

## **Consumers Energy** Memorandum

**To:** Bethany Swanberg  
Environmental Quality & Sustainability Department

**From:** Harold D. Register, Jr.  
Environmental Quality & Sustainability Department

**Date:** September 29, 2023

**Subject:** JH Campbell Unit 1-2 Bottom Ash Pond North/South  
40 CFR 257.102(c) Closure by Removal Certification

**CC:** Heather Prentice, Risk Management  
File, Environmental Services

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### 1.0 INTRODUCTION

CEC prepared a "[Notification of Intent to Close](#)" for the JH Campbell Unit 1-2 Bottom Ash Pond North/South (JHC U1-2 BAP) on September 7, 2018 to comply with the requirements of §257.102(g). This correspondence was subsequently placed into the operating record per §257.105(i)(7), noticed to the State Director per §257.106(i)(7) and posted to the publicly accessible website per §257.107(i)(7). Prior to the "Notification of Intent to Close," a [Closure Plan](#) (Golder, 2018) per the requirements of §257.102(b)(1)-(2) was developed for the JHC U1-2 BAP. Compliance documents required pursuant to §257.107 can be publicly accessed at: <https://www.consumersenergy.com/community/sustainability/environment/waste-management/coal-combustion-residuals>

Closure of the JHC U1-2 BAP was conducted in accordance with §257.102(c), which states:

***Closure by removal of CCR.*** *An owner or operator may elect to close a CCR unit by removing and decontaminating all areas affected by releases from the CCR unit. CCR removal and decontamination of the CCR unit are complete when constituent concentrations throughout the CCR unit and any areas affected by releases from the CCR unit have been removed and groundwater monitoring concentrations do not exceed the groundwater protection standard established pursuant to § 257.95(h) for constituents listed in appendix IV to this part.*

This technical memorandum has been prepared to document the closure activities at the JHC U1-2 BAP and provide certification from a qualified professional engineer that closure of the surface impoundment has been successfully completed, per §257.102(f)(3).

### 2.0 COAL COMBUSTION RESIDUALS (CCR) REMOVAL

In addition to following the closure details in the JHC U1-2 BAP Closure Plan, removal and documentation procedures implemented for CCR Removal are described in greater detail in the *Consumers Energy J.H. Campbell Generating Facility Bottom Ash Ponds 1-2 Closure Work Plan (Rev. 1)* (Closure Work Plan) (Golder, 2017) submitted to the Michigan Department of Environmental Quality (MDEQ) on December 5, 2017. MDEQ concurred with the Closure Work Plan in a letter dated February 26, 2018. The procedures and detail of this Closure Work Plan were necessary for acceptance by state regulators that coal ash, defined as a solid waste by state statute, had in fact been removed completely from the unit. The Michigan Department of Environment, Great Lakes, and Energy (EGLE, formerly MDEQ) did not require a solid waste

operating license for JHC U1-2 BAP because elements of closure were initiated prior to December 28, 2018.

As described in the Closure Work Plan, the multiple lines of evidence approach used to document CCR removal provided a predictable and reliable means to objectively measure concentrations of CCR based on physical sample properties. CCR removal was documented based on three lines of evidence:

- First line of evidence: comparison of interim excavation termination grades to known elevations of CCR from previous site characterizations and engineering records;
- Second line of evidence: photographic documentation including periodic photographs of CCR removal progression and photographs of excavated areas at random grid nodes; and
- Third line of evidence: quantitative colorimeter analysis at random grid nodes to confirm CCR removal.

This approach took advantage of the clear visible distinction between the color of the CCR and the color of the underlying soil documented in soil borings and during previous removal activities for beneficial reuse and pond cleanout. This visible color difference was confirmed during the CCR removal activities and documented within each of the removal verification reports.

It is noteworthy that in the performance of this work, an alternative third line of evidence was developed for a limited subset of observation nodes. The microscopic quantification of CCR content was utilized when field observations noted that some excavated areas could be influenced by subsurface soils that do not match the site-specific colorimetric curve for JHC U1-2 BAP. The development and application of this methodology in support of the other lines of evidence is detailed in the supporting documentation.

During August, September, and October 2018, Ryan Incorporated Central was contracted by CEC to perform excavation activities to remove CCR from Bottom Ash Ponds 1-2. Documentation was collected and certified by Golder in *Bottom Ash Ponds 1-2 N/S CCR Removal Documentation Report* (Final CCR Removal Report) (Attachment A) to provide lines of evidence to confirm that CCR was removed per the Closure Work Plan. During CCR removal and documentation, the following tasks were completed:

- Bottom Ash Ponds 1-2 were dewatered by actively pumping decant water into an overflow ditch and ultimately through the site treatment system and National Pollutant Discharge Elimination System (NPDES) permitted outfall.
- CCR was removed by excavation until CCR was no longer visually observed on the excavation surfaces.
- Final excavation grades were compared to apparent elevations where CCR was noted in borehole logs from previous site characterizations.
- A 50-foot grid with a total of 104 nodes was established across the limits of Bottom Ash Ponds 1-2.
- Photographic documentation was conducted of the general CCR removal operation.
- Photographic documentation of excavated areas was completed on at least 50 percent of the grid nodes.
- Quantitative colorimetric analysis was completed on at least 25 percent of the grid nodes (50 percent of the photographed grid nodes).

- Quantitative microscopic analysis was completed as an alternative to colorimetric analysis where soils on excavated surfaces did not match the site-specific colorimetric curve.

Subsequently, EGLE concurred that bottom ash, which is a regulated solid waste in Michigan, had been removed in accordance with the Closure Work Plan (EGLE, 2019).

### 3.0 COMPLIANCE WITH GROUNDWATER PROTECTION STANDARDS

Per §257.102(c), closure of a CCR impoundment is not deemed complete until groundwater monitoring concentrations associated with the unit do not exceed the groundwater protection standards (GWPSs) established pursuant to §257.95(h) for Appendix IV constituents. In the case of JHC U1-2 BAP, CEC provided Notification of an [Appendix IV Constituent Exceeding Groundwater Protection Standard](#) (GWPS) (CEC, 2019) stating arsenic had been confirmed detected at statistically significant levels above the standards established pursuant to §257.95(h). An [Assessment of Corrective Measures](#) (TRC, 2019) reviewed five potential alternatives for corrective actions.

As CEC was developing the final remedy, updates on the progress towards selecting the final remedy were prepared and posted on a semiannual basis pursuant to §257.98(a). Continued monitoring and evaluations culminated in the [Remedy Selection](#) (CEC, 2023a) that recognized the source removal by excavation had been successful in removing CCR and that groundwater monitoring reported on an annual basis did not indicate that any other Appendix IV constituents had exceeded their respective GWPSs established pursuant to §257.95(h).

Ultimately, CEC was able to certify that the requirements for satisfying that the final remedy had been completed pursuant to §257.98(c) as follows:

- (1) The owner or operator of the CCR unit demonstrates compliance with the groundwater protection standards established under § 257.95(h) has been achieved at all points within the plume of contamination that lie beyond the groundwater monitoring well system established under § 257.91.
- (2) Compliance with the groundwater protection standards established under § 257.95(h) has been achieved by demonstrating that concentrations of constituents listed in appendix IV to this part have not exceeded the groundwater protection standard(s) for a period of three consecutive years using the statistical procedures and performance standards in § 257.93(f) and (g).
- (3) All actions required to complete the remedy have been satisfied.

Importantly, the Remedy Completion Report (CEC, 2023b) and the [2022 Annual Groundwater Monitoring and Corrective Action Report, JH Campbell Power Plant Ponds 1-2 North and 1-2 South CCR Unit](#) (TRC, 2023) documents that arsenic was the only Appendix IV constituent that exceeded the GWPS established under § 257.95(h) (an Alternate Source Demonstration was asserted and accepted for selenium). Additionally, these reports establish that arsenic attained the GWPS and demonstrated that attainment for a period of three years. Satisfaction of the performance criteria under §257.98(c) also satisfies the closure performance standard under §257.102(c).

#### 4.0 POST-CLOSURE CARE REQUIREMENTS

The post-closure care section in the CCR rule states the following: "An owner or operator of a CCR unit that elects to close a CCR unit by removing CCR as provided by §257.102(c) is not subject to the post-closure care criteria under this section." (§257.104(a)(2)).

#### 5.0 CONCLUSIONS

This technical memorandum presents the summary of documented observations and data collected during the field work completed for the JHC U1-2 BAP closure as further detailed in:

*ATTACHMENT A:* Golder Associates, Inc. August 2019. Bottom Ash Ponds 1-2 N/S CCR Removal Documentation Report

As of the certification date of this report (see Section 6.0), the JHC U1-2 BAP will be deemed a closed CCR unit under 40 CFR §257. Accordingly, the CCR unit is not subject to post-closure care requirements or any other requirements under 40 CFR §257 of the CCR rule.

#### 6.0 CLOSURE CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

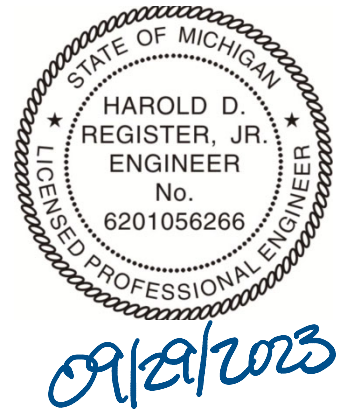
I hereby certify in accordance with §257.102(f)(3) that the JH Campbell Unit 1-2 Bottom Ash Pond N/S (JHC 1-2 BAP) was closed in accordance with the requirements of §257.102(c) of the CCR rule and the written Closure Work Plan as developed under §257.102(b). To the best of my knowledge, information, and belief, the information contained herein is true and correct and this document has been prepared in accordance with generally accepted good engineering practices.

  
\_\_\_\_\_  
Signature

September 29, 2023  
\_\_\_\_\_  
Date of Certification

Harold D. Register, Jr., P.E.  
\_\_\_\_\_  
Name

6201056266  
\_\_\_\_\_  
Professional Engineer Certification Number



## 7.0 REFERENCES

Consumers Energy Company. September. 2018. Notification of Intent to Initiate Closure for JH Campbell Bottom Ash Ponds Unit 1&2 N/S.

Consumers Energy Company. January, 2019. Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g).

Consumers Energy Company. July 2023. JH Campbell Ponds 1-2 North and 1-2 South Coal Combustion Residual (CCR) Unit 40 CFR 257.97(a) Selection of Remedy Letter Report.

Consumers Energy Company. September 2023. JH Campbell Ponds 1-2 North and 1-2 South Coal Combustion Residual (CCR) 40 CFR 257.98(e) Completion of Remedy Letter Report.

EGLE. February 26, 2018. EGLE Response to Consumers Energy J.H. Campbell Generating Facility Bottom Ash Ponds 1-2 Closure Work Plan (Rev. 1).

EGLE. October 22, 2019. Bottom Ash Pond 1-2 CCR Removal Documentation Report Approval, Consumers Energy JH Campbell Landfill, Ottawa County.

Golder Associates, Inc. January 2018. J.H. Campbell Generating Facility Bottom Ash Ponds 1-2 Closure Plan, West Olive, Michigan, Pursuant to 40 CFR 257.102.

Golder Associates, Inc. January 2017. Consumers Energy J.H. Campbell Generating Facility Bottom Ash Ponds 3 N/S Closure Work Plan (Rev. 1).

TRC Environmental Corporation. January 2018. Annual Groundwater Monitoring Report, JH Campbell Power Plant, Unit 3 North and 3 South CCR Unit, West Olive, Michigan.

TRC Environmental Corporation. September 2019. Assessment of Corrective Measures Consumers Energy Company JH Campbell Ponds 1-2 North and 1-2 South and Pond A Coal Combustion Residual Units.

TRC Environmental Corporation. January 2023. 2022 Annual Groundwater Monitoring and Corrective Action Report, JH Campbell Power Plant Ponds 1-2 North and 1-2 South CCR Unit, West Olive, Michigan.



