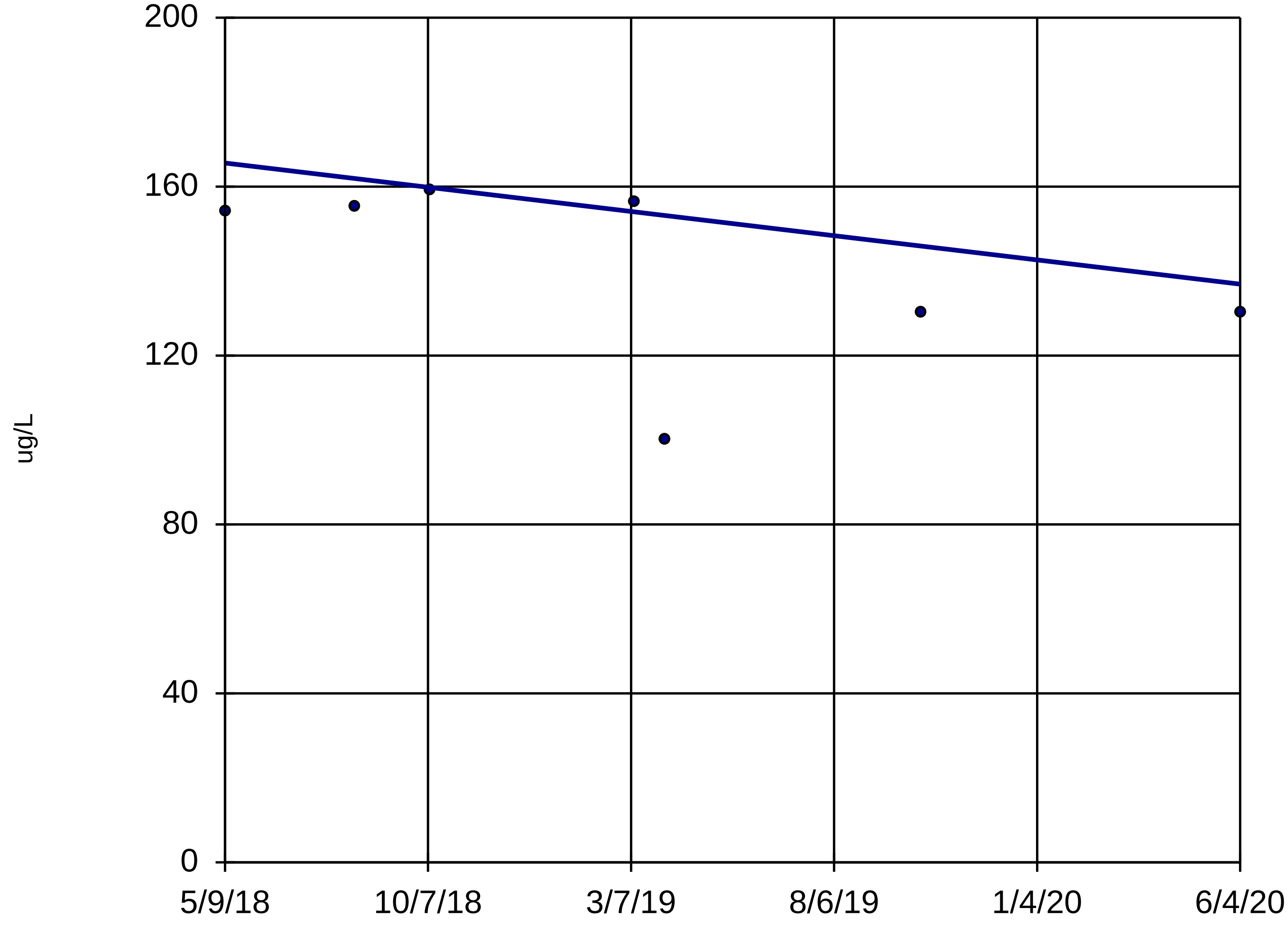


Constituent: Molybdenum   Analysis Run 11/21/2020 5:58 PM

Burlington Generating Station   Client: SCS Engineers   Data: BGS_Export_201121_Rev

Sen's Slope Estimator

MW-307



n = 7

Slope = -13.83
units per year.

