2019 Annual Groundwater Monitoring and Corrective Action Report

Columbia Energy Center
Dry Ash Disposal Facility, Modules 1 through 3
Pardeeville, Wisconsin

Prepared for:

Alliant Energy

SCS ENGINEERS

25219067.00 | January 31, 2020

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

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1.0 INTRODUCTION

This 2019 Annual Groundwater Monitoring and Corrective Action Report was prepared to support compliance with the groundwater monitoring requirements of the Coal Combustion Residuals (CCR) Rule [40 CFR 257.50-107]. Specifically, this report was prepared to fulfill the requirements of 40 CFR 257.90(e). The applicable sections of the Rule are provided below in italics, followed by applicable information relative to the 2019 Annual Groundwater Monitoring and Corrective Action Report for the CCR Units.

This report covers the period of groundwater monitoring from January 1, 2019, through December 31, 2019.

The groundwater monitoring system for the Columbia Energy Center (COL) Dry Ash Disposal Facility Modules 1 through 3 is a multiunit system, monitoring three existing CCR units:

- COL Dry Ash Disposal Facility – Module 1 (existing CCR Landfill)
- COL Dry Ash Disposal Facility – Module 2 (existing CCR Landfill)
- COL Dry Ash Disposal Facility – Module 3 (existing CCR Landfill)

The system is designed to detect monitored constituents at the waste boundary of Modules 1 through 3 of the COL Dry Ash Disposal Facility as required by 40 CFR 257.91(d). The groundwater monitoring system consists of two upgradient and three downgradient monitoring wells. A separate groundwater monitoring system evaluates groundwater conditions for Module 4 of the COL Dry Ash Disposal Facility.

2.0 §257.90(e) ANNUAL REPORT REQUIREMENTS

Annual groundwater monitoring and corrective action report. For existing CCR landfills and existing CCR surface impoundments, no later than January 31, 2018, and annually thereafter, the owner or operator must prepare an annual groundwater monitoring and corrective action report. For new CCR landfills, new CCR surface impoundments, and all lateral expansions of CCR units, the owner or operator must prepare the initial annual groundwater monitoring and corrective action report no later than January 31 of the year following the calendar year a groundwater monitoring system has been established for such CCR unit as required by this subpart, and annually thereafter. For the preceding calendar year, the annual report must document the status of the groundwater monitoring and corrective action program for the CCR unit, summarize key actions completed, describe any problems encountered, discuss actions to resolve the problems, and project key activities for the upcoming year. For purposes of this section, the owner or operator has prepared the annual report when the report is placed in the facility's operating record as required by § 257.105(h)(1). At a minimum, the annual groundwater monitoring and corrective action report must contain the following information, to the extent available:

2.1 §257.90(e)(1) SITE MAP

A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit;

A map of the site location is provided on **Figure 1.** A map showing the Dry Ash Disposal Facility Modules 1 through 3 and all background (or upgradient) and downgradient monitoring wells with

identification numbers for the groundwater monitoring program is provided as Figure 2. Other CCR units are also shown on Figure 2.

2.2 §257.90(e)(2) MONITORING SYSTEM CHANGES

Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken;

No new monitoring wells were installed, and no wells were decommissioned as part of the groundwater monitoring program for Modules 1 through 3 of the Dry Ash Disposal Facility in 2019.

2.3 §257.90(e)(3) SUMMARY OF SAMPLING EVENTS

In addition to all the monitoring data obtained under §§ 257.90 through 257.98, a summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs;

Two groundwater sampling events were completed in 2019 at the COL Dry Ash Disposal Modules 1 through 3 as part of ongoing detection monitoring.

Groundwater samples collected during the semiannual events, in April and October 2019, were analyzed for the Appendix III constituents. A summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring program is included in Table 1. The results of the analytical laboratory analyses are provided in the laboratory reports in Appendices A1 through A2.

Assessment monitoring has not been initiated for Modules 1 through 3 of the Dry Ash Disposal Facility.

2.4 §257.90(e)(4) MONITORING TRANSITION NARRATIVE

A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels);

There were no transitions between monitoring programs during 2019. The COL Dry Ash Disposal Facility, Modules 1 through 3, remained in the detection monitoring program.

In 2019, the monitoring results for the October 2018 and April 2019 monitoring events were evaluated for statistically significant increases (SSIs) in detection monitoring parameters relative to background. For both events, SSIs for boron, chloride, and sulfate were identified, and an SSI for total dissolved solids (TDS) was identified for the April 2019 event. However, alternative source demonstrations (ASDs) were completed, demonstrating that sources other than the CCR units were the likely cause of the observed concentrations. The ASD reports are provided in Appendix B.

2.5 §257.90(e)(5) OTHER REQUIREMENTS

Other information required to be included in the annual report as specified in §§ 257.90 through 257.98.

Additional potentially applicable requirements for the annual report, and the location of the requirement within the Rule, are provided in the following sections. For each cited section of the Rule, the portion referencing the annual report requirement is provided below in italics, followed by applicable information relative to the 2019 Annual Groundwater Monitoring and Corrective Action Report for the CCR Units.

2.5.1 § 257.90(e) General Requirements

For the preceding calendar year, the annual report must document the status of the groundwater monitoring and corrective action program for the CCR unit, summarize key actions completed, describe any problems encountered, discuss actions to resolve the problems, and project key activities for the upcoming year.

Status of Groundwater Monitoring and Corrective Action Program: The groundwater monitoring and corrective action program was in detection monitoring throughout 2019.

Summary of Key Actions Completed:

- Statistical evaluation and determination of SSIs for the October 2018 and April 2019 monitoring events.
- ASD reports for the SSIs identified from the October 2018 and April 2019 monitoring events.
- Two semiannual groundwater sampling and analysis events (April and October 2019).