# J.H. Campbell Generating Facility

## *Bottom Ash Ponds 1-2 N/S CCR Removal Documentation Report*

Submitted to:

**Consumers Energy Company**

1945 W. Parnall Road  
Jackson, Michigan USA 49201

Submitted by:

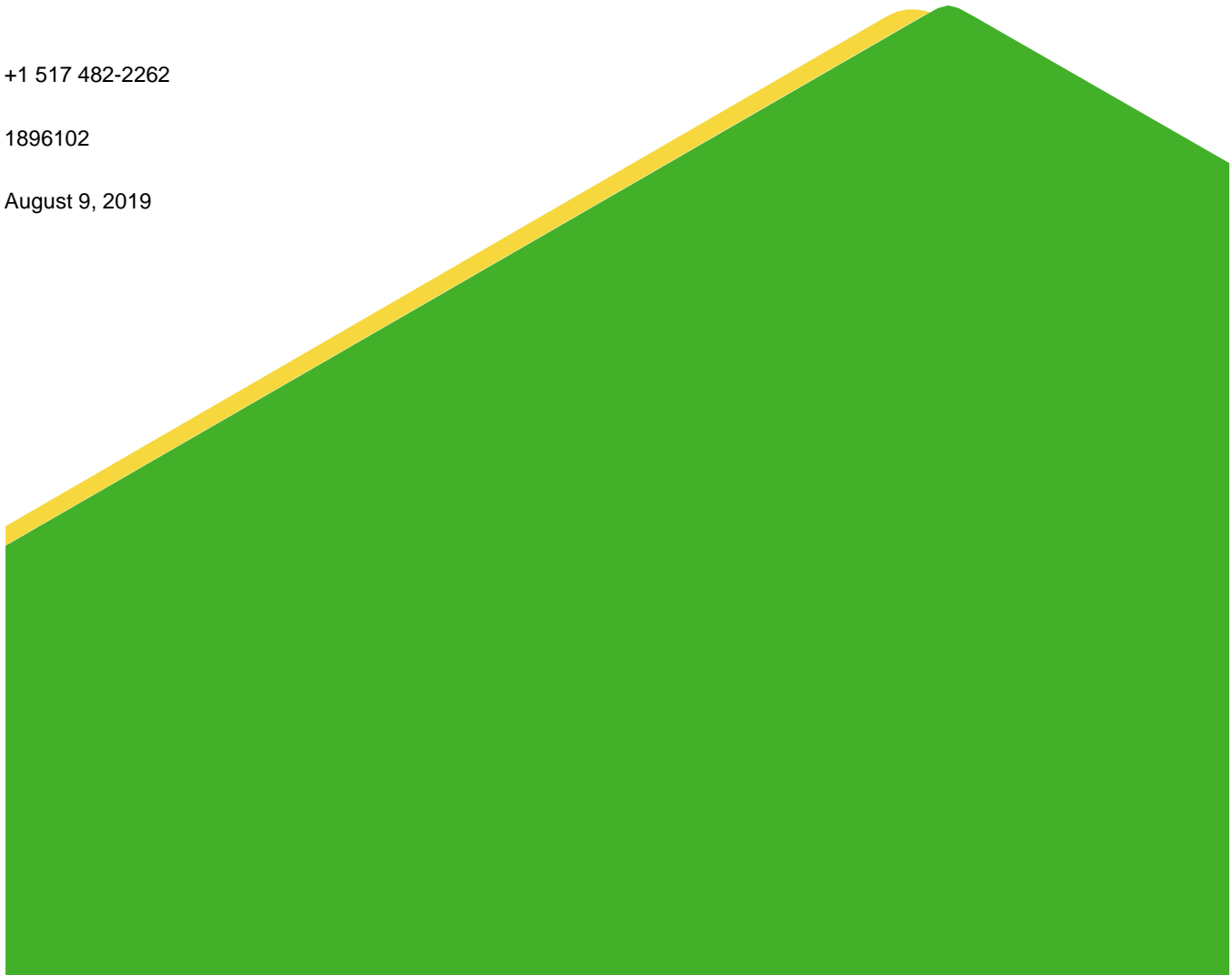
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1896102

August 9, 2019

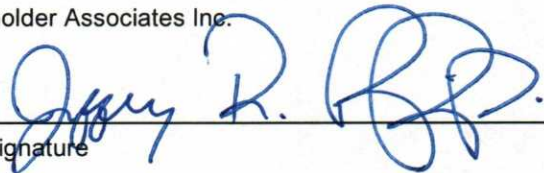


# CERTIFICATION

## Professional Engineer Certification Statement

I hereby certify after having reviewed the attached documentation and being familiar with the *Consumers Energy J.H. Campbell Generating Facility Bottom Ash Ponds 1-2 Closure Work Plan* dated December 4, 2017 (Closure Work Plan) submitted to the Michigan Department of Environment, Great Lakes, and Energy (EGLE, formerly MDEQ) on December 5, 2017, that this CCR Removal Documentation Report is accurate and the work documented was completed in substantial accordance with the requirements of the Closure Work Plan.

Golder Associates Inc.

  
\_\_\_\_\_  
Signature

August 9, 2019  
\_\_\_\_\_  
Date of Report Certification

Jeffrey R. Piaskowski  
\_\_\_\_\_  
Name

6201061033  
\_\_\_\_\_  
Professional Engineer Certification Number



## Executive Summary

This Coal Combustion Residuals (CCR) Removal Documentation Report (Report) has been prepared to document removal of CCR to decommission the Bottom Ash Ponds 1-2 N/S (Ponds 1-2) CCR surface impoundment at the Consumers Energy Company's (CEC) J.H. Campbell Generating Facility (JH Campbell) located in West Olive, Michigan. This Report provides final verification of CCR removal from the entire Bottom Ash Ponds 1-2 CCR unit as a regulated waste under Part 115, Solid Waste Management of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended.

Removal and documentation procedures were implemented as described in the Consumers Energy J.H. Campbell Generating Facility Bottom Ash Ponds 1-2 Closure Work Plan dated December 4, 2017 (Closure Work Plan) submitted to the Michigan Department of Environment, Great Lakes, and Energy (EGLE, formerly MDEQ) on December 5, 2017. EGLE concurred with the Closure Work Plan in a letter dated February 26, 2018. This Report is being submitted to EGLE as a final certification that all solid waste has been removed from Bottom Ash Ponds 1-2.

The multiple lines of evidence approach described in the Closure Work Plan and used to document CCR removal provides a predictable and reliable means to objectively measure concentrations of CCR based on physical sample properties. The approach takes advantage of the clear visible distinction between the color of the CCR and the color of the underlying soil documented in soil borings and during previous removal activities for beneficial reuse and pond cleanout.

The following information was obtained to document the CCR removal objective was met at the Bottom Ash Ponds 1-2 CCR surface impoundment at JH Campbell.

- First line of evidence – comparison of the excavation surface to known elevations of CCR from previous site characterizations and engineering records.

**Appendix A**, Subsurface Investigation Data provides the basis for establishing the proposed excavation surface. **Figure 2**, Bottom Ash Ponds 1-2 N/S Excavation Surface provides documentation of the excavation surface.

- Second line of evidence – photographic documentation including periodic photographs of CCR removal progression and photographs of excavated areas at random grid nodes.

**Appendix B**, Bottom Ash Ponds 1-2 N/S CCR Removal Photo Log and **Appendix C**, Bottom Ash Ponds 1-2 N/S Grid Node Photographic Documentation Log provide photographic documentation of CCR removal. Photographed grid node locations are illustrated on **Figure 4**, Bottom Ash Ponds 1-2 N/S Photographed Grid Nodes.

- Third line of evidence - quantitative colorimetric analysis at random grid nodes to confirm CCR removal.

**Table 1**, Bottom Ash Ponds 1-2 N/S Colorimeter/Microscopy Results documents confirmation of CCR removal. Sampled grid node locations are illustrated on **Figure 5**, Bottom Ash Ponds 1-2 N/S Colorimeter/Microscopy Grid Nodes.

- Alternative third line of evidence – microscopic quantification of CCR content where excavated areas are influenced by soils that do not match the site-specific colorimetric curve for Bottom Ash Ponds 1-2.

**Table 1** documents confirmation of CCR removal. Sampled grid node locations are illustrated on **Figure 5**.



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## APPENDICES

Appendix A	Subsurface Investigation Data
Appendix B	Bottom Ash Ponds 1-2 N/S CCR Removal Photo Log
Appendix C	Bottom Ash Ponds 1-2 N/S Grid Node Photographic Documentation Log
Appendix D	CTL Group CCR Removal Microscopy Memo

## 1.0 INTRODUCTION

### 1.1 Purpose

Consumers Energy Company (CEC) identified Bottom Ash Ponds 1-2 N/S (Ponds 1-2) located at its J.H. Campbell Generating Facility (JH Campbell) in West Olive, Michigan (**Figure 1**) as an “existing CCR surface impoundment” under the Coal Combustion Residual (CCR) Resource Conservation and Recovery Act (RCRA) Rule (40 CFR 257 Subpart D) (“CCR RCRA Rule”), as it was directly receiving and storing commingled CCR and low volume miscellaneous wastewaters as of the effective date of the CCR RCRA Rule (October 19, 2015).

CEC developed the *Consumers Energy J.H. Campbell Generating Facility Bottom Ash Ponds 1-2 Closure Work Plan* dated December 4, 2017 (Closure Work Plan). The Closure Work Plan was submitted to the Michigan Department of Environment Great Lakes, and Energy (EGLE, formerly MDEQ) on December 5, 2017; and EGLE concurred with the Closure Work Plan in a letter dated February 26, 2018. The Closure Work Plan was prepared to request agreement from EGLE on CEC’s plan to close Bottom Ash Ponds 1-2 by removal of CCR and included general descriptions of the following:

- Plans for removal of waste
- Multiple lines of evidence to document waste removal including the basis for an objective waste removal standard to address potential long-term sources of groundwater impacts
- Schedule for implementing the work
- Performance monitoring after waste removal in accordance with the CCR RCRA Rule

This CCR Removal Documentation Report (Report) has been prepared to document and certify the removal of CCR from Bottom Ash Ponds 1-2 and is being submitted to meet the request from EGLE for “submittal of a final certification that all solid waste has been removed along with the supporting documentation after completion of the removal activities.”

## 2.0 CCR REMOVAL AND DOCUMENTATION

Removal and documentation procedures were implemented as described in the Closure Work Plan. The Closure Work Plan presents that CCR removal would be confirmed using an objective standard of at least 95 percent CCR removal; meaning that, following excavation of CCR, the remaining material left in place on the exposed surface would be comprised of no more than five percent CCR particles determined by weight. The 95 percent criterion is based on chemical analyses that have shown the criterion to be protective of groundwater based on non-residential drinking water and groundwater/surface water interface (GSI) criteria.

During excavation operations, CCR removal was documented based on the following three lines of evidence presented in the Closure Work Plan:

- First line of evidence – comparison of the excavation surface to known elevations of CCR from previous site characterizations and engineering records.
- Second line of evidence – photographic documentation including periodic photographs of CCR removal progression and photographs of excavated areas at random grid nodes.
- Third line of evidence - quantitative colorimetric analysis at random grid nodes to confirm CCR removal.

- Alternative third line of evidence – microscopic quantification of CCR content where excavated areas are influenced by soils that do not match the site-specific colorimetric curve for Bottom Ash Ponds 1-2.

## 2.1 Narrative Description of CCR Removal

During August, September, and October 2018 Ryan Incorporated Central (Ryan) was retained by CEC to perform excavation activities to remove CCR from Bottom Ash Ponds 1-2. Documentation was collected by Golder Associates Inc. (Golder) to provide lines of evidence to confirm that 95 percent of the CCR was removed per the Closure Work Plan. During CCR removal and documentation, the following tasks were completed:

- Bottom Ash Ponds 1-2 were dewatered by actively pumping decant water into an overflow ditch and ultimately through the site treatment system and National Pollutant Discharge Elimination System (NPDES) permitted outfall.
- CCR was removed by excavation until CCR was no longer visually observed on the excavation surfaces.
- Final excavation grades were compared to apparent elevations where CCR was noted in borehole logs from previous site characterizations.
- A 50-foot grid with a total of 104 nodes was established across the limits of Bottom Ash Ponds 1-2.
- Photographic documentation was conducted of the general CCR removal operation.
- Photographic documentation of excavated areas was completed on at least 50 percent of the grid nodes.
- Quantitative colorimetric analysis was completed on at least 25 percent of the grid nodes (50 percent of the photographed grid nodes).
- Quantitative microscopic analysis was completed as an alternative to colorimetric analysis where soils on excavated surfaces did not match the site-specific colorimetric curve.

## 2.2 Documentation of Excavation Grades – First Line of Evidence

The first line of evidence to assess CCR removal activities was confirmation that excavations were completed to at least the elevation established as the base of CCR from existing information. The elevation of the base of CCR (proposed CCR excavation limits) was established based on subsurface investigations completed in Bottom Ash Ponds 1-2. The subsurface investigations included the following boreholes, which are presented on **Figure 2** and recorded in **Appendix A**:

- JHC-BH-16005
- JHC-BH-16007
- JHC-BH-16008
- JHC-BH-16005A
- JHC-BH-16007A
- JHC-BH-16006
- JHC-BH-16007B

Visual observations for the presence of CCR were completed during excavation activities until CCR were no longer present on the excavation surface. As the base and side slopes of the excavation approached the proposed CCR excavation limits, the field observations were compared to the material descriptions in the boring logs to assist in selecting the limit of excavation. The base of excavation was at or below anticipated CCR elevations at subsurface investigation locations with the exception of JHC-BH-16007B in Bottom Ash Ponds 1-2, where the excavation surface was 1.6 feet above the anticipated base of CCR. One three-foot-deep test pit (TP-

16007B) was conducted at this location during construction to confirm the CCR removal objective was met. The test pit log is included in **Appendix A**.

### 2.3 Photographic Documentation – Second Line of Evidence

Consistent with EGLE guidance, *Sampling Strategies and Statistics Training Materials for Part 201 Cleanup Criteria (S3TM)*, a 50-foot grid with a total of 104 nodes was established across the limits of Bottom Ash Ponds 1-2 for assessment of CCR removal. The grid is illustrated on **Figure 3**. Confirmation by visual assessment and photographic documentation was completed on at least 50 percent of the grid nodes selected using a random number generator. The locations of the 52 grid nodes selected for photographic documentation are illustrated on **Figure 4**.

Each grid node was inspected visually to identify whether residual CCR was present on the exposed surface of the excavation. If CCR were visible, additional material was removed. When no CCR or only trace amounts of CCR were observed, photographs and written descriptions were taken to document the material left in place at the 52 randomly selected grid nodes. The photography procedure was standardized such that it included the following elements:

- Photographs were taken during construction to document general CCR removal means and methods.
- Photographs were taken of a representative sample area measuring one-square-foot that contained surficial materials present at the base of the excavation at each randomly selected grid node.
- Photographs were taken from a standardized height so that the same area and level of detail is shown by each photograph.

Photographs documenting general CCR removal means and methods are included in **Appendix B**. Photographic documentation of the selected grid nodes are included in **Appendix C**.