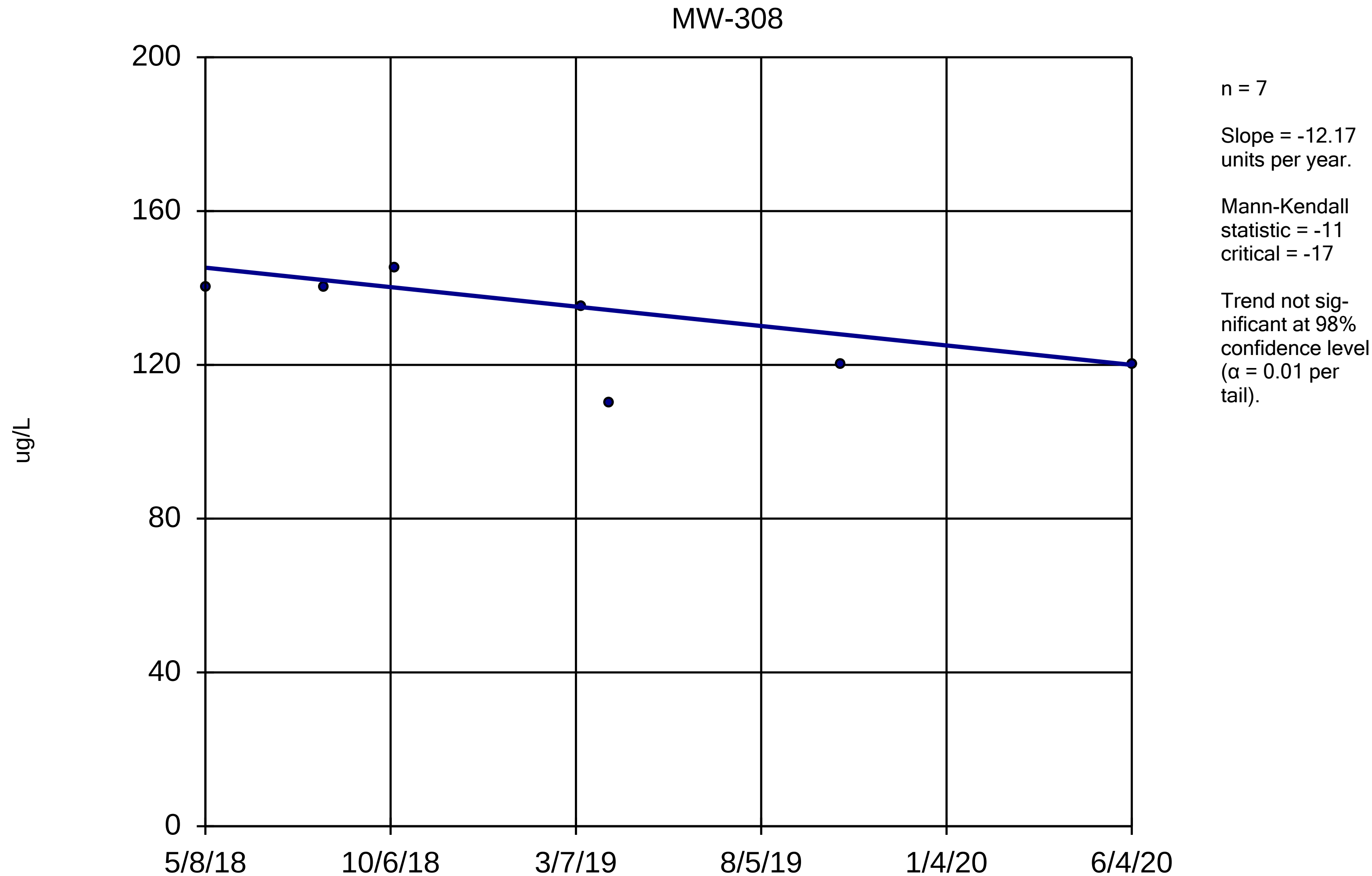
Mann-Kendall
statistic = -6
critical = -17

Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: Molybdenum   Analysis Run 11/21/2020 5:58 PM

Burlington Generating Station   Client: SCS Engineers   Data: BGS_Export_201121_Rev