Description of Any Problems Encountered: No problems were encountered in 2019.

Discussion of Actions to Resolve the Problems: Not applicable.

Projection of Key Activities for the Upcoming Year (2020):

- Statistical evaluation and determination of any SSIs for the October 2019 and April 2020 monitoring events.
- If an SSI is determined, then within 90 days either:
  - Complete ASD (if applicable), or
  - Establish an assessment monitoring program.
- Two semiannual groundwater sampling and analysis events (April and October 2020).

2.5.2 §257.94(d) Alternative Detection Monitoring Frequency

The owner or operator must include the demonstration providing the basis for the alternative monitoring frequency and the certification by a qualified professional engineer in the annual groundwater monitoring and corrective action report required by § 257.90(e).

Not applicable. No alternative detection monitoring frequency has been proposed.

2.5.3 §257.94(e)(2) Alternative Source Demonstration for Detection Monitoring

The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer.

The ASD reports prepared to address the SSIs observed for the October 2018 and April 2019 sampling events are provided in **Appendix B**. The ASD reports are certified by a qualified professional engineer.

2.5.4 §257.95(c) Alternative Assessment Monitoring Frequency

The owner or operator must include the demonstration providing the basis for the alternative monitoring frequency and the certification by a qualified professional engineer in the annual groundwater monitoring and corrective action report required by § 257.90(e).

Not applicable. Assessment monitoring has not been initiated.

2.5.5 §257.95(d)(3) Assessment Monitoring Results and Standards

Include the recorded concentrations required by paragraph (d)(1) of this section, identify the background concentrations established under § 257.94(b), and identify the groundwater protection standards established under paragraph (d)(2) of this section in the annual groundwater monitoring and corrective action report required by § 257.90(e).

Not applicable. Assessment monitoring has not been initiated.

2.5.6 §257.95(g)(3)(ii) Alternative Source Demonstration for Assessment Monitoring

The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer.

Not applicable. Assessment monitoring has not been initiated.

2.5.7 §257.96(a) Extension of Time for Corrective Measures Assessment

The assessment of corrective measures must be completed within 90 days, unless the owner or operator demonstrates the need for additional time to complete the assessment of corrective measure due to site-specific conditions or circumstances. The owner or operator must obtain a certification from a qualified professional engineer attesting that the demonstration is accurate. The 90-day deadline to complete the assessment of corrective measures may be extended for longer than 60 days. The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer.

Not applicable. Corrective measures assessment has not been initiated.

Table 1

CCR Rule Groundwater Samples Summary

Table 1. CCR Rule Groundwater Samples Summary
Columbia Energy Center Dry Ash Disposal Facility, Modules 1-3 /
SCS Engineers Project #25219067.00

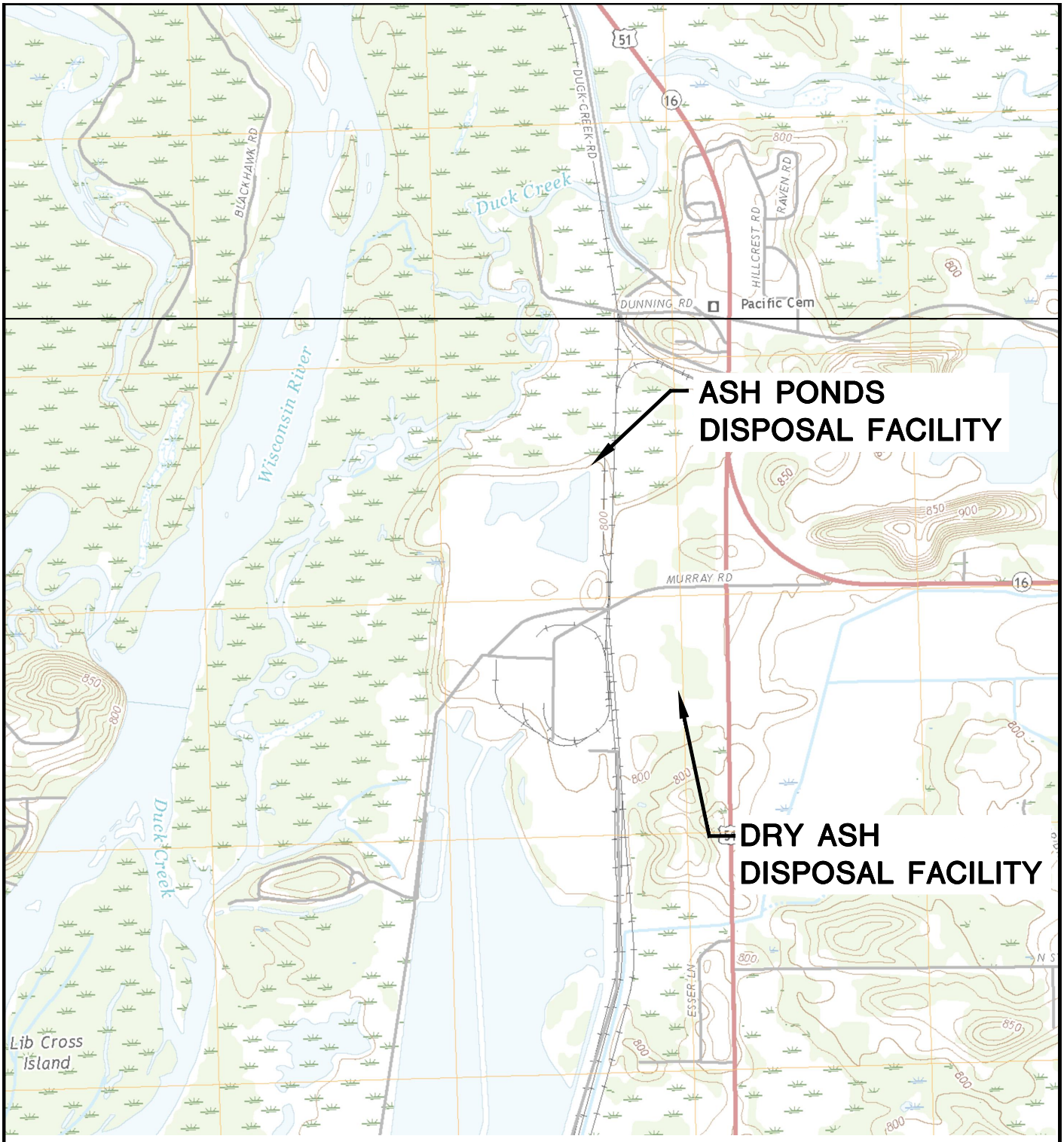
Sample Dates	Downgradient Wells			Background Wells	
	MW-302	MW-34A	MW-33AR	MW-84A	MW-301
April 2-3, 2019	D	D	D	D	D
October 8-9, 2019	D	D	D	D	D
Total Samples	2	2	2	2	2