### 2.4 Colorimetric – Third Line of Evidence

As described in the Closure Work Plan, a colorimetric analysis utilizing a digital colorimeter to precisely measure the color of a soil sample was developed to confirm CCR removal. Soil samples were collected from the base of the excavation at randomly selected grid nodes using the same grid node selection methodology developed for the photographic documentation (i.e., colorimetric confirmation was conducted on at least 50 percent of the photographed nodes or at least 25 percent of the total grid nodes). The 26 grid nodes that were selected for colorimetric confirmation are illustrated on **Figure 5**. Colorimetric confirmation results for each sampled grid node are included in **Table 1**.

The colorimetric testing was conducted with a Konica-Minolta CR-400 colorimeter in general accordance with ASTM E1347, Standard Test Method for Color and Color-Difference Measurement by Tristimulus Colorimetry. In accordance with the Closure Work Plan, a site-specific color-concentration calibration curve was developed (using samples collected prior to CCR removal) to confirm the 95 percent CCR removal objective was achieved. All sampled grid nodes passed colorimetric confirmation testing, except six grid nodes that were influenced by soils that did not match the site-specific colorimetric curve for Bottom Ash Ponds 1-2. CCR removal at the six grid nodes that did not pass colorimetric analysis was confirmed through microscopy, which is the alternative third line of evidence described in Section 2.5 of this Report.

It should be noted that one minor clarification to the methodology presented in the Closure Work Plan was made and accepted by EGLE in 2017 during field implementation at Bottom Ash Pond 3N. If the CCR content of a sample was measured in the range of 4.5 percent to 5.5 percent, the sample was tested three additional times using the remaining portion of the sample, split three times. This repeated sub-sampling and analysis resulted in the testing of four splits of a sample, from which the average CCR content was reported. This clarification and additional testing was used at Grid Node #19. The remainder of the grid node colorimetry analyses yielded results of 4.5 percent or less CCR.

## 2.5 Microscopy – Alternative Third Line of Evidence

Microscopy was used as an alternative to colorimetric analysis where soils on excavated surfaces did not match the site-specific colorimetric curve. Microscopy determined the darker materials noted in certain locations were due to the presence of silty and organic soils that were not consistent with the site-specific colorimetric curve.

The alternative third line of evidence was used to document CCR removal at the following six grid nodes where colorimetry analysis resulted in false-negatives.

- Grid Node #31
- Grid Node #36
- Grid Node #40R
- Grid Node #49R
- Grid Node #74
- Grid Node #103

Microscopy was used to document the third line of evidence at six grid nodes as illustrated on **Figure 5** and summarized in **Table 1**. A memo provided by CTL Group that documents at least 95 percent CCR removal at these grid nodes is provided in **Appendix D**, CTL Group CCR Removal Microscopy Memo.

## 3.0 SUMMARY

CCR removal and documentation procedures were implemented as described in the Closure Work Plan submitted to EGLE on December 5, 2017. Where the proposed lines of evidence to support CCR removal were not documentable, an alternative line of evidence was documented to support CCR removal met closure objectives. The multiple lines of evidence indicate that CCR has been removed from Bottom Ash Ponds 1-2 at JH Campbell.

The multiple lines of evidence approach provided a predictable and reliable means to objectively measure concentrations of CCR based on physical sample properties and confirmed that the materials remaining on the base of the excavation contained no visually identifiable CCR and documented at least 95 percent CCR removal when tested by colorimetric or microscopic methods.

During excavation operations, CCR removal was documented based on the following three lines of evidence:

- First line of evidence – comparison of the excavation surface to known elevations of CCR from previous site characterizations and engineering records.
- Second line of evidence – photographic documentation including periodic photographs during CCR removal and photographs of excavated areas at random grid nodes.
- Third line of evidence - quantitative colorimetric analysis at random grid nodes to confirm CCR removal.
- Alternative third line of evidence – microscopic quantification of CCR content where excavated areas are influenced by soils that do not match the site-specific colorimetric curve for Bottom Ash Ponds 1-2.

This Report has been prepared to document the removal of solid waste from Bottom Ash Ponds 1-2 and is being submitted to meet the request from EGLE for “submittal of a final certification that all solid waste has been removed along with the supporting documentation after completion of the removal activities.”

### **Standard of Care**

Golder has prepared this Report in a manner consistent with the level of care and skill ordinarily exercised by members of the engineering and science professions currently practicing under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this Report. No other warranty, expressed or implied, is made.

## Signature Page

### Golder Associates Inc.



Jeff Piaskowski, P.E.  
*Senior Project Engineer*



Mark Bergeon, P.G.  
*Program Leader and Associate*

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## Tables



**Table 1: Colorimeter/Microscopy Results - Sampled Grid Nodes**

Node/ Location	Northing	Easting	Date Sampled	Color Value (RGB integer)	Colorimeter CCR (%)	Microscopic Estimation of CCR (%)	Pass / Fail (less than 5%)
2	-1300.00	1909.28	8/27/2018	10980713	3.47	-	Pass
3 <sup>(b)</sup>	-1250.00	1907.36	8/27/2018	11638385	0.00	-	Pass
10 <sup>(b)</sup>	-900.00	1928.57	8/31/2018	11836798	0.00	-	Pass
11	-1385.30	1950.00	8/27/2018	11244403	0.97	-	Pass
13 <sup>(b)</sup>	-1300.00	1950.00	8/27/2018	11440748	0.00	-	Pass
19	-1000.00	1950.00	9/10/2018	10584408	8.87	-	Fail
19R(a)				10847063	5.08	-	Pass
19R(b)				10912856	4.26	-	
19R(c)				11044184	2.79	-	
19R(d)				10978648	3.50	-	
19R Average <sup>(c)</sup>				10945688	3.87	-	
26	-1250.00	2000.00	8/27/2018	9665885	28.90	-	Fail
26R			8/29/2018	11112558	2.11	-	Pass
30 <sup>(b)</sup>	-1050.00	2000.00	8/28/2018	11572077	0.00	-	Pass
31 <sup>(d)</sup>	-1000.00	2000.00	8/31/2018	10517840	(a)	1.0	Pass
36 <sup>(d)</sup>	-1400.00	2050.00	8/27/2018	10388579	(a)	0.5	Pass

(a): Quantitative colorimeter analyses were not practicable for these samples due to the sand color variations and dark organics and other material present in the samples which made them inappropriate for comparison to the colorimeter curve calculated using brown sand and CCR samples.

(b): Colorimeter calculated concentration is less than the reference range, and referred to as non detectable (ND).

(c): If a sample yielded a percent CCR between 4.5% and 5.5%, three additional splits of the sample were analyzed (A, B, C, and D are separately tested splits of the sample). The average of the four results were reported as the percent CCR for the node.

(d): Microscopy analysis was determined to be the most accurate method for testing of CCR percentages for samples with a darker base color than the base sample used for the generation of Ponds 1-2 colorimetric curve.

R: Designates a retest sample collected at the same Northing and Easting of original sample after additional material was removed from a 100 by 100 foot area about the node.

**Table 1: Colorimeter/Microscopy Results - Sampled Grid Nodes**

Node/ Location	Northing	Easting	Date Sampled	Color Value (RGB integer)	Colorimeter CCR (%)	Microscopic Estimation of CCR (%)	Pass / Fail (less than 5%)
40 <sup>(d)</sup>	-1200.00	2050.00	8/27/2018	10582345	8.91	-	Fail
40R <sup>(d)</sup>			8/29/2018	10846806	(a)	< 1.0	Pass
42	-1100.00	2050.00	8/27/2018	10914148	4.24	-	Pass
46 <sup>(b)</sup>	-900.00	2050.00	8/31/2018	11574140	0.00	-	Pass
49 <sup>(d)</sup>	-765.34	2050.00	8/31/2018	10059871	19.02	-	Fail
49R <sup>(d)</sup>	-765.34	2050.00	9/4/2018	9796443	(a)	2.0	Pass
51	-1350.00	2100.00	8/27/2018	11112301	2.11	-	Pass
52	-1300.00	2100.00	8/27/2018	11243886	0.97	-	Pass
54 <sup>(b)</sup>	-1200.00	2100.00	8/27/2018	11573367.00	0.00	-	Pass
57	-1050.00	2100.00	8/28/2018	10979681	3.49	-	Pass
64	-1376.80	2150.00	8/27/2018	11047281	2.76	-	Pass
71	-1050.00	2150.00	8/28/2018	9929060	22.09	-	Fail
71R <sup>(b)</sup>			8/29/2018	11638129	0.00	-	Pass
72	-1000.00	2150.00	8/28/2018	11374957	0.04	-	Pass
74 <sup>(d)</sup>	-900.00	2150.00	9/6/2018	10455401	(a)	1.0	Pass
78	-1368.72	2200.00	8/27/2018	11375214	0.04	-	Pass
93	-1300.00	2243.00	8/27/2018	11177578	1.52	-	Pass
95 <sup>(b)</sup>	-1200.00	2231.00	8/27/2018	11440749	0.00	-	Pass
103 <sup>(d)</sup>	-800.00	2228.33	9/7/2018	10521192	(a)	< 0.5	Pass

(a): Quantitative colorimeter analyses were not practicable for these samples due to the sand color variations and dark organics and other material present in the samples which made them inappropriate for comparison to the colorimeter curve calculated using brown sand and CCR samples.

(b): Colorimeter calculated concentration is less than the reference range, and referred to as non detectable (ND).

(c): If a sample yielded a percent CCR between 4.5% and 5.5%, three additional splits of the sample were analyzed (A, B, C, and D are separately tested splits of the sample). The average of the four results were reported as the percent CCR for the node.

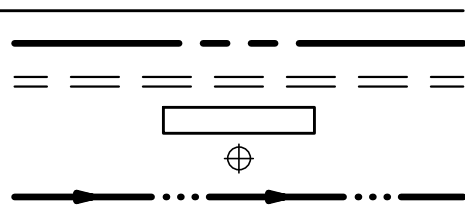
(d): Microscopy analysis was determined to be the most accurate method for testing of CCR percentages for samples with a darker base color than the base sample used for the generation of Ponds 1-2 colorimetric curve.

R: Designates a retest sample collected at the same Northing and Easting of original sample after additional material was removed from a 100 by 100 foot area about the node.

## Figures

**LEGEND**

- SOLID WASTE BOUNDARY
- EXISTING ASH TRESTLE
- EXISTING BUILDING
- BENCHMARK
- DEWATERING DECANT DISCHARGE



REV	DATE	DESCRIPTION	BY	CHK	APP
	08-09-19	ISSUED FOR FINAL REPORT	SSF	HAD	MAB

SIGNATURE
NAME
MICHIGAN P.E. NO.



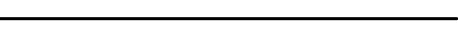


  
**Consumers Energy**  
 J.H. CAMPBELL ASH STORAGE FACILITY

<b>JH CAMPBELL BOTTOM ASH PONDS 1-2 N/S</b>			
<b>SITE OVERVIEW</b>			
SCALE	1" = 400'	DRAWING NO.	FIGURE
JOB			<b>1</b>
			REV.

**NOTES**

- COORDINATES SHOWN ARE ON THE J.H. CAMPBELL LOCAL PLANT DATUM
- ELEVATIONS ARE ON THE J.H. CAMPBELL LOCAL PLANT DATUM (NGVD 29).
- EXCAVATED CONTOURS SHOWN ARE FROM THE POST-EXCAVATION SURVEY DATA PROVIDED BY RYAN INCORPORATED CENTRAL ON SEPTEMBER 19, 2018.