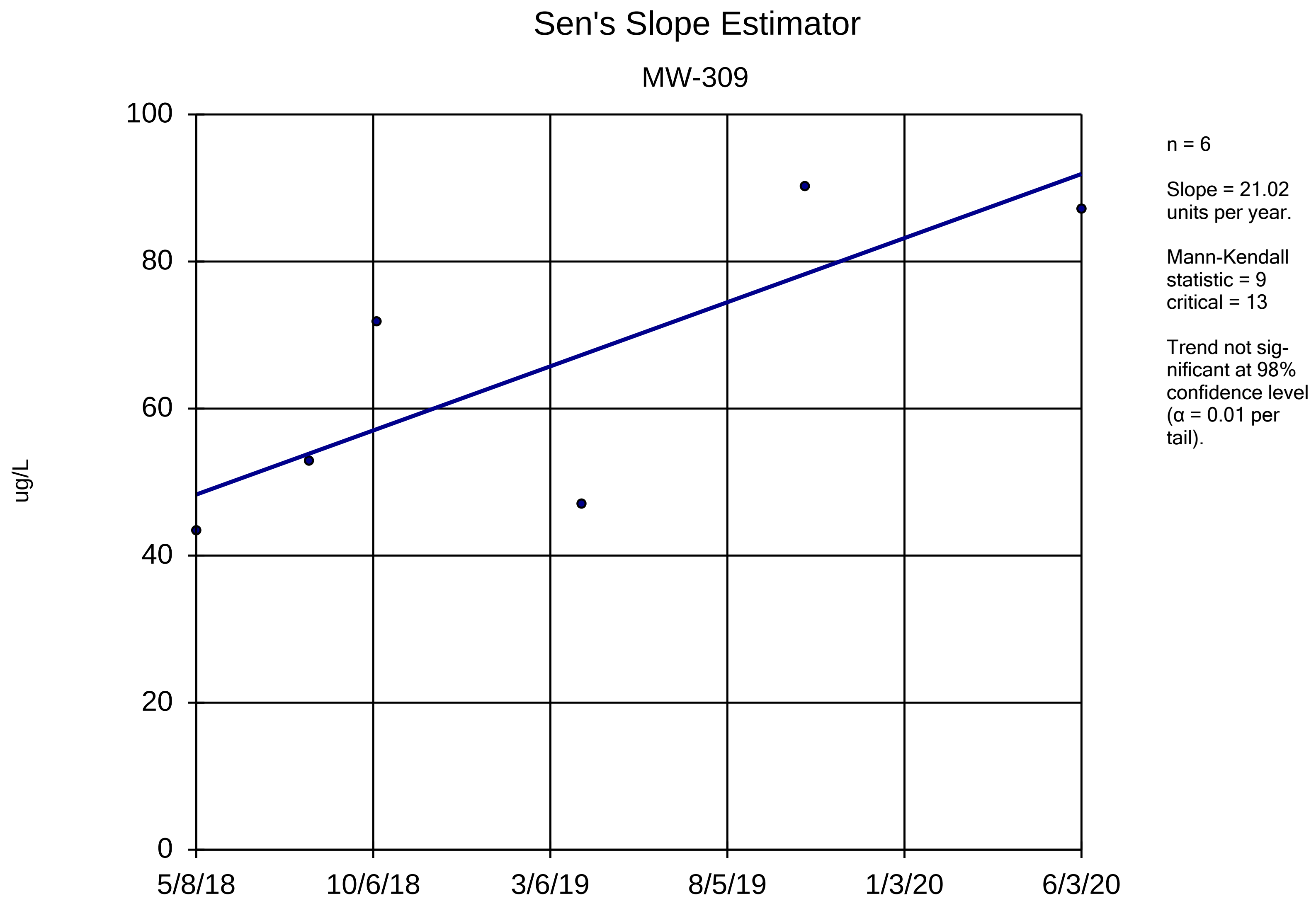
Sen's Slope Estimator



Constituent: Molybdenum   Analysis Run 11/21/2020 5:58 PM

Burlington Generating Station   Client: SCS Engineers   Data: BGS_Export_201121_Rev