Abbreviations:
D = Required by Detection Monitoring Program

Created by: ACW Date: 11/18/2019
Last revision by: ACW Date: 11/18/2019
Checked by: MDB Date: 1/8/2020

I:\25219067.00\Deliverables\2019 Federal Annual Report - MOD 1-3 LF\Tables\[Table 1 - 2019_GW_Samples_Summary_LF-1-3.xlsx]GW Summary

Figures

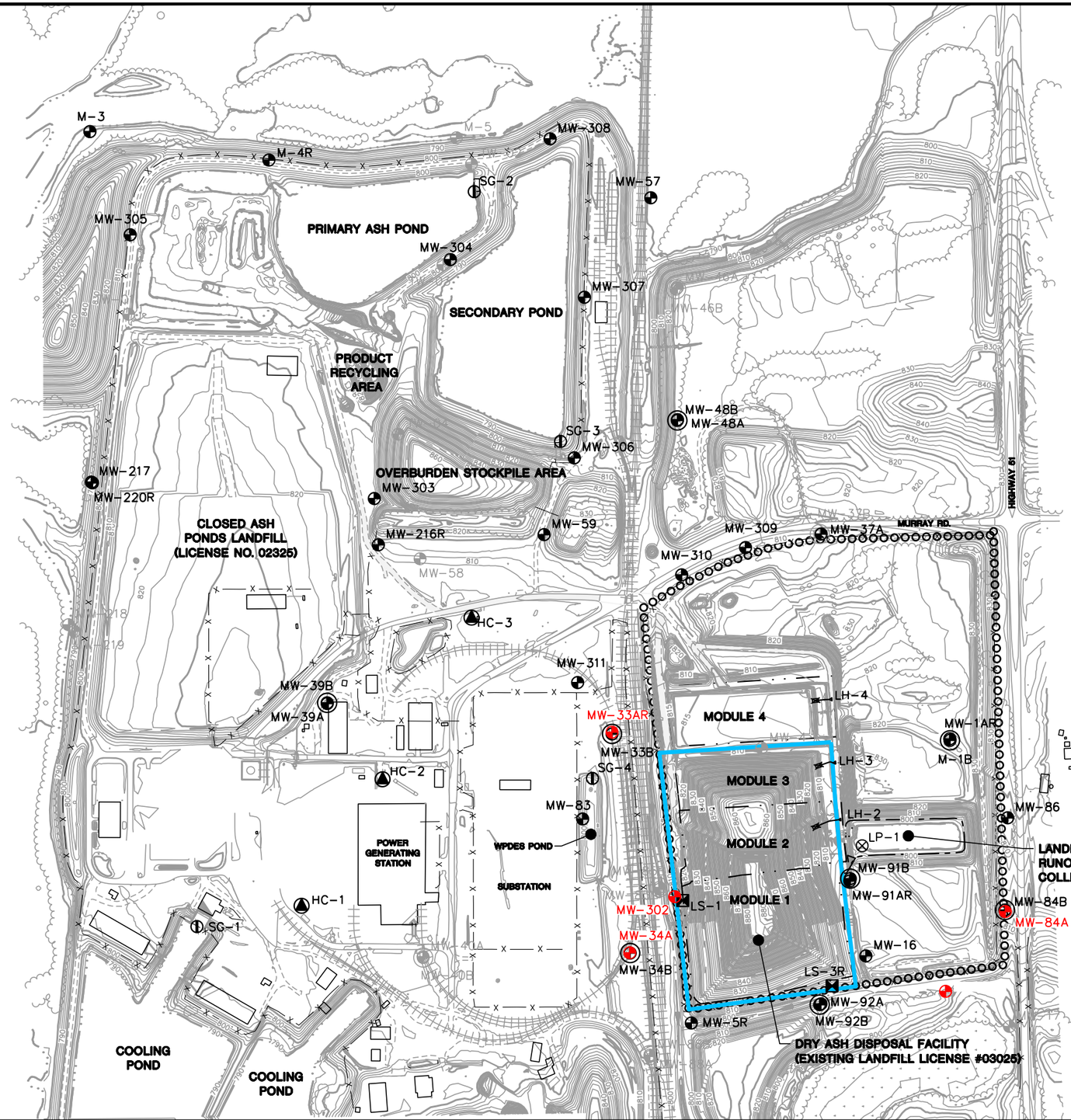


N

POYNETTE QUADRANGLE
WISCONSIN–COLUMBIA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
2018
SCALE: 1" = 2,000'