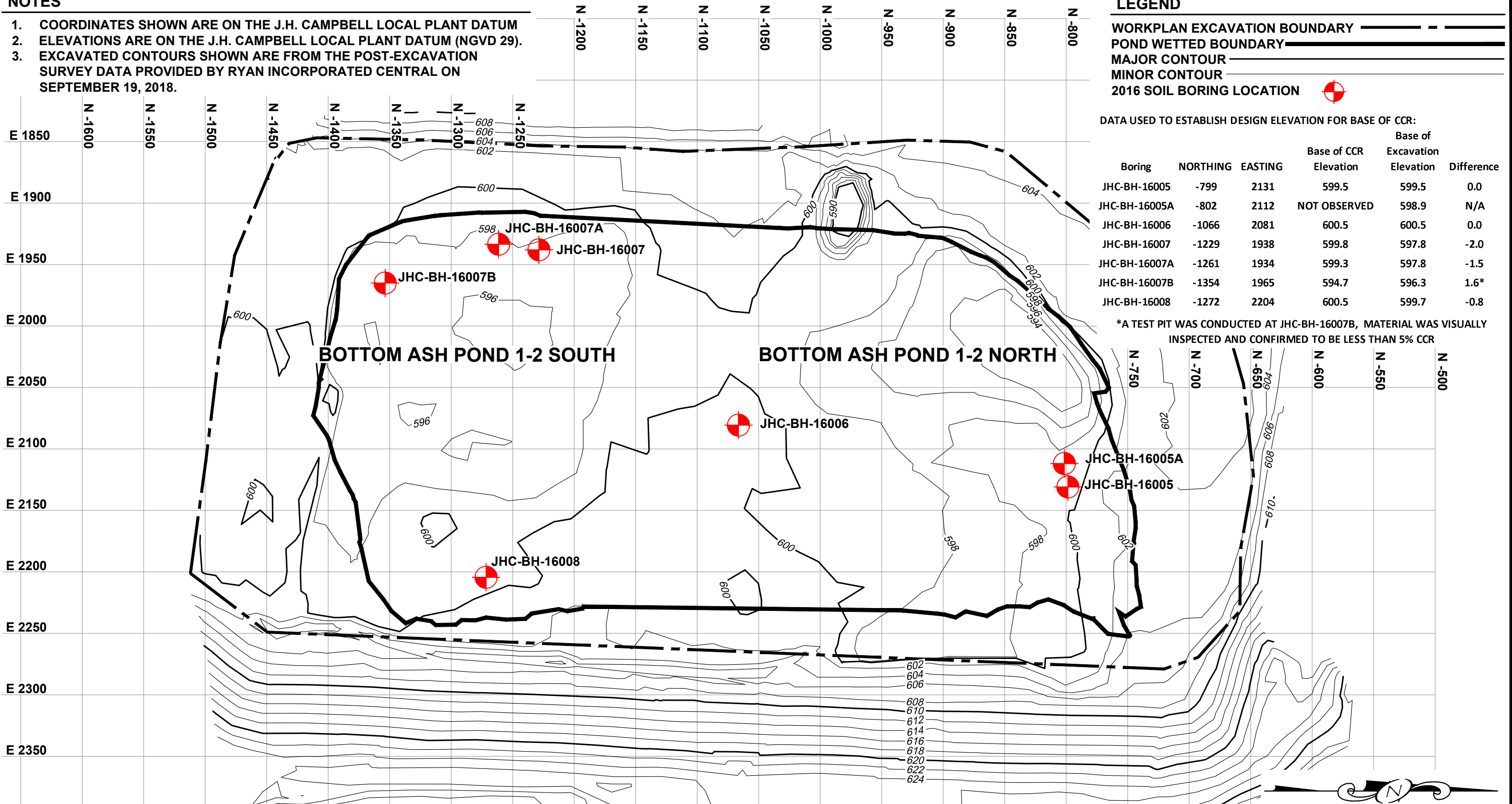
**LEGEND**

- WORKPLAN EXCAVATION BOUNDARY 
- POND WETTED BOUNDARY 
- MAJOR CONTOUR 
- MINOR CONTOUR 
- 2016 SOIL BORING LOCATION 

DATA USED TO ESTABLISH DESIGN ELEVATION FOR BASE OF CCR:

Boring	NORTHING	EASTING	Base of CCR Elevation	Base of Excavation Elevation	Difference
JHC-BH-16005	-799	2131	599.5	599.5	0.0
JHC-BH-16005A	-802	2112	NOT OBSERVED	598.9	N/A
JHC-BH-16006	-1066	2081	600.5	600.5	0.0
JHC-BH-16007	-1229	1938	599.8	597.8	-2.0
JHC-BH-16007A	-1261	1934	599.3	597.8	-1.5
JHC-BH-16007B	-1354	1965	594.7	596.3	1.6*
JHC-BH-16008	-1272	2204	600.5	599.7	-0.8

\*A TEST PIT WAS CONDUCTED AT JHC-BH-16007B, MATERIAL WAS VISUALLY INSPECTED AND CONFIRMED TO BE LESS THAN 5% CCR



REV	DATE	DESCRIPTION	BY	CHK	APP
	08-09-19	ISSUED FOR FINAL REPORT	SSF	HAD	MAB

SIGNATURE
NAME
MICHIGAN P.E. NO.

  
**Consumers Energy**  
 J.H. CAMPBELL ASH STORAGE FACILITY






**JH CAMPBELL BOTTOM ASH PONDS 1-2 N/S**  
**CCR REMOVAL DOCUMENTATION -**  
**EXCAVATION SURFACE**

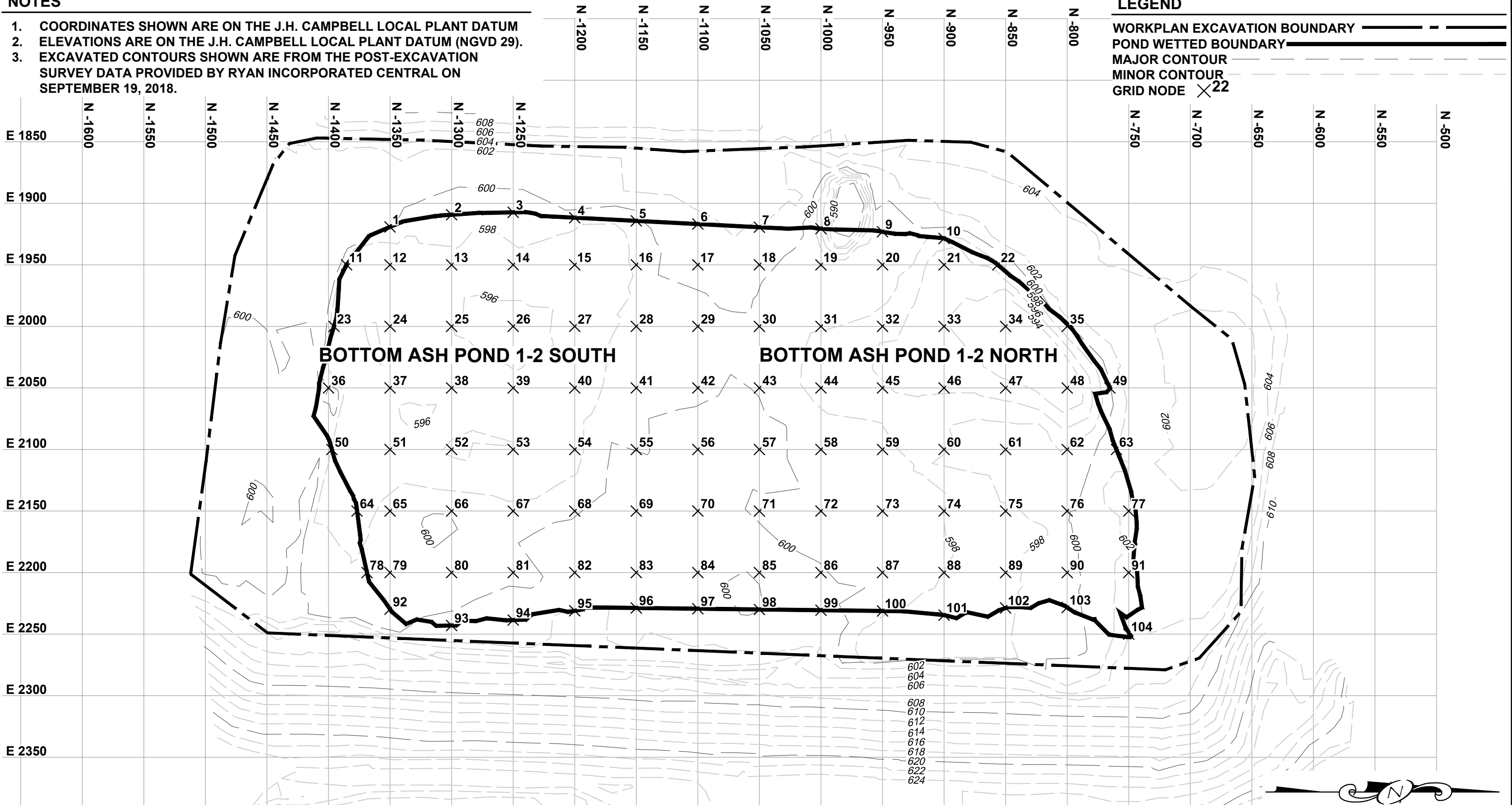
SCALE	1" = 75'	DRAWING NO.	FIGURE	REV.
JOB			<b>2</b>	

**NOTES**

- COORDINATES SHOWN ARE ON THE J.H. CAMPBELL LOCAL PLANT DATUM
- ELEVATIONS ARE ON THE J.H. CAMPBELL LOCAL PLANT DATUM (NGVD 29).
- EXCAVATED CONTOURS SHOWN ARE FROM THE POST-EXCAVATION SURVEY DATA PROVIDED BY RYAN INCORPORATED CENTRAL ON SEPTEMBER 19, 2018.

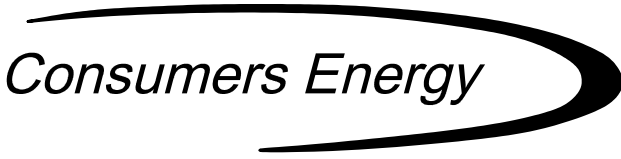
**LEGEND**

- WORKPLAN EXCAVATION BOUNDARY 
- POND WETTED BOUNDARY 
- MAJOR CONTOUR 
- MINOR CONTOUR 
- GRID NODE  22



REV	08-09-19	ISSUED FOR FINAL REPORT	SSF	HAD	MAB
	DATE	DESCRIPTION	BY	CHK	APP

SIGNATURE
NAME
MICHIGAN P.E. NO.

  
**Consumers Energy**  
 J.H. CAMPBELL ASH STORAGE FACILITY

**JH CAMPBELL BOTTOM ASH PONDS 1-2 N/S**  
**CCR REMOVAL DOCUMENTATION -**  
**SAMPLE GRID NODES**

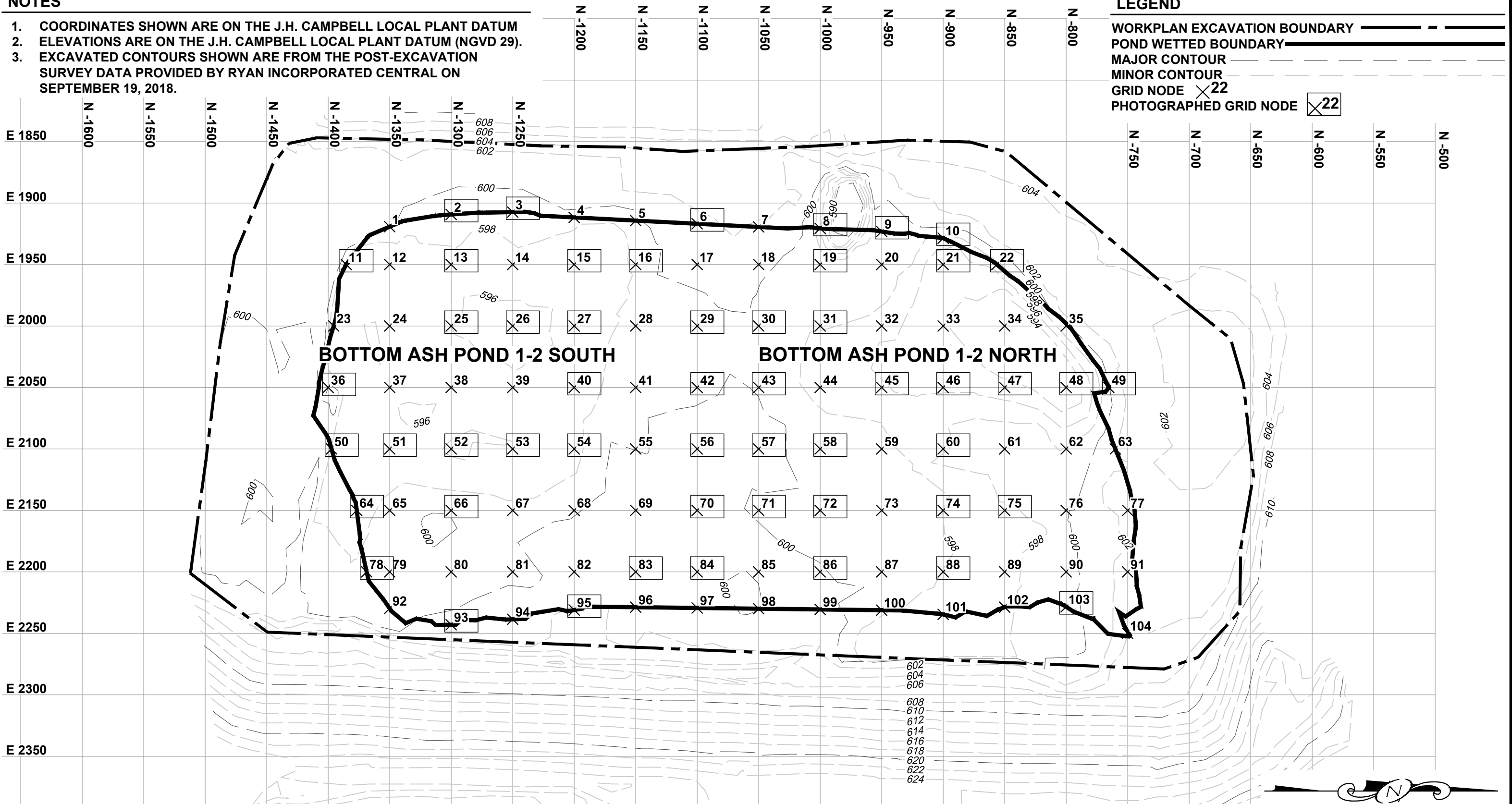
SCALE	1" = 75'	DRAWING NO.	FIGURE	REV.
JOB			<b>3</b>	

**NOTES**

- COORDINATES SHOWN ARE ON THE J.H. CAMPBELL LOCAL PLANT DATUM
- ELEVATIONS ARE ON THE J.H. CAMPBELL LOCAL PLANT DATUM (NGVD 29).
- EXCAVATED CONTOURS SHOWN ARE FROM THE POST-EXCAVATION SURVEY DATA PROVIDED BY RYAN INCORPORATED CENTRAL ON SEPTEMBER 19, 2018.

**LEGEND**

- WORKPLAN EXCAVATION BOUNDARY
- POND WETTED BOUNDARY
- MAJOR CONTOUR
- MINOR CONTOUR
- GRID NODE 22
- PHOTOGRAPHED GRID NODE 22



REV	DATE	DESCRIPTION	BY	CHK	APP
	08-09-19	ISSUED FOR FINAL REPORT	SSF	HAD	MAB

SIGNATURE
NAME
MICHIGAN P.E. NO.