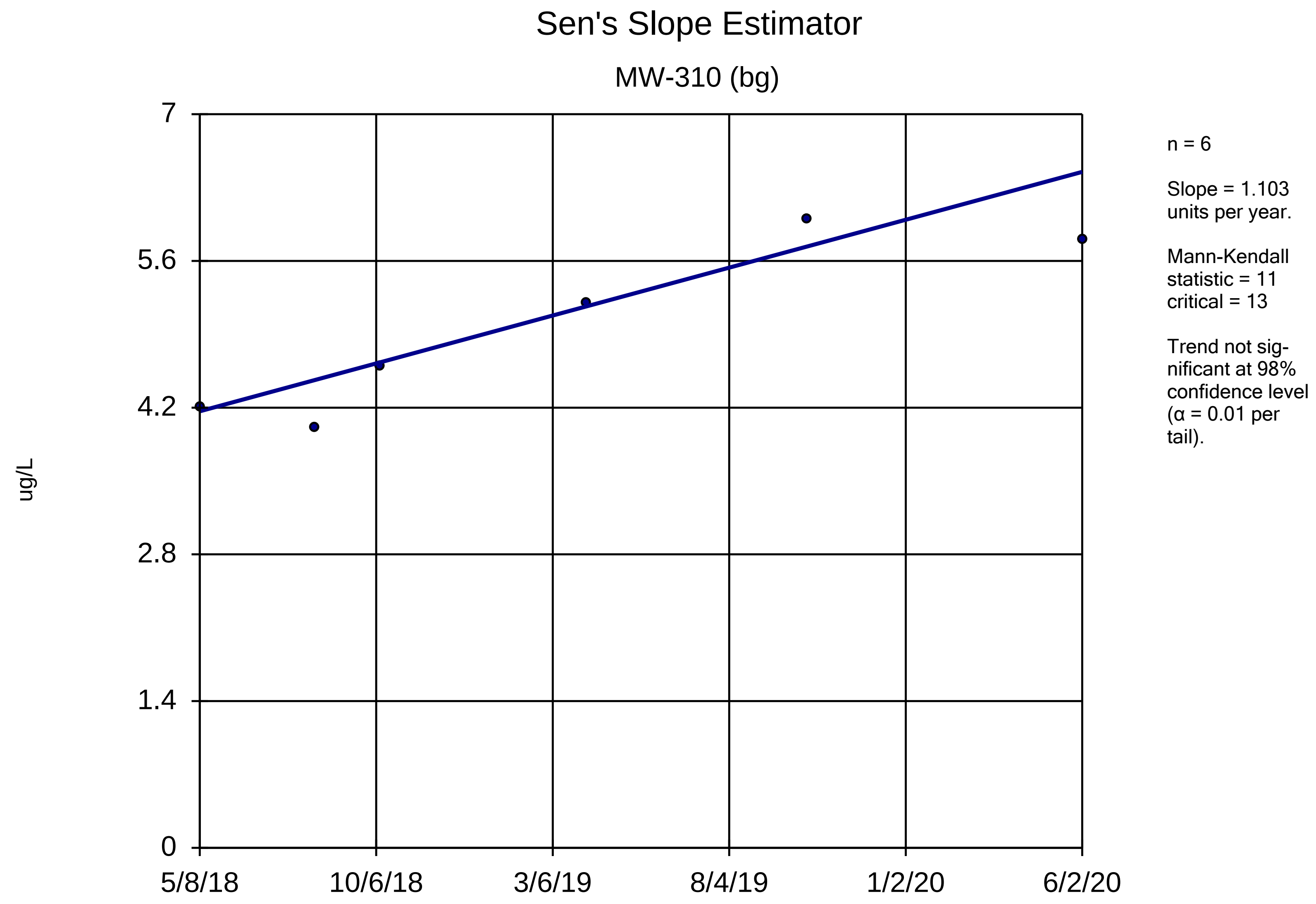
Sanitas™ v.9.6.27 Software licensed to SCS Engineers. UG



Constituent: Molybdenum   Analysis Run 11/21/2020 5:58 PM

Burlington Generating Station   Client: SCS Engineers   Data: BGS_Export_201121_Rev