CLIENT: ALLIANT ENERGY COLUMBIA ENERGY CENTER W8375 MURRAY ROAD PARDEEVILLE, WI 53954	SITE: ALLIANT ENERGY COLUMBIA ENERGY CENTER PARDEEVILLE, WI	SITE LOCATION MAP	
PROJECT NO. 25219067.00	DRAWN BY: BSS	ENGINEER: SCS ENGINEERS 2830 DAIRY DRIVE MADISON, WI 53718-6751 PHONE: (608) 224-2830	FIGURE 1
DRAWN: 12/02/2019	CHECKED BY: MDB		
REVISED: 01/10/2020	APPROVED BY: TK 01/30/2020		

I:\25219067.00\Drawings\CCR 2019 Annual Report\Site Location Map.dwg, 1/30/2020 3:38:21 PM



LEGEND

- EXISTING MAJOR CONTOUR (10' INTERVAL)
- EXISTING MINOR CONTOUR (2' CONTOUR)
- EXISTING FENCELINE
- EXISTING TRACKS
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EDGE OF WATER
- APPROVED LIMITS OF WASTE (DRY ASH LANDFILL)
- CONSTRUCTED LIMITS OF WASTE (DRY ASH LANDFILL)
- WATER SUPPLY WELL
- STAFF GAUGE
- WATER TABLE WELL
- PIEZOMETER
- SURFACE WATER SAMPLE LOCATION
- LYSIMETER
- ABANDONED WATER TABLE WELL
- ABANDONED PIEZOMETER
- LEACHATE HEADWELL
- CCR UNIT
- CCR MONITORING WELL

NOTES:

1. BASE MAP CREATED FROM AERIAL SURVEY BY KBM, FLOWN DECEMBER 1, 2014, AND GROUND SURVEY BY SCS ENGINEERS IN MAY 2016, JUNE 2016, OCTOBER 2016, NOVEMBER 2016, APRIL 2017, NOVEMBER 2017, JULY 2018, AUGUST 2018, FEBRUARY 2019, AND MAY 2019.
2. MONITORING WELL LOCATIONS AND ELEVATIONS SURVEYED BY WISCONSIN POWER AND LIGHT, INC. IN DECEMBER 1994, NOVEMBER 1996, APRIL 2003, AND JANUARY 2016 AND BY SCS ENGINEERS IN FEBRUARY 2018.
3. SUPPLY WELL LOCATIONS ARE APPROXIMATE AND ASSUMED BASED ON JANUARY 2013 DRAWINGS BY TRC.
4. MONITORING WELLS MW-301 THROUGH MW-305 INSTALLED BY BADGER STATE DRILLING ON NOVEMBER 11-13, 2015.
5. MONITORING WELLS MW-306 THROUGH MW-308 INSTALLED BY BADGER STATE DRILLING ON NOVEMBER 14-15, 2016.
6. MONITORING WELLS MW-309 THROUGH MW-311 INSTALLED BY BADGER STATE DRILLING ON FEBRUARY 13-14, 2018.

500 0 500

SCALE: 1" = 500'

N

PROJECT NO.	25219067.00	DRAWN BY:	BSS
DRAWN:	12/02/2019	CHECKED BY:	MDB
REVISED:	01/13/2020	APPROVED BY:	TK 01/30/2020

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

CLIENT: ALLIANT ENERGY
COLUMBIA ENERGY CENTER
W8375 MURRAY ROAD
PARDEEVILLE, WI 53954

SITE: ALLIANT ENERGY
COLUMBIA ENERGY CENTER
MODULE 1-3 DRY ASH DISPOSAL FACILITY
PARDEEVILLE, WI

SITE PLAN AND MONITORING WELL LOCATIONS

FIGURE 2

I:\25219067.00\Drawings\CCR 2019 Annual Report\Mod 1-3 L...\Site Plan and Monitoring ...ell Locations.dwg, 1/30/2020 3:39:... PM

Appendix A

Laboratory Reports

A1 April 2019 Detection Monitoring

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

April 18, 2019

Meghan Blodgett
SCS ENGINEERS
2830 Dairy Drive
Madison, WI 53718

RE: Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185260

Dear Meghan Blodgett:
Enclosed are the analytical results for sample(s) received by the laboratory on April 04, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Dan Milewsky
dan.milewsky@pacelabs.com
(920)469-2436
Project Manager

Enclosures

cc: Tom Karwoski, SCS ENGINEERS
Nicole Kron, SCS ENGINEERS
Jeff Maxted, ALLIANT ENERGY
Marc Morandi, ALLIANT ENERGY

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
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(920)469-2436

CERTIFICATIONS

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185260

Green Bay Certification IDs

1241 Bellevue Street, Green Bay, WI 54302
Florida/NELAP Certification #: E87948
Illinois Certification #: 200050
Kentucky UST Certification #: 82
Louisiana Certification #: 04168
Minnesota Certification #: 055-999-334
New York Certification #: 12064
North Dakota Certification #: R-150
Virginia VELAP ID: 460263
South Carolina Certification #: 83006001
Texas Certification #: T104704529-14-1
Wisconsin Certification #: 405132750
Wisconsin DATCP Certification #: 105-444
USDA Soil Permit #: P330-16-00157
Federal Fish & Wildlife Permit #: LE51774A-0

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

SAMPLE SUMMARY

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185260

Lab ID	Sample ID	Matrix	Date Collected	Date Received
40185260001	**MW-302**	Water	04/02/19 16:25	04/04/19 09:30
40185260002	**MW-33AR**	Water	04/02/19 15:30	04/04/19 09:30
40185260003	**MW-34A**	Water	04/02/19 14:30	04/04/19 09:30
40185260004	**FIELD BLANK MOD1-3LF**	Water	04/02/19 16:25	04/04/19 09:30