*Consumers Energy*

**J.H. CAMPBELL ASH STORAGE FACILITY**

**JH CAMPBELL BOTTOM ASH PONDS 1-2 N/S  
CCR REMOVAL DOCUMENTATION -  
PHOTOGRAPHED GRID NODES**

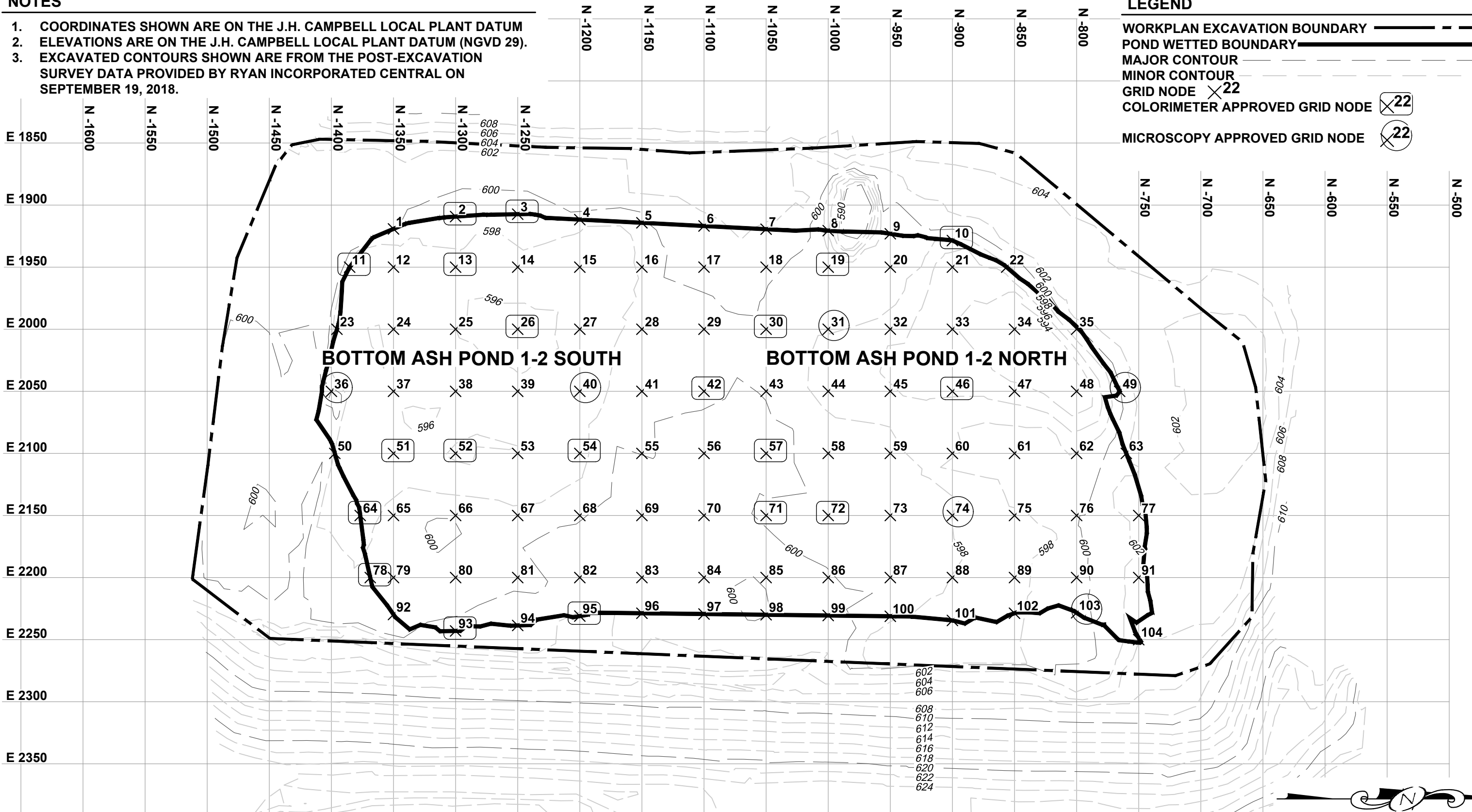
SCALE	1" = 75'	DRAWING NO.	FIGURE	REV.
JOB			<b>4</b>	

**NOTES**

- COORDINATES SHOWN ARE ON THE J.H. CAMPBELL LOCAL PLANT DATUM
- ELEVATIONS ARE ON THE J.H. CAMPBELL LOCAL PLANT DATUM (NGVD 29).
- EXCAVATED CONTOURS SHOWN ARE FROM THE POST-EXCAVATION SURVEY DATA PROVIDED BY RYAN INCORPORATED CENTRAL ON SEPTEMBER 19, 2018.

**LEGEND**

- WORKPLAN EXCAVATION BOUNDARY
- POND WETTED BOUNDARY
- MAJOR CONTOUR
- MINOR CONTOUR
- GRID NODE
- COLORIMETER APPROVED GRID NODE
- MICROSCOPY APPROVED GRID NODE



REV	DATE	DESCRIPTION	BY	CHK	APP
	08-09-19	ISSUED FOR FINAL REPORT	SSF	HAD	MAB

SIGNATURE
NAME
MICHIGAN P.E. NO.

*Consumers Energy*

**J.H. CAMPBELL ASH STORAGE FACILITY**

**JH CAMPBELL BOTTOM ASH PONDS 1-2 N/S**  
**CCR REMOVAL DOCUMENTATION -**  
**COLORIMETER/MICROSCOPY CONFIRMATION GRID NODES**

SCALE	1" = 75'	DRAWING NO.	FIGURE	REV.
JOB			<b>5</b>	



**APPENDIX A**

## Subsurface Investigation Data

PROJECT: JH Campbell Ash Ponds  
 PROJECT NUMBER: 1654923  
 LOCATION: N end of Unit 1/2 N Pond  
 CLIENT: Consumers

## RECORD OF BOREHOLE JHC-BH-16005

SHEET 1 of 1

DRILLING METHOD: Sonic  
 DRILLING DATE: 5-18-16  
 DRILL RIG: Sonic

DATUM: NGVD29  
 AZIMUTH: ---  
 NAD83 MI PLANE-S COORDS: N 518452.6, E 12633735

GS ELEVATION (ft): 605.6  
 TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE			RUN		SAMPLES		POCKET PENETROMETER (tons/ft <sup>2</sup> )	LAB TESTS		NOTES WATER LEVELS	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	REC / ATT	NUMBER		TYPE	ENVIRONMENTAL (SPLP & TOTAL METALS)		GRAIN SIZE DISTRIBUTION
					DEPTH (ft)								
0		VEGETATION:											
0 - 5.1		WATER.		[Dotted Pattern]									
5	Sonic	5.1 - 6.1 (CCR) COAL COMBUSTION RESIDUALS, black, wet, soft.		[Dotted Pattern]	600.5 5.1 599.5 6.1					● ● ●	●		
6.1 - 10.1		(SP) SAND, poorly graded, medium to fine, trace gravel and fines, brown, non-cohesive, wet, loose to compact.	SP		1	5.00 5.00		1 2 3	SONIC SONIC SONIC				
10.1 - 15.1		(SP) No recovery, assumed to be SAND.	SP		2	0.00 5.00							
15		Boring completed at 15.1 ft.			590.5								
20		NOTES: 1. Drilled from a barge. 2. Mud line at a depth of 5.1 feet.											
25													
30													
35													
40													

DUL\_BOREHOLE (BC ASH POND) 1654923 JH CAMPBELL ASH PONDS. 20160715.GPJ DUL\_GOLDER.GDT 6/6/17



DEPTH SCALE: 1 in to 5 ft  
 DRILLING CONTRACTOR: Ann Arbor Tech Serv.  
 DRILLER: Dave/Jim

LOGGED: MMJ  
 CHECKED: JRP  
 DATE: 6/4/2017

PROJECT: JH Campbell Ash Ponds  
 PROJECT NUMBER: 1654923  
 LOCATION: N end of Unit 1/2 N Pond  
 CLIENT: Consumers



# RECORD OF BOREHOLE JHC-BH-16005A

SHEET 1 of 1

DRILLING METHOD: Sonic  
 DRILLING DATE: 5-19-16  
 DRILL RIG: Sonic

DATUM: NGVD29  
 AZIMUTH: ---  
 NAD83 MI PLANE-S COORDS: N 518449.4, E 12633716

GS ELEVATION (ft): 605.6  
 TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE			RUN		SAMPLES		POCKET PENETROMETER (tons/ft <sup>2</sup> )	LAB TESTS		NOTES WATER LEVELS	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	REC / ATT	NUMBER		TYPE	ENVIRONMENTAL (SPLP & TOTAL METALS)		GRAIN SIZE DISTRIBUTION
					DEPTH (ft)								
0	Direct push	VEGETATION: 0.0 - 5.2 WATER.			600.4								
5		5.2 - 10.2 No recovery, see JHC-BH-16005 for lithology.			5.2								
10	Sonic	10.2 - 18.2 (SP) SAND, poorly graded, medium to fine, trace gravel and fines, brown, non-cohesive, wet, loose to compact.	SP		595.4	1	3.00 3.00				●		
15					10.2	2	5.00 5.00	1	SONIC				
20		Boring completed at 18.2 ft.			587.4	2	SONIC			●			
20		<b>NOTES:</b> 1. Drilled from a barge. 2. Mud line at a depth of 5.2 feet. 3. Re-attempt of boring JHC-BH-16005. Barge was relocated approximately 10 feet west of JHC-BH-16005.											

DUL\_BOREHOLE (BC ASH POND) 1654923 JH CAMPBELL ASH PONDS. 20160715.GPJ DUL\_GOLDER.GDT 6/6/17



DEPTH SCALE: 1 in to 5 ft  
 DRILLING CONTRACTOR: Ann Arbor Tech Serv.  
 DRILLER: Dave/Jim

LOGGED: MMJ  
 CHECKED: JRP  
 DATE: 6/4/2017

PROJECT: JH Campbell Ash Ponds  
 PROJECT NUMBER: 1654923  
 LOCATION: S end of Unit 1/2 N Pond  
 CLIENT: Consumers

## RECORD OF BOREHOLE JHC-BH-16006

SHEET 1 of 1

DRILLING METHOD: Sonic  
 DRILLING DATE: 5-18-16  
 DRILL RIG: Sonic

DATUM: NGVD29  
 AZIMUTH: ---  
 NAD83 MI PLANE-S COORDS:

GS ELEVATION (ft): 605.6  
 TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE			RUN		SAMPLES		POCKET PENETROMETER (tons/ft <sup>2</sup> )	LAB TESTS		NOTES WATER LEVELS	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	REC / ATT	NUMBER		TYPE	ENVIRONMENTAL (SPLP & TOTAL METALS)		GRAIN SIZE DISTRIBUTION
					DEPTH (ft)								
0		VEGETATION:											
		0.0 - 4.1 WATER.		[Dotted pattern]									
		4.1 - 5.1 (CCR) COAL COMBUSTION RESIDUALS, black, wet, soft.		[Dotted pattern]	601.5								
5		5.1 - 19.1 (SP) SAND, poorly graded, medium to fine, trace gravel and fines, brown, non-cohesive, wet, loose to compact.		[Dotted pattern]	4.1 600.5 5.1	1	2.00 5.00	1	SONIC	●			
	Sonic		SP			2	5.00 5.00	2	SONIC	●			
						3	3.00 5.00	3 4	SONIC SONIC	● ●			
15					586.5								
20		Boring completed at 19.1 ft.											
		NOTES: 1. Drilled from a barge. 2. Mud line at a depth of 4.1 feet.											
25													
30													
35													
40													

DUL\_BOREHOLE (BC ASH POND) 1654923 JH CAMPBELL ASH PONDS. 20160715.GPJ DUL\_GOLDER.GDT 6/6/17



DEPTH SCALE: 1 in to 5 ft  
 DRILLING CONTRACTOR: Ann Arbor Tech Serv.  
 DRILLER: Dave/Jim

LOGGED: MMJ  
 CHECKED: JRP  
 DATE: 6/4/6017

PROJECT: JH Campbell Ash Ponds  
 PROJECT NUMBER: 1654923  
 LOCATION: W end of Unit 1/2 S Pond  
 CLIENT: Consumers

## RECORD OF BOREHOLE JHC-BH-16007

SHEET 1 of 1

DRILLING METHOD: Sonic  
 DRILLING DATE: 5-18-16  
 DRILL RIG: Sonic

DATUM: NGVD29  
 AZIMUTH: ---  
 NAD83 MI PLANE-S COORDS:

GS ELEVATION (ft): 614.9  
 TOC ELEVATION: ---  
 N 518019.3, E 12633549

DEPTH (ft)	BORING METHOD	SOIL PROFILE			RUN		SAMPLES		POCKET PENETROMETER (tons/ft <sup>2</sup> )	LAB TESTS		NOTES WATER LEVELS	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	REC / ATT	NUMBER		TYPE	ENVIRONMENTAL (SPLP & TOTAL METALS)		GRAIN SIZE DISTRIBUTION
					DEPTH (ft)								
0		VEGETATION:											
0.0 - 7.1		WATER.		[Dotted Pattern]									
7.1 - 10.7	Sonic	(CCR) COAL COMBUSTION RESIDUALS, black to dark gray, wet, soft.		[Dotted Pattern]	607.8 7.1						●	●	
10.7 - 12.1		(SP) SAND, poorly graded, fine, trace to some CCR, trace gravel brown, non-cohesive, wet, loose.	SP	[Dotted Pattern]	604.2 10.7	1	5.00 5.00	2	SONIC		●	●	
12.1 - 15.1		(CCR) COAL COMBUSTION RESIDUALS, dark gray, wet, soft to firm.		[Dotted Pattern]	602.8 12.1	2	2.50 3.00	3	SONIC		●	●	
15.1 - 15.1		Boring completed at 15.1 ft.		[Dotted Pattern]	599.8	4		4	SONIC		●		
20		<p><b>NOTES:</b></p> <ol style="list-style-type: none"> <li>1. Drilled from a barge.</li> <li>2. Mud line at a depth of 7.1 feet.</li> <li>3. Unable to recover material below 15.1 feet. Drillers were able to advance casing; however, material was not entering the casing and sample liner. There may have been a buried boulder too large to enter the casing or the material below 15.1 feet was unable to displace sampled material already present in the casing.</li> </ol>											