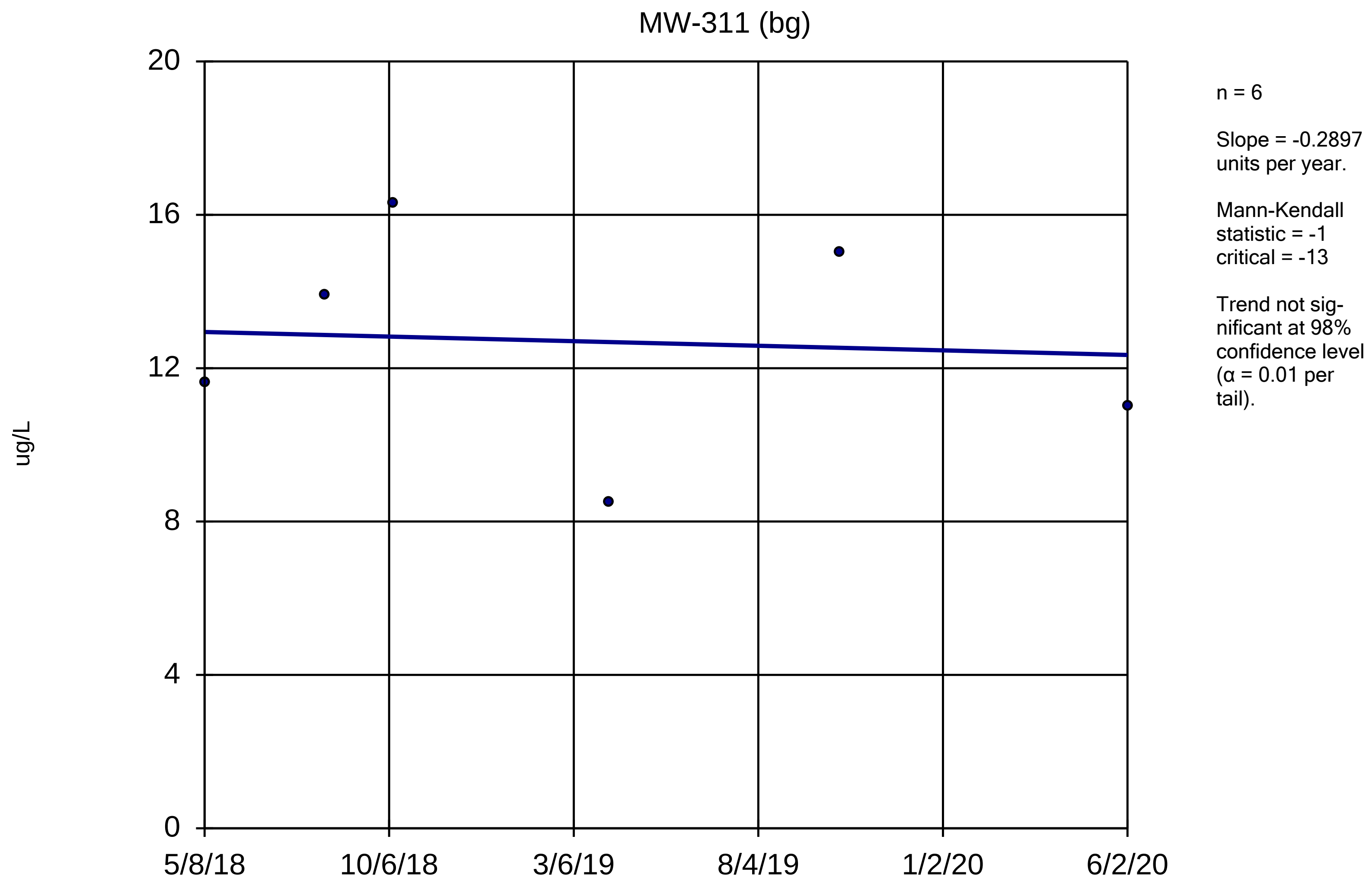
11/25/2020 - Classification: Internal - ECRM7803921