Pace Analytical Services, LLC
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Green Bay, WI 54302
(920)469-2436

SAMPLE ANALYTE COUNT

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185260

Lab ID	Sample ID	Method	Analysts	Analytes Reported
40185260001	**MW-302**	EPA 6020	KXS	2
			AXL	7
		SM 2540C	TMK	1
		EPA 9040	ALY	1
		EPA 300.0	HMB	3
40185260002	**MW-33AR**	EPA 6020	KXS	2
			AXL	7
		SM 2540C	TMK	1
		EPA 9040	ALY	1
		EPA 300.0	HMB	3
40185260003	**MW-34A**	EPA 6020	KXS	2
			AXL	7
		SM 2540C	TMK	1
		EPA 9040	ALY	1
		EPA 300.0	HMB	3
40185260004	**FIELD BLANK MOD1-3LF**	EPA 6020	KXS	2
		SM 2540C	TMK	1
		EPA 9040	ALY	1
		EPA 300.0	HMB	3

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
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ANALYTICAL RESULTS

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185260

Sample: MW-302 **Lab ID: 40185260001** Collected: 04/02/19 16:25 Received: 04/04/19 09:30 Matrix: Water

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
6020 MET ICPMS	Analytical Method: EPA 6020 Preparation Method: EPA 3010								
Boron	**254**	ug/L	11.0	3.3	1	04/05/19 08:40	04/09/19 07:37	7440-42-8	
Calcium	**62400**	ug/L	250	69.8	1	04/05/19 08:40	04/09/19 07:37	7440-70-2	
Field Data	Analytical Method:								
Field pH	**7.32**	Std. Units			1		04/02/19 16:25		
Field Specific Conductance	**538.6**	umhos/cm			1		04/02/19 16:25		
Oxygen, Dissolved	**9.65**	mg/L			1		04/02/19 16:25	7782-44-7	
REDOX	**126.7**	mV			1		04/02/19 16:25		
Turbidity	**9.72**	NTU			1		04/02/19 16:25		
Static Water Level	**787.56**	feet			1		04/02/19 16:25		
Temperature, Water (C)	**9.8**	deg C			1		04/02/19 16:25		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**290**	mg/L	20.0	8.7	1		04/09/19 12:35		
9040 pH	Analytical Method: EPA 9040								
pH at 25 Degrees C	**7.4**	Std. Units	0.10	0.010	1		04/09/19 10:46		H6
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**1.5J**	mg/L	2.0	0.50	1		04/16/19 22:05	16887-00-6	B
Fluoride	**<0.10**	mg/L	0.30	0.10	1		04/16/19 22:05	16984-48-8	
Sulfate	**25.2**	mg/L	3.0	1.0	1		04/16/19 22:05	14808-79-8	

Sample: MW-33AR **Lab ID: 40185260002** Collected: 04/02/19 15:30 Received: 04/04/19 09:30 Matrix: Water

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
6020 MET ICPMS	Analytical Method: EPA 6020 Preparation Method: EPA 3010								
Boron	**568**	ug/L	11.0	3.3	1	04/05/19 08:40	04/09/19 07:43	7440-42-8	
Calcium	**131000**	ug/L	250	69.8	1	04/05/19 08:40	04/09/19 07:43	7440-70-2	
Field Data	Analytical Method:								
Field pH	**7.72**	Std. Units			1		04/02/19 15:30		
Field Specific Conductance	**1312**	umhos/cm			1		04/02/19 15:30		
Oxygen, Dissolved	**10.22**	mg/L			1		04/02/19 15:30	7782-44-7	
REDOX	**129.0**	mV			1		04/02/19 15:30		
Turbidity	**2.71**	NTU			1		04/02/19 15:30		
Static Water Level	**786.63**	feet			1		04/02/19 15:30		
Temperature, Water (C)	**10.3**	deg C			1		04/02/19 15:30		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**784**	mg/L	20.0	8.7	1		04/09/19 12:35		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
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ANALYTICAL RESULTS

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185260

Sample: MW-33AR **Lab ID: 40185260002** Collected: 04/02/19 15:30 Received: 04/04/19 09:30 Matrix: Water

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
9040 pH	Analytical Method: EPA 9040								
pH at 25 Degrees C	**7.6**	Std. Units	0.10	0.010	1		04/09/19 10:51		H6
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**229**	mg/L	20.0	5.0	10		04/17/19 12:12	16887-00-6	
Fluoride	**<0.10**	mg/L	0.30	0.10	1		04/16/19 22:18	16984-48-8	
Sulfate	**201**	mg/L	30.0	10.0	10		04/17/19 12:12	14808-79-8	

Sample: MW-34A **Lab ID: 40185260003** Collected: 04/02/19 14:30 Received: 04/04/19 09:30 Matrix: Water

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
6020 MET ICPMS	Analytical Method: EPA 6020 Preparation Method: EPA 3010								
Boron	**204**	ug/L	11.0	3.3	1	04/05/19 08:40	04/09/19 07:50	7440-42-8	
Calcium	**67500**	ug/L	250	69.8	1	04/05/19 08:40	04/09/19 07:50	7440-70-2	
Field Data	Analytical Method:								
Field pH	**7.73**	Std. Units			1		04/02/19 14:30		
Field Specific Conductance	**531.7**	umhos/cm			1		04/02/19 14:30		
Oxygen, Dissolved	**10.22**	mg/L			1		04/02/19 14:30	7782-44-7	
REDOX	**104.4**	mV			1		04/02/19 14:30		
Turbidity	**64.77**	NTU			1		04/02/19 14:30		
Static Water Level	**786.82**	feet			1		04/02/19 14:30		
Temperature, Water (C)	**10.6**	deg C			1		04/02/19 14:30		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**310**	mg/L	20.0	8.7	1		04/09/19 12:35		
9040 pH	Analytical Method: EPA 9040								
pH at 25 Degrees C	**7.7**	Std. Units	0.10	0.010	1		04/09/19 10:59		H6
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**18.7**	mg/L	2.0	0.50	1		04/15/19 12:12	16887-00-6	
Fluoride	**<0.10**	mg/L	0.30	0.10	1		04/15/19 12:12	16984-48-8	
Sulfate	**70.4**	mg/L	15.0	5.0	5		04/15/19 18:00	14808-79-8	