DUL\_BOREHOLE (BC ASH POND) 1654923 JH CAMPBELL ASH PONDS. 20160715.GPJ DUL\_GOLDER.GDT 6/6/17



DEPTH SCALE: 1 in to 5 ft  
 DRILLING CONTRACTOR: Ann Arbor Tech Serv.  
 DRILLER: Dave/Jim

LOGGED: MMJ  
 CHECKED: JRP  
 DATE: 6/4/2017

PROJECT: JH Campbell Ash Ponds  
 PROJECT NUMBER: 1654923  
 LOCATION: W end of Unit 1/2 S Pond  
 CLIENT: Consumers

## RECORD OF BOREHOLE JHC-BH-16007A

SHEET 1 of 1

DRILLING METHOD: Sonic  
 DRILLING DATE: 5-18-16  
 DRILL RIG: Sonic

DATUM: NGVD29  
 AZIMUTH: ---  
 NAD83 MI PLANE-S COORDS: N 517986.5, E 12633545

GS ELEVATION (ft): 614.9  
 TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE			RUN		SAMPLES		POCKET PENETROMETER (tons/ft <sup>2</sup> )	LAB TESTS		NOTES WATER LEVELS	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	REC / ATT	NUMBER		TYPE	ENVIRONMENTAL (SPLP & TOTAL METALS)		GRAIN SIZE DISTRIBUTION
					DEPTH (ft)								
0	Direct push	0.0 - 7.1 WATER.		[Dotted Pattern]	607.8								
5		7.1 - 13.8 No recovery, see JHC-BH-16007 for lithology.			7.1								
10	Sonic	13.8 - 15.6 (CCR) COAL COMBUSTION RESIDUALS, black to dark gray, wet, soft.		[Triangle Pattern]	601.1 13.8			1	SONIC		●	●	
15		15.6 - 17.8 (SP) SAND, poorly graded, medium to fine, trace fines, brown, non-cohesive, wet, loose to compact.	SP	[Dotted Pattern]	599.3 15.6	1	4.00 4.00	2	SONIC		●		
20		Boring completed at 17.8 ft.											
25	<p><b>NOTES:</b></p> <ol style="list-style-type: none"> <li>1. Drilled from a barge.</li> <li>2. Mud line at a depth of 7.1 feet.</li> <li>3. Re-attempt of boring JHC-BH-16007. Barge was relocated approximately 5 to 10 feet south of JHC-BH-16007.</li> <li>4. Unable to recover material below 17.8 feet. Encountered similar conditions as JHC-BH-16007. Drillers suspect the material below 17.8 feet was unable to displace sampled material already present in the casing.</li> </ol>												
30													
35													
40													

DUL\_BOREHOLE (BC ASH POND) 1654923 JH CAMPBELL ASH PONDS. 20160715.GPJ DUL\_GOLDER.GDT 6/6/17



DEPTH SCALE: 1 in to 5 ft  
 DRILLING CONTRACTOR: Ann Arbor Tech Serv.  
 DRILLER: Dave/Jim

LOGGED: MMJ  
 CHECKED: JRP  
 DATE: 6/4/2017

PROJECT: JH Campbell Ash Ponds  
 PROJECT NUMBER: 1654923  
 LOCATION: W end of Unit 1/2 S Pond  
 CLIENT: Consumers

## RECORD OF BOREHOLE JHC-BH-16007B

SHEET 1 of 1

DRILLING METHOD: Sonic  
 DRILLING DATE: 5-19-16  
 DRILL RIG: Sonic

DATUM: NGVD29  
 AZIMUTH: ---  
 NAD83 MI PLANE-S COORDS: N 517894.7, E 12633578

GS ELEVATION (ft): 614.9  
 TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE			RUN		SAMPLES		POCKET PENETROMETER (tons/ft <sup>2</sup> )	LAB TESTS		NOTES WATER LEVELS	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	REC / ATT	NUMBER		TYPE	ENVIRONMENTAL (SPLP & TOTAL METALS)		GRAIN SIZE DISTRIBUTION
					DEPTH (ft)								
0	Direct push	0.0 - 7.0 WATER.		[Dotted Pattern]	607.9								
5		7.0 - 12.0 No recovery, see JHC-BH-16007 for lithology.			7.0								
10	Sonic	12.0 - 16.0 (SP) SAND, poorly graded, fine, trace to some CCR, trace gravel, brown, non-cohesive, wet, loose.	SP	[Dotted Pattern]	602.9 12.0	1	4.00 4.00						
15		16.0 - 18.2 (CCR) COAL COMBUSTION RESIDUALS, black, wet, soft.		[Triangle Pattern]	598.9 16.0			1	SONIC	●			
20		18.2 - 20.2 (CCR) COAL COMBUSTION RESIDUALS with SAND, dark grayish brown, wet, loose.		[Triangle Pattern]	596.7 18.2	2	5.00 5.00						
25		20.2 - 26.0 (SP) SAND, poorly graded, medium to fine, trace fines, brown, non-cohesive, wet, loose to compact.	SP	[Dotted Pattern]	594.7 20.2	3	2.00 5.00	2	SONIC	●	●		
30		Boring completed at 26.0 ft.				588.9							
35	<p><b>NOTES:</b></p> <ol style="list-style-type: none"> <li>1. Drilled from a barge.</li> <li>2. Mud line at a depth of 7.0 feet.</li> <li>3. Re-attempt of boring JHC-BH-16007. Barge was relocated approximately 20 feet south of JHC-BH-16007.</li> </ol>												
40													

DUL BOREHOLE (BC ASH POND) 1654923 JH CAMPBELL ASH PONDS. 20160715.GPJ DUL\_GOLDER.GDT 6/6/17



DEPTH SCALE: 1 in to 5 ft  
 DRILLING CONTRACTOR: Ann Arbor Tech Serv.  
 DRILLER: Dave/Jim

LOGGED: MMJ  
 CHECKED: JRP  
 DATE: 6/4/2017

PROJECT: JHC Pond Closures  
 PROJECT NUMBER: 1896102  
 LOCATION: Pond 1-2 S  
 CLIENT: CEC

# RECORD OF TEST PIT TP-16007B

SHEET 1 of 1

EXCAVATION DATE: 8-27-18  
 EQUIPMENT: Shovel

DATUM: NGVD29  
 COORDS: N: -1,354 E: 1,965

GS ELEVATION (ft): 597.31

DEPTH (ft)	SOIL PROFILE				SAMPLES		NOTES AND REMARKS	WATER CONTENT (PERCENT)				NOTES WATER LEVELS
	DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE		W <sub>e</sub>   10 20 30 40   W <sub>i</sub>				
				DEPTH (ft)								
0	VEGETATION: 0.0 - 3.0 (SP) SAND, poorly graded, fine to medium, light brown.	SP										
	Boring completed at 3.0 ft.				594.3							
5	NOTES: 1. Coordinates provided in plant datum.											
10												

DUL\_TESTPIT\_POND\_CLOSURE.GPJ GLDR\_ANC.GDT 7/16/19



DEPTH SCALE: 1 in to 1.3 ft  
 DRILLING CONTRACTOR: Golder  
 DRILLER: HD

LOGGED: HD  
 CHECKED: JRP  
 DATE: 7/16/2019

Figure TP-16007B



PROJECT: JH Campbell Ash Ponds  
 PROJECT NUMBER: 1654923  
 LOCATION: E end of Unit 1/2 S Pond  
 CLIENT: Consumers

## RECORD OF BOREHOLE JHC-BH-16008

SHEET 1 of 1

DRILLING METHOD: Sonic  
 DRILLING DATE: 5-18-16  
 DRILL RIG: Sonic

DATUM: NGVD29  
 AZIMUTH: ---  
 NAD83 MI PLANE-S COORDS: N 517980.6, E 12633816

GS ELEVATION (ft): 614.9  
 TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE			RUN		SAMPLES		POCKET PENETROMETER (tons/ft <sup>2</sup> )	LAB TESTS		NOTES WATER LEVELS	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	REC / ATT	NUMBER		TYPE	ENVIRONMENTAL (SPLP & TOTAL METALS)		GRAIN SIZE DISTRIBUTION
					DEPTH (ft)								
0		0.0 - 6.4 WATER.		[Dotted Pattern]									
	Sonic	6.4 - 7.9 (CCR) COAL COMBUSTION RESIDUALS, black, wet, soft.		[Dotted Pattern]	608.5 6.4			1	SONIC		●		
		7.9 - 11.4 (SP) SAND, poorly graded, fine, trace gravel, reddish brown, non-cohesive, wet, loose.	SP	[Dotted Pattern]	607.0 7.9	1	5.00 5.00	2 3	SONIC SONIC		● ●		
		11.4 - 14.4 (CCR) COAL COMBUSTION RESIDUALS with SAND, fine to coarse, trace to some gravel, black to dark brown, non-cohesive, wet, loose.		[Dotted Pattern]	603.5 11.4			4	SONIC		●	●	
		14.4 - 16.4 (SP) SAND, poorly graded, medium to fine, trace gravel and fines, brown, non-cohesive, wet, loose to compact.	SP	[Dotted Pattern]	600.5 14.4	2	5.00 5.00	5	SONIC		●	●	
		Boring completed at 16.4 ft.											
20		<p><b>NOTES:</b></p> <ol style="list-style-type: none"> <li>1. Drilled from a barge.</li> <li>2. Mud line at a depth of 6.4 feet.</li> <li>3. Drillers observed a hard layer at 14.4 feet while sampling, similar to conditions encountered in JHC-BH-16007. No sample was recovered below 14.4 feet on the initial attempt. Driller obtained full recovery between 11.4 and 16.4 feet on a second attempt.</li> </ol>											

DUL\_BOREHOLE (BC ASH POND) 1654923 JH CAMPBELL ASH PONDS. 20160715.GPJ DUL\_GOLDER.GDT 6/6/17



DEPTH SCALE: 1 in to 5 ft  
 DRILLING CONTRACTOR: Ann Arbor Tech Serv.  
 DRILLER: Dave/Jim

LOGGED: MMJ  
 CHECKED: JRP  
 DATE: 6/4/2017

**APPENDIX B**

**Bottom Ash Ponds 1-2 N/S CCR  
Removal Photo Log**

**Project Title: Ponds 1-2 N/S Excavation Sequence Photo Documentation Log**

**PHOTO 1**

Date: 2018/06/06

Prior to beginning CCR  
removal

Orientation: Looking north.



**PHOTO 2**

Date: 2018/06/06

Prior to beginning CCR  
removal

Orientation: Ortho



**Project Title: Ponds 1-2 N/S Excavation Sequence Photo Documentation Log**

**PHOTO 3**

Date: 2018/06/21

First day of CCR removal.

Orientation: Looking northwest.



**PHOTO 4**

Date: 2018/06/25

Orientation: Looking north.



**Project Title: Ponds 1-2 N/S Excavation Sequence Photo Documentation Log**

**PHOTO 5**

Date: 2018/06/26

Orientation: Looking north.



**PHOTO 6**

Date: 2018/06/26

Orientation: Ortho.



**Project Title: Ponds 1-2 N/S Excavation Sequence Photo Documentation Log**

**PHOTO 7**

Date: 2018/06/28

Orientation: Looking west.



**PHOTO 8**

Date: 2018/06/29

Orientation: Looking east.



**Project Title: Ponds 1-2 N/S Excavation Sequence Photo Documentation Log**

**PHOTO 9**

Date: 2018/07/02

Orientation: Looking south.



**PHOTO 10**

Date: 2018/07/06

Orientation: Looking west.



**Project Title: Ponds 1-2 N/S Excavation Sequence Photo Documentation Log**

**PHOTO 11**

Date: 2018/07/09

Orientation: Looking west.



**PHOTO 12**

Date: 2018/07/10

Orientation: Looking southwest.





**Project Title: Ponds 1-2 N/S Excavation Sequence Photo Documentation Log**

**PHOTO 13**

Date: 2018/07/11

Orientation: Looking south.



**PHOTO 14**

Date: 2018/07/12

Orientation: Looking southwest.



**Project Title: Ponds 1-2 N/S Excavation Sequence Photo Documentation Log**

**PHOTO 15**

Date: 2018/07/24

Orientation: Looking north.



**PHOTO 16**

Date: 2018/07/24

Orientation: Ortho.



**Project Title: Ponds 1-2 N/S Excavation Sequence Photo Documentation Log**

**PHOTO 17**

Date: 2018/07/25

Orientation: Looking southwest.



**PHOTO 18**

Date: 2018/07/26

Orientation: Looking south.



**Project Title: Ponds 1-2 N/S Excavation Sequence Photo Documentation Log**

**PHOTO 19**

Date: 2018/07/30

Orientation: Looking south.



**PHOTO 20**

Date: 2018/07/31

Orientation: Looking southwest.