Constituent: Molybdenum Analysis Run 11/21/2020 5:58 PM

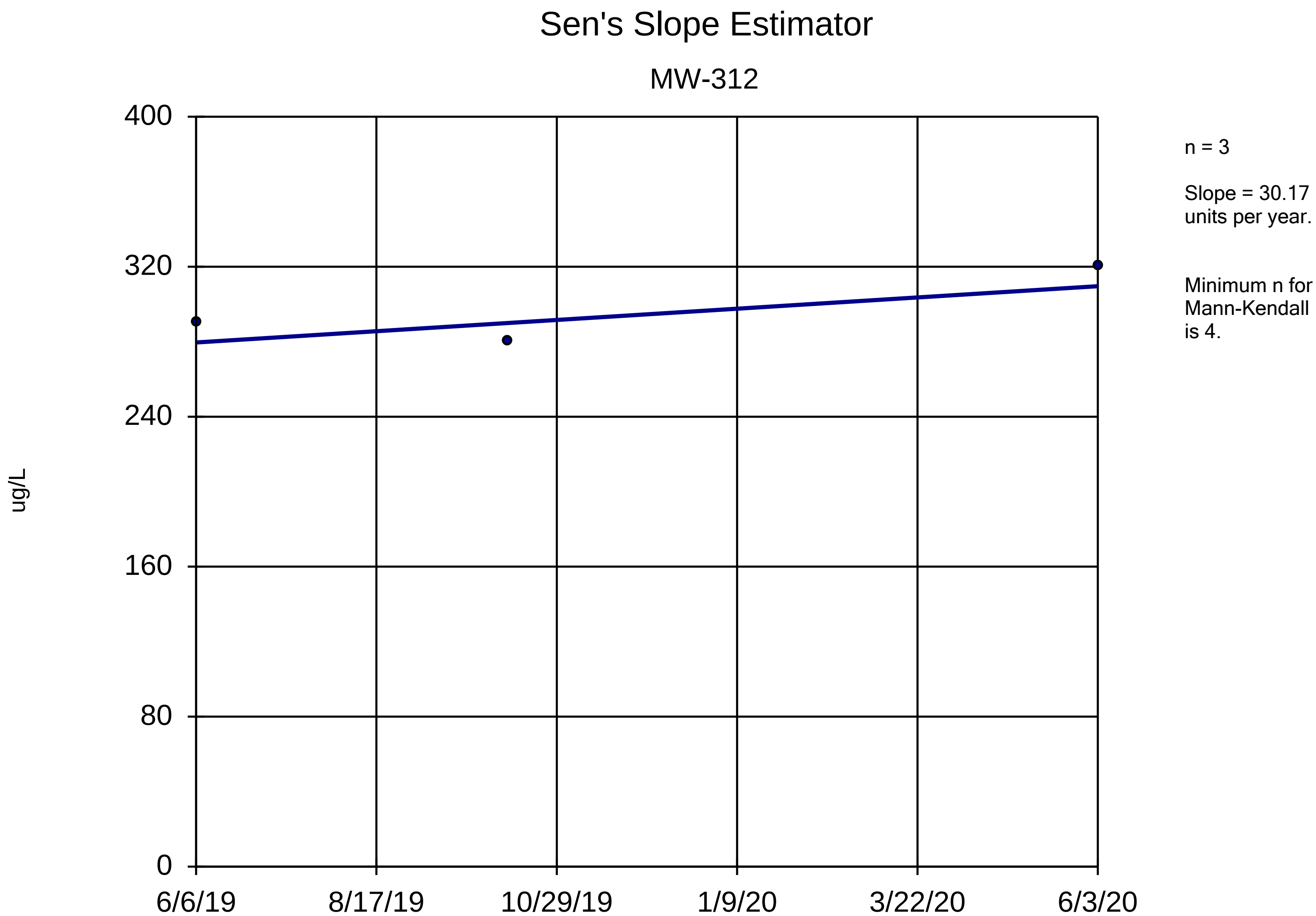
Burlington Generating Station Client: SCS Engineers Data: BGS_Export_201121_Rev