Sample: FIELD BLANK MOD1-3LF **Lab ID: 40185260004** Collected: 04/02/19 16:25 Received: 04/04/19 09:30 Matrix: Water

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
6020 MET ICPMS	Analytical Method: EPA 6020 Preparation Method: EPA 3010								
Boron	**<3.3**	ug/L	11.0	3.3	1	04/05/19 08:40	04/09/19 05:00	7440-42-8	
Calcium	**<69.8**	ug/L	250	69.8	1	04/05/19 08:40	04/09/19 05:00	7440-70-2	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185260

Sample: FIELD BLANK MOD1-3LF **Lab ID: 40185260004** Collected: 04/02/19 16:25 Received: 04/04/19 09:30 Matrix: Water

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**<8.7**	mg/L	20.0	8.7	1		04/09/19 12:35		
9040 pH	Analytical Method: EPA 9040								
pH at 25 Degrees C	**7.0**	Std. Units	0.10	0.010	1		04/09/19 11:04		H6
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**<0.50**	mg/L	2.0	0.50	1		04/15/19 12:24	16887-00-6	
Fluoride	**<0.10**	mg/L	0.30	0.10	1		04/15/19 12:24	16984-48-8	
Sulfate	**<1.0**	mg/L	3.0	1.0	1		04/15/19 12:24	14808-79-8	

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185260

QC Batch: 317485 Analysis Method: EPA 6020
QC Batch Method: EPA 3010 Analysis Description: 6020 MET
Associated Lab Samples: 40185260001, 40185260002, 40185260003, 40185260004

METHOD BLANK: 1846066 Matrix: Water
Associated Lab Samples: 40185260001, 40185260002, 40185260003, 40185260004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Boron	ug/L	<3.3	11.0	04/09/19 04:47	
Calcium	ug/L	<69.8	250	04/09/19 04:47	

LABORATORY CONTROL SAMPLE: 1846067

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	500	486	97	80-120	
Calcium	ug/L	5000	4990	100	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1846068 1846069

Parameter	Units	40185256001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	26.9	500	500	492	498	93	94	75-125	1	20	
Calcium	ug/L	126000	5000	5000	126000	123000	12	-46	75-125	2	20	P6

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185260

QC Batch: 317813 Analysis Method: SM 2540C
QC Batch Method: SM 2540C Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 40185260001, 40185260002, 40185260003, 40185260004

METHOD BLANK: 1847582 Matrix: Water
Associated Lab Samples: 40185260001, 40185260002, 40185260003, 40185260004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	<8.7	20.0	04/09/19 12:32	

LABORATORY CONTROL SAMPLE: 1847583

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	577	552	96	80-120	

SAMPLE DUPLICATE: 1847584

Parameter	Units	40185256001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	462	462	0	5	

SAMPLE DUPLICATE: 1847585

Parameter	Units	40185260001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	290	284	2	5	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185260

QC Batch: 317736 Analysis Method: EPA 9040
QC Batch Method: EPA 9040 Analysis Description: 9040 pH
Associated Lab Samples: 40185260001, 40185260002, 40185260003, 40185260004

SAMPLE DUPLICATE: 1847351

Parameter	Units	40185260001 Result	Dup Result	RPD	Max RPD	Qualifiers
pH at 25 Degrees C	Std. Units	7.4	7.4	0	20	H6

SAMPLE DUPLICATE: 1847381

Parameter	Units	40185339014 Result	Dup Result	RPD	Max RPD	Qualifiers
pH at 25 Degrees C	Std. Units	7.7	7.7	0	20	H6

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185260

QC Batch: 317955
QC Batch Method: EPA 300.0
Analysis Method: EPA 300.0
Analysis Description: 300.0 IC Anions
Associated Lab Samples: 40185260001, 40185260002

METHOD BLANK: 1848305 Matrix: Water
Associated Lab Samples: 40185260001, 40185260002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	0.52J	2.0	04/16/19 10:22	
Fluoride	mg/L	<0.10	0.30	04/16/19 10:22	
Sulfate	mg/L	<1.0	3.0	04/16/19 10:22	

LABORATORY CONTROL SAMPLE: 1848306

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	20	21.6	108	90-110	
Fluoride	mg/L	2	2.0	98	90-110	
Sulfate	mg/L	20	21.7	109	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1848307 1848308

Parameter	Units	40185204004 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	43.0	100	100	149	148	106	105	90-110	1	15	
Fluoride	mg/L	<0.50	10	10	10.3	10.4	103	104	90-110	1	15	
Sulfate	mg/L	<5.0	100	100	109	109	105	105	90-110	0	15	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1848309 1848310

Parameter	Units	40185260002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	229	200	200	439	425	105	98	90-110	3	15	
Fluoride	mg/L	<0.10	2	2	1.9	2.0	97	99	90-110	2	15	
Sulfate	mg/L	201	200	200	411	397	105	98	90-110	3	15	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185260

QC Batch: 318035 Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 Analysis Description: 300.0 IC Anions
Associated Lab Samples: 40185260003, 40185260004

METHOD BLANK: 1848956 Matrix: Water
Associated Lab Samples: 40185260003, 40185260004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	<0.50	2.0	04/15/19 11:11	
Fluoride	mg/L	<0.10	0.30	04/15/19 11:11	
Sulfate	mg/L	<1.0	3.0	04/15/19 11:11	