**Project Title: Ponds 1-2 N/S Excavation Sequence Photo Documentation Log**

**PHOTO 21**

Date: 2018/08/01

Orientation: Looking west.



**PHOTO 22**

Date: 2018/08/02

Orientation: Looking south.



**Project Title: Ponds 1-2 N/S Excavation Sequence Photo Documentation Log**

**PHOTO 23**

Date: 2018/08/03

Orientation: Looking southwest.



**PHOTO 24**

Date: 2018/08/07

Orientation: Looking south.



**Project Title: Ponds 1-2 N/S Excavation Sequence Photo Documentation Log**

**PHOTO 25**

Date: 2018/08/08

Orientation: Looking south.



**PHOTO 26**

Date: 2018/08/09

Orientation: Looking south.



**Project Title: Ponds 1-2 N/S Excavation Sequence Photo Documentation Log**

**PHOTO 27**

Date: 2018/08/13

Orientation: Looking south.



**PHOTO 28**

Date: 2018/08/15

Orientation: Looking south.





**Project Title: Ponds 1-2 N/S Excavation Sequence Photo Documentation Log**

**PHOTO 29**

Date: 2018/08/16

Orientation: Looking south.



**PHOTO 30**

Date: 2018/08/17

Orientation: Looking south.



**Project Title: Ponds 1-2 N/S Excavation Sequence Photo Documentation Log**

**PHOTO 31**

Date: 2018/08/20

Orientation: Looking south.



**PHOTO 32**

Date: 2018/08/21

Orientation: Looking south.



**Project Title: Ponds 1-2 N/S Excavation Sequence Photo Documentation Log**

**PHOTO 33**

Date: 2018/08/22

Orientation: Looking North.



**PHOTO 34**

Date: 2018/08/22

Orientation: Ortho



**Project Title: Ponds 1-2 N/S Excavation Sequence Photo Documentation Log**

**PHOTO 35**

Date: 2018/08/23

Orientation: Looking southwest.



**PHOTO 36**

Date: 2018/08/27

Orientation: Looking south.



**Project Title: Ponds 1-2 N/S Excavation Sequence Photo Documentation Log**

**PHOTO 37**

Date: 2018/08/28

Orientation: Looking south.



**PHOTO 38**

Date: 2018/08/29

Orientation: Looking south.



**Project Title: Ponds 1-2 N/S Excavation Sequence Photo Documentation Log**

**PHOTO 39**

Date: 2018/08/30

Orientation: Looking south.



**PHOTO 40**

Date: 2018/08/31

Orientation: Looking south.



**Project Title: Ponds 1-2 N/S Excavation Sequence Photo Documentation Log**

**PHOTO 41**

Date: 2018/09/04

Orientation: Looking south.



**PHOTO 42**

Date: 2018/09/05

Orientation: Looking south.



**PHOTO 42**

Date: 2018/09/18

Orientation: Looking north.



**PHOTO 42**

Date: 2018/09/18

Orientation: Ortho





**PHOTO 42**

Date: 2018/10/25

Orientation: Looking north.



**PHOTO 42**

Date: 2018/10/25

Orientation: Ortho



**APPENDIX C**

**Bottom Ash Ponds 1-2 N/S  
Grid Node Photographic  
Documentation Log**

**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 1**

**Node Number:** 2  
**Location:** North -1300.00,  
 East 1909.28  
**Colorimeter Result:** 3.47  
 percent CCR



**PHOTO 2**

**Node Number:** 3  
**Location:** North -1050.00,  
 East 2000.00  
**Colorimeter Result:** Non-  
 detectable (ND), -1.17  
 percent CCR



**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 3**

**Node Number:** 6  
**Location:** North -1100.00,  
East 1916.85  
**Colorimeter Result:** N/A



**PHOTO 4**

**Node Number:** 8  
**Location:** North -1000.00,  
East 1920.59  
**Colorimeter Result:** N/A



**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 5**

**Node Number:** 9  
**Location:** North -950.00,  
East 1923.12  
**Colorimeter Result:** N/A



**PHOTO 6**

**Node Number:** 10  
**Location:** North -900.00,  
East 1928.57  
**Colorimeter Result:** ND,  
-1.52 percent CCR



**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 7**

**Node Number:** 11  
**Location:** North -1385.30,  
 East 1950.00  
**Colorimeter Result:** 0.97  
 percent CCR



**PHOTO 8**

**Node Number:** 13  
**Location:** North -1300.00,  
 East 1950.00  
**Colorimeter Result:** ND,  
 -0.34 percent CCR



**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 9**

**Node Number:** 15  
**Location:** North -1200.00,  
East 1950.00  
**Colorimeter Result:** N/A  
**Note:** Darker brown and red  
sand



**PHOTO 10**

**Node Number:** 16  
**Location:** North -1150.00,  
East 1950.00  
**Colorimeter Result:** N/A



**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 11**

**Node Number:** 19  
**Location:** North -1000.00,  
East 1950.00  
**Colorimeter Result:** 3.87  
percent CCR



**PHOTO 12**

**Node Number:** 21  
**Location:** North -900.00,  
East 1950.00  
**Colorimeter Result:** N/A





**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 13**

**Node Number:** 22  
**Location:** North -856.34,  
East 1950.00  
**Colorimeter Result:** N/A



**PHOTO 14**

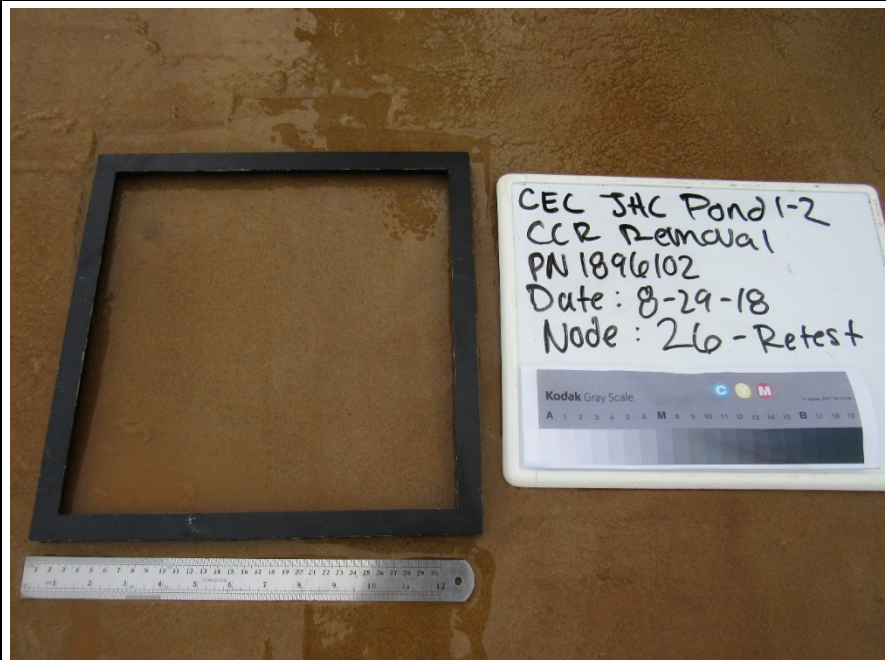
**Node Number:** 25  
**Location:** North -1300.00,  
East 2000.00  
**Colorimeter Result:** N/A



**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 15**

**Node Number:** 26  
**Location:** North -1250.00,  
East 2000.00  
**Colorimeter Result:** 2.11  
percent CCR



**PHOTO 16**

**Node Number:** 27  
**Location:** North -1200.00,  
East 2000.00  
**Colorimeter Result:** N/A



**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 17**

**Node Number:** 29  
**Location:** North -1100.00,  
East 2000.00  
**Colorimeter Result:** N/A



**PHOTO 18**

**Node Number:** 30  
**Location:** North -1050.00,  
East 2000.00  
**Colorimeter Result:** ND,  
-0.95 percent CCR



**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 19**

**Node Number:** 31  
**Location:** North -1000.00,  
 East 2000.00  
**Microscopy Result:**  
 1.0 percent CCR  
**Note:** Sand exhibits more  
 orange tint than base sand  
 on which reference curves  
 are based.



**PHOTO 20**

**Node Number:** 36  
**Location:** North -1400.00,  
 East 2050.00  
**Microscopy Result:**  
 0.5 percent CCR  
**Note:** Sand exhibits browner  
 tint than base sand on which  
 reference curves are based.



**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 21**

**Node Number:** 40  
**Location:** North -1200.00,  
 East 2050.00  
**Microscopy Result:**  
 Less than 1.0 percent CCR  
**Note:** Sand exhibits  
 somewhat more orange tint  
 than base sand on which  
 reference curves are based.



**PHOTO 22**

**Node Number:** 42  
**Location:** North -1100.00,  
 East 2050.00  
**Colorimeter Result:** 4.24  
 percent CCR



**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 23**

**Node Number:** 43  
**Location:** North -1050.00,  
East 2050.00  
**Colorimeter Result:** N/A



**PHOTO 24**

**Node Number:** 45  
**Location:** North -950.00,  
East 2050.00  
**Colorimeter Result:** N/A



**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 25**

**Node Number:** 46  
**Location:** North -900.00,  
East 2050.00  
**Colorimeter Result:** ND,  
-0.95 percent CCR



**PHOTO 26**

**Node Number:** 47  
**Location:** North -850.00,  
East 2050.00  
**Colorimeter Result:** N/A



**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 27**

**Node Number:** 48R  
**Location:** North -800.00,  
 East 2050.00  
**Colorimeter Result:** N/A



**PHOTO 28**

**Node Number:** 49R  
**Location:** North -765.34,  
 East 2050.00  
**Microscopy Result:**  
 2.0 percent CCR  
**Notes:** Sample contained  
 dark organic debris (e.g.  
 fragments of twigs/bark).  
 Sand exhibits browner tint  
 than base sand on which  
 reference curves are based.





**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 29**

**Node Number:** 50  
**Location:** North -1397.24,  
East 2100.00  
**Colorimeter Result:** N/A



**PHOTO 30**

**Node Number:** 51  
**Location:** North -1350.00,  
East 2100.00  
**Colorimeter Result:** 2.11  
percent CCR



**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

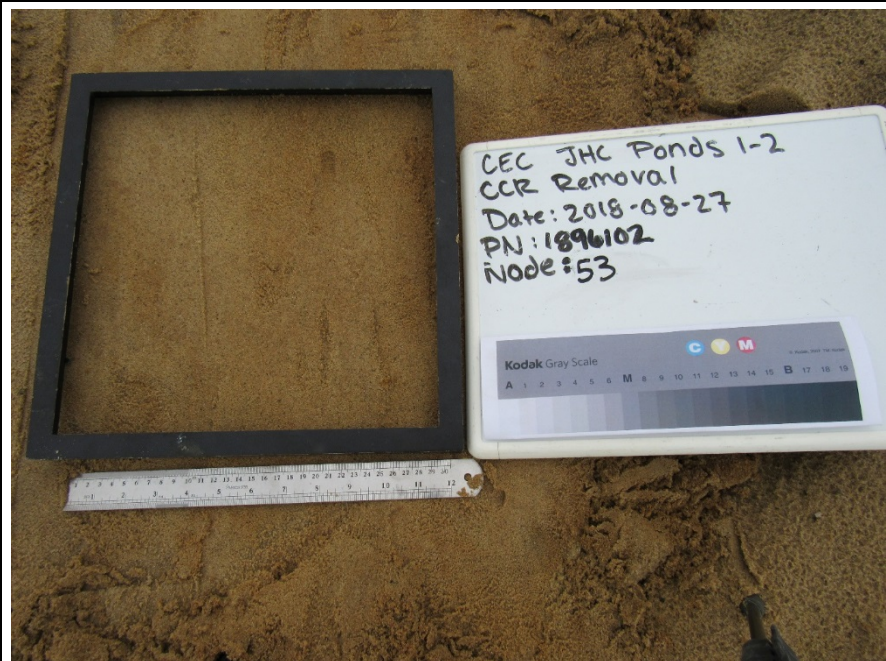
**PHOTO 31**

**Node Number:** 52  
**Location:** North -1300.00,  
East 2100.00  
**Colorimeter Result:** 0.97  
percent CCR



**PHOTO 32**

**Node Number:** 53  
**Location:** North -1250.00,  
East 2100.00  
**Colorimeter Result:** N/A



**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 33**

**Node Number:** 54  
**Location:** North -1200.00,  
East 2100.00  
**Colorimeter Result:** ND,  
-0.95 percent CCR



**PHOTO 34**

**Node Number:** 56  
**Location:** North -1100.00,  
East 2100.00  
**Colorimeter Result:** N/A



**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 35**

**Node Number:** 57  
**Location:** North -1050.00,  
East 2100.00  
**Colorimeter Result:** 3.49  
percent CCR



**PHOTO 36**

**Node Number:** 58  
**Location:** North -1000.00,  
East 2100.00  
**Colorimeter Result:** N/A



**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 37**

**Node Number:** 60  
**Location:** North -900.00,  
East 2100.00  
**Colorimeter Result:** N/A



**PHOTO 38**

**Node Number:** 64  
**Location:** North -1376.80,  
East 2150.00  
**Colorimeter Result:** 2.76  
percent CCR



**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 39**

**Node Number:** 66  
**Location:** North -1300.00,  
East 2150.00  
**Colorimeter Result:** N/A



**PHOTO 40**

**Node Number:** 70  
**Location:** North -1100.00,  
East 2150.00  
**Colorimeter Result:** N/A



**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 41**

**Node Number:** 71R  
**Location:** North -1050.00,  
East 2150.00  
**Colorimeter Result:** ND,  
-1.17 percent CCR



**PHOTO 42**

**Node Number:** 72  
**Location:** North -1000.00,  
East 2150.00  
**Colorimeter Result:** 0.04  
percent CCR



**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 43**

**Node Number:** 74  
**Location:** North -900.00,  
 East 2150.00  
**Microscopy Result:**  
 1.0 percent CCR  
**Note:** Sand exhibits  
 browner tint than base sand  
 on which reference curves  
 are based.