Sen's Slope Estimator



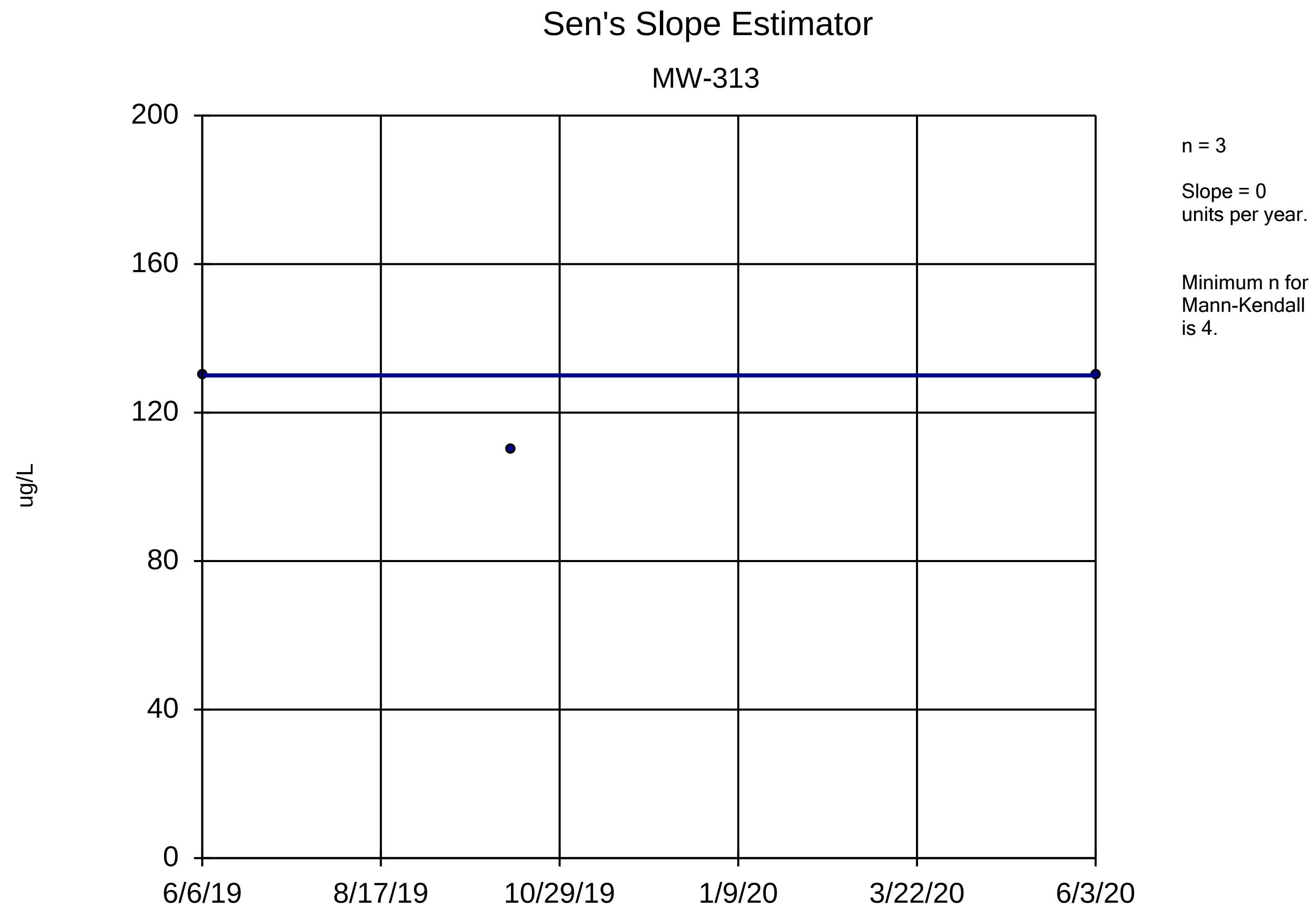
Constituent: Molybdenum   Analysis Run 11/21/2020 5:58 PM

Burlington Generating Station   Client: SCS Engineers   Data: BGS_Export_201121_Rev



Constituent: Molybdenum   Analysis Run 11/21/2020 5:58 PM

Burlington Generating Station   Client: SCS Engineers   Data: BGS_Export_201121_Rev



Constituent: Molybdenum   Analysis Run 11/21/2020 5:58 PM

Burlington Generating Station   Client: SCS Engineers   Data: BGS_Export_201121_Rev