LABORATORY CONTROL SAMPLE: 1848957

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	20	21.2	106	90-110	
Fluoride	mg/L	2	2.1	104	90-110	
Sulfate	mg/L	20	21.4	107	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1848958 1848959

Parameter	Units	40185548003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	261	200	200	438	463	88	101	90-110	6	15	M0
Fluoride	mg/L	<1.0	20	20	18.0	19.8	90	99	90-110	9	15	
Sulfate	mg/L	54.2	200	200	232	252	89	99	90-110	8	15	M0

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1848960 1848961

Parameter	Units	40185308003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	106	200	200	313	318	104	106	90-110	1	15	
Fluoride	mg/L	<1.0	20	20	20.6	21.5	103	108	90-110	4	15	
Sulfate	mg/L	94.8	200	200	298	309	102	107	90-110	3	15	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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(920)469-2436

QUALIFIERS

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185260

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above LOD.

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

LOD - Limit of Detection adjusted for dilution factor, percent moisture, initial weight and final volume.

LOQ - Limit of Quantitation adjusted for dilution factor, percent moisture, initial weight and final volume.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected at or above the adjusted LOD.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

ANALYTE QUALIFIERS

B	Analyte was detected in the associated method blank.
H6	Analysis initiated outside of the 15 minute EPA required holding time.
M0	Matrix spike recovery and/or matrix spike duplicate recovery was outside laboratory control limits.
P6	Matrix spike recovery was outside laboratory control limits due to a parent sample concentration notably higher than the spike level.

Pace Analytical Services, LLC
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(920)469-2436

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185260

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
40185260001	**MW-302**	EPA 3010	317485	EPA 6020	317570
40185260002	**MW-33AR**	EPA 3010	317485	EPA 6020	317570
40185260003	**MW-34A**	EPA 3010	317485	EPA 6020	317570
40185260004	**FIELD BLANK MOD1-3LF**	EPA 3010	317485	EPA 6020	317570
40185260001	**MW-302**				
40185260002	**MW-33AR**				
40185260003	**MW-34A**				
40185260001	**MW-302**	SM 2540C	317813		
40185260002	**MW-33AR**	SM 2540C	317813		
40185260003	**MW-34A**	SM 2540C	317813		
40185260004	**FIELD BLANK MOD1-3LF**	SM 2540C	317813		
40185260001	**MW-302**	EPA 9040	317736		
40185260002	**MW-33AR**	EPA 9040	317736		
40185260003	**MW-34A**	EPA 9040	317736		
40185260004	**FIELD BLANK MOD1-3LF**	EPA 9040	317736		
40185260001	**MW-302**	EPA 300.0	317955		
40185260002	**MW-33AR**	EPA 300.0	317955		
40185260003	**MW-34A**	EPA 300.0	318035		
40185260004	**FIELD BLANK MOD1-3LF**	EPA 300.0	318035		

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UPPER MIDWEST REGION
MN: 612-607-1700 WI: 920-469-2436

Page 1 of

MH

40185260

CHAIN OF CUSTODY

*Preservation Codes
A=None B=HCL C=H2SO4 D=HNO3 E=DI Water F=Methanol G=NaOH
H=Sodium Bisulfate Solution I=Sodium Thiosulfate J=Other

(Please Print Clearly)	
Company Name:	SCS
Branch/Location:	Madison WI
Project Contact:	Meg Blodgett
Phone:	608-216-7362
Project Number:	25219067
Project Name:	Alliant - Columbia
Project State:	WI
Sampled By (Print):	Adam Watson
Sampled By (Sign):	Paul A. Groom for Adam Watson
PO #:	Regulatory Program:

Quote #:	
Mail To Contact:	
Mail To Company:	
Mail To Address:	
Invoice To Contact:	
Invoice To Company:	
Invoice To Address:	
Invoice To Phone:	

Data Package Options (billable)
☐ EPA Level III
☐ EPA Level IV

MS/MSD
☐ On your sample (billable)
☐ NOT needed on your sample

Matrix Codes

A = Air	W = Water
B = Biota	DW = Drinking Water
C = Charcoal	GW = Ground Water
O = Oil	SW = Surface Water
S = Soil	WW = Waste Water
SI = Sludge	WP = Wipe

PACE LAB #	CLIENT FIELD ID	COLLECTION DATE	COLLECTION TIME	MATRIX	FILTERED? (YES/NO) Y/N	PRESERVATION (CODE)* Pick Letter	Analyses Requested: TDS, SO4, Ph	Florida, Cl	Ca, B	CLIENT COMMENTS	LAB COMMENTS (Lab Use Only)	Profile #
001	MW 302	4-2-19	16:25	GW	No	A	X	X	X			
002	MW 33AR	4-2-19	15:30	↓								
003	MW 34A	4-2-19	14:30	↓								
004	Field Blank Mod1	4-2-19	16:25	DI								
005	MW 309	4-2-19	9:10	GW								
006	MW 310	4-2-19	9:55	↓								
007	MW 311	4-2-19	10:50	↓								
008	Field Blank Mod4	4-2-19	9:55	DI								
009	MW 306	4-1-19	18:15	GW								
010	MW 304	4-1-19	17:25	↓								
011	MW 308	4-1-19	16:50	↓								
012	Field Blank SC Mod	4-1-19	16:50	DI			↓	↓	↓			
~~013~~	4/4/19 SCW											

Rush Turnaround Time Requested - Prelims
(Rush TAT subject to approval/surcharge)
Date Needed:

Transmit Prelim Rush Results by (complete what you want):

Email #1:	
Email #2:	
Telephone:	
Fax:	