**PHOTO 44**

**Node Number:** 75  
**Location:** North -850.00,  
 East 2150.00  
**Colorimeter Result:** N/A





**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 45**

**Node Number:** 78  
**Location:** North -1368.72,  
East 2200.00  
**Colorimeter Result:** 0.04  
percent CCR



**PHOTO 46**

**Node Number:** 83  
**Location:** North -1150.00,  
East 2200.00  
**Colorimeter Result:** N/A



**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 47**

**Node Number:** 84  
**Location:** North -1100.00,  
East 2200.00  
**Colorimeter Result:** N/A



**PHOTO 48**

**Node Number:** 86  
**Location:** North -1000.00,  
East 2200.00  
**Colorimeter Result:** N/A



**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 49**

**Node Number:** 88  
**Location:** North -900.00,  
East 2200.00  
**Colorimeter Result:** N/A



**PHOTO 50**

**Node Number:** 93  
**Location:** North -1300.00,  
East 2243.00  
**Colorimeter Result:** 1.52  
percent CCR



**Project Title: Ponds 1-2 N/S Grid Node Photographic Documentation Log**

**PHOTO 51**

**Node Number:** 95  
**Location:** North -1200.00,  
 East 2231.00  
**Colorimeter Result:** ND,  
 -0.34 percent CCR



**PHOTO 52**

**Node Number:** 103  
**Location:** North -800.00,  
 East 2228.33  
**Microscopy Result:** less  
 than 0.5 percent CCR  
**Note:** Sand exhibits browner  
 tint than base sand on which  
 reference curves are based.



**APPENDIX D**

## CTL Group CCR Removal Microscopy Memo



**CTLGroup MEMO**

Project No.: 150283  
To: Jeff Piaskowski, Golder Associates, Inc.

Date: March 22, 2019  
From: Laura Powers

Subject: **Microscopical Examination of CCR Ponds 1-2 Colorimetry Fail Samples**

CTLGroup has re-analyzed a suite of field samples from the Ponds 1-2 nodes listed in Table 1 to estimate the amount of CCR and provide micrographs illustrating the general characteristics of the soil. Field colorimetry values for these samples exceeded the 5% threshold. Field microscopy determined that the amount of CCR in each sample was less than this value. Estimates made in the laboratory confirm that the amount of CCR is less than 5%.

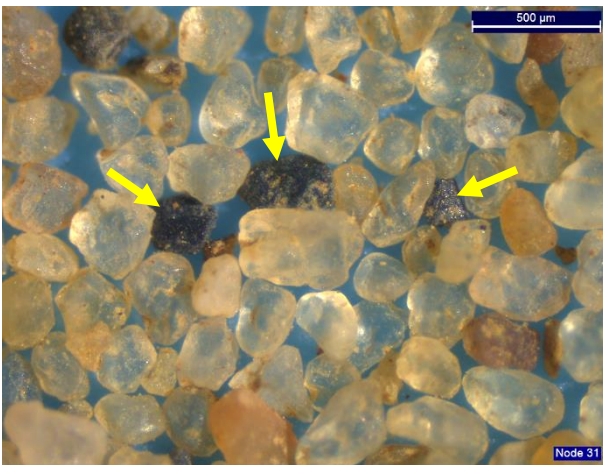
**TABLE 1 PONDS 1-2 NODE SAMPLES**

Nodes	Field Microscopy Estimate of CCR%	Laboratory Estimate of CCR %
31	1 to 3	1
36	<0.5	0.5
40R	<1	<1
49R	2 to 4	2
74	<2	1
103	<2	<0.5

The attached pages contain laboratory stereomicroscope photographs of each re-test sample taken at progressive higher magnifications. The amount of CCR was visually estimated in at least ten fields of view at magnifications of 25X to 50X using comparison charts (“Summary Concerning Some Additional Aids in Studying Sedimentary Formations,” Terry, R.D. and Chilingar, G.V., 1955, and re-produced in many soils, mineralogy, and petrology text books).



The sand is lightly coated with silty material. Substantial amounts of darker colored rocks and minerals are present



Arrows show CCR particles.

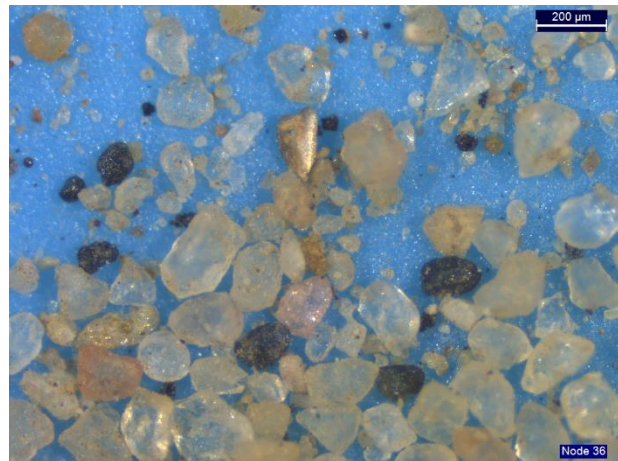
**Node 31** Estimated CCR content is 1%. The color of the sample is influenced by silty coatings on sand particles and by the presence of darker colored minerals and rocks.



The sample is clean sand that mainly consists of white, pale yellow, and colorless transparent quartz. Dark red, green, brown, and gray particles of various minerals and rocks are common. Arrow shows a CCR particle.



Arrow shows black CCR particle.



Dark particles are CCR. Most CCR particles are observed in the fines (note scale bar).

**Node 36** Estimated CCR content is 1%. Particles have minimal amounts of silty coatings. The color of the sample is mainly influenced by the abundance of darker colored particles of granite, chert, schist, siltstone, and other rocks and minerals. CCR is mainly present among the very small particles.

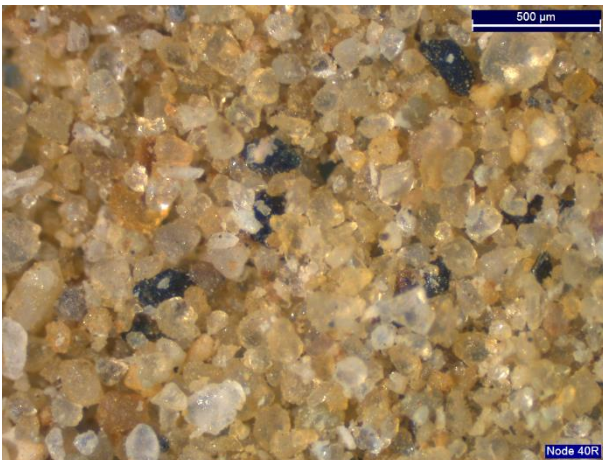




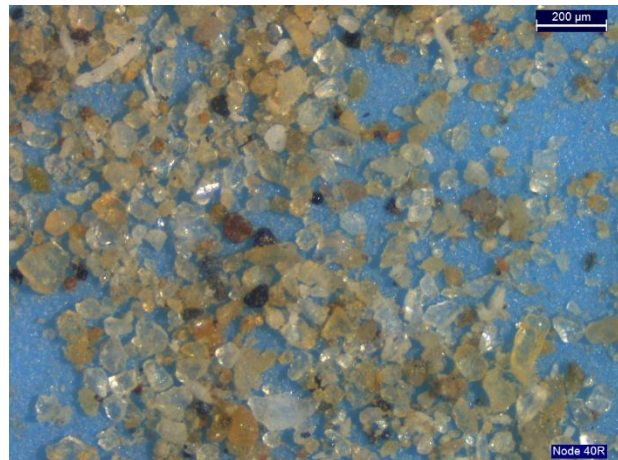
The sand is unevenly coated with yellow silty material. Darker colored particles are mostly schist, chert, and granite.



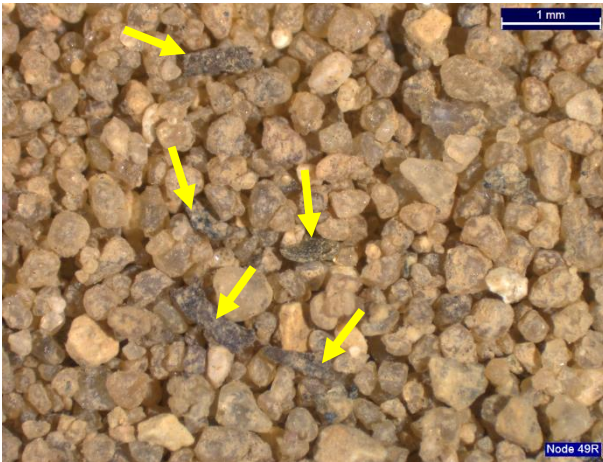
Many of the particles do not exhibit yellow coatings.



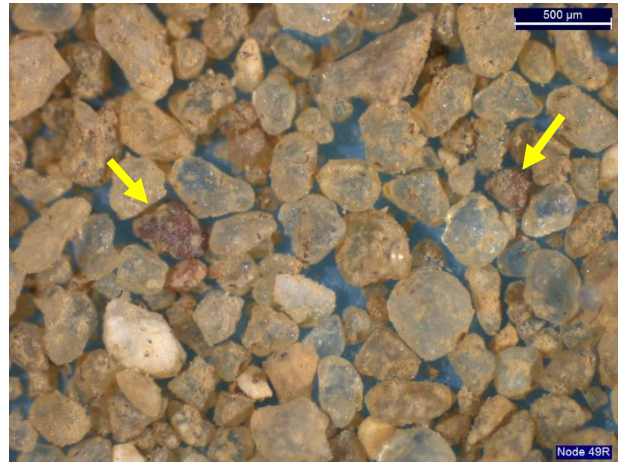
Black particles are CCR. Most CCR particles are observed in the fines (note scale bar).



**Node 40R** Estimated CCR content is 1%. Particles have variable amounts of silty coatings. The color of the sample is mainly influenced by yellow coatings and the abundance of darker colored particles of granite, chert, schist, siltstone, and other rocks and minerals. CCR is mainly present among the very small particles.



Sand particles are heavily coated with buff-colored silty material that partially obscures the color of the particles. Arrows show plant matter that rose to the surface of the sample.



Arrows show dark red granite particles. Note locally heavy pink-buff coatings on sand particles.

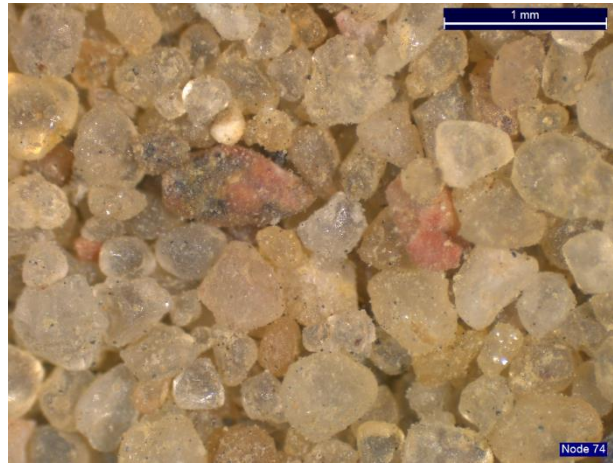


Arrows show spherical black CCR particles that are partially coated with silty material.

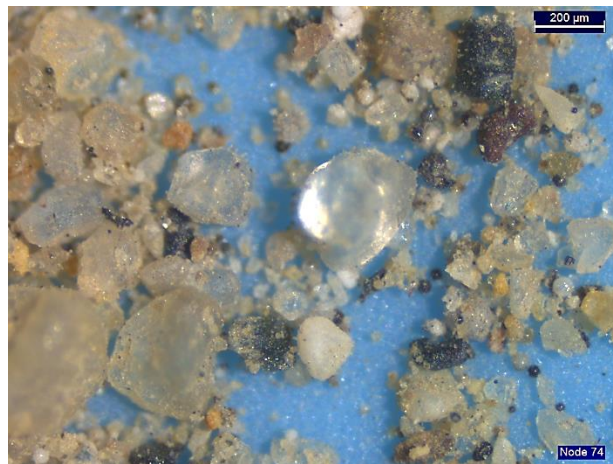


Arrow shows black porous carbon CCR particle.

**Node 49R** Estimated CCR content is 1%. The color of the sample is mainly influenced by the silty coating and the presence of plant material. Darker colored sand particles are partially obscured by the coatings, which are less prominent on the CCR particles.



Red, green, and gray particles are mostly schist, chert, and granite. Sand particles are lightly coated with buff-colored silty material.



Black and red-black particles are CCR. Most CCR particles are observed in the fines (note scale bars).

**Note 74** Estimated CCR content is 1%. Particles have minimal amounts of silty coatings. The color of the sample is mainly influenced by the abundance of darker colored particles of granite, chert, schist, siltstone, and other rocks and minerals.



Red, green, and gray particles are mostly schist, chert, and granite. Sand particles are minimally coated with buff-colored silty material.



Arrow show plant matter.



Arrow show black CCR particle.

**Node 103** Estimated CCR content is <math><0.5\%</math>. Particles have minimal amounts of silty coatings. The color of the sample is mainly influenced by the abundance of darker colored rock and mineral particles. Only trace amounts of plant matter and CCR or observed.



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