Samples on HOLD are subject to special pricing and release of liability

Relinquished By:	Date/Time:	Received By:	Date/Time:
Paul A. Groom	4-3-19 18:30		
Fed Ex	4-4-19 0930		
Relinquished By:	Date/Time:	Received By:	Date/Time:
Relinquished By:	Date/Time:	Received By:	Date/Time:
Relinquished By:	Date/Time:	Received By:	Date/Time:
Relinquished By:	Date/Time:	Received By:	Date/Time:

PACE Project No.
40185260

Receipt Temp = 2.0 °C

Sample Receipt pH
~~OK~~ / Adjusted

Cooler Custody Seal
Present / ~~Not Present~~
Intact / Not Intact

C019a(27Jun2006)

Version 6.0 06/14/06

ORIGINAL

Pace Analytical Services, LLC
1241 Bellevue Street, Suite 9
Green Bay, WI 54302

Sample Preservation Receipt Form

Client Name: SCS Project # 40185260

All containers needing preservation have been checked and noted below: ☑Yes ☐No ☐N/A Initial when completed: SKW Date/ Time:

Lab Lot# of pH paper: 10453581 Lab Std #ID of preservation (if pH adjusted):

Pace Lab #	Glass							Plastic							Vials						Jars			General			VOA Vials (>6mm) *	H2SO4 pH ≤2	NaOH+Zn Act pH ≥9	NaOH pH ≥12	HNO3 pH ≤2	pH after adjusted	Volume (mL)
	AG1U	AG1H	AG4S	AG4U	AG5U	AG2S	BG3U	BP1U	BP2N	BP2Z	BP3U	BP3C	BP3N	BP3S	DG9A	DG9T	VG9U	VG9H	VG9M	VG9D	JGFU	WGFU	WPFU	SP5T	ZPLC	GN							
001											2		1																	X		2.5 / 5 / 10
002											2		1																	X		2.5 / 5 / 10
003											2		1																	X		2.5 / 5 / 10
004											2		1																	X		2.5 / 5 / 10
005											2		1																	X		2.5 / 5 / 10
006											2		1																	X		2.5 / 5 / 10
007											2		1																	X		2.5 / 5 / 10
008											2		1																	X		2.5 / 5 / 10
009											2		1																	X		2.5 / 5 / 10
010											2		1																	X		2.5 / 5 / 10
011											2		1																	X		2.5 / 5 / 10
012											2		1																	X		2.5 / 5 / 10
013																																2.5 / 5 / 10
014																																2.5 / 5 / 10
015																																2.5 / 5 / 10
016																																2.5 / 5 / 10
017																																2.5 / 5 / 10
018																																2.5 / 5 / 10
019																																2.5 / 5 / 10
020																																2.5 / 5 / 10

Exceptions to preservation check: VOA, Coliform, TOC, TOX, TOH, O&G, WI DRO, Phenolics, Other: _____ Headspace in VOA Vials (>6mm) : ☐Yes ☐No ☑N/A *If yes look in headspace column

AG1U	1 liter amber glass	BP1U	1 liter plastic unpres	DG9A	40 mL amber ascorbic	JGFU	4 oz amber jar unpres
AG1H	1 liter amber glass HCL	BP2N	500 mL plastic HNO3	DG9T	40 mL amber Na Thio	WGFU	4 oz clear jar unpres
AG4S	125 mL amber glass H2SO4	BP2Z	500 mL plastic NaOH, Znact	VG9U	40 mL clear vial unpres	WPFU	4 oz plastic jar unpres
AG4U	120 mL amber glass unpres	BP3U	250 mL plastic unpres	VG9H	40 mL clear vial HCL		
AG5U	100 mL amber glass unpres	BP3C	250 mL plastic NaOH	VG9M	40 mL clear vial MeOH	SP5T	120 mL plastic Na Thiosulfate
AG2S	500 mL amber glass H2SO4	BP3N	250 mL plastic HNO3	VG9D	40 mL clear vial DI	ZPLC	ziploc bag
BG3U	250 mL clear glass unpres	BP3S	250 mL plastic H2SO4			GN:	

1610

Pace Analytical™ 1241 Bellevue Street, Green Bay, WI 54302	Document Name: Sample Condition Upon Receipt (SCUR)	Document Revised: 25Apr2018
	Document No.: F-GB-C-031-Rev.07	Issuing Authority: Pace Green Bay Quality Office

Sample Condition Upon Receipt Form (SCUR)

Project #:

WO#: 40185260

40185260

Client Name: SCS

Courier: ☐ CS Logistics ☑ Fed Ex ☐ Speedee ☐ UPS ☐ Waltco ☐ Client ☐ Pace Other:

Tracking #: 786437200524

Custody Seal on Cooler/Box Present: ☐ yes ☒ no Seals intact: ☐ yes ☐ no

Custody Seal on Samples Present: ☐ yes ☑ no Seals intact: ☐ yes ☐ no

Packing Material: ☑ Bubble Wrap ☐ Bubble Bags ☐ None ☐ Other

Thermometer Used SR - N/A **Type of Ice:** (Wet) Blue Dry None ☑ Samples on ice, cooling process has begun

Cooler Temperature Uncorr: ROI /Corr:

Temp Blank Present: ☐ yes ☐ no **Biological Tissue is Frozen:** ☐ yes ☐ no

Person examining contents:
Date: 4-4-19
Initials: SKL

Temp should be above freezing to 6°C.
Biota Samples may be received at ≤ 0°C.

Chain of Custody Present:	☑Yes ☐No ☐N/A	1.
Chain of Custody Filled Out:	☐Yes ☑No ☐N/A	2. No pg#, Mail, Invoice 4-4-19 SL
Chain of Custody Relinquished:	☑Yes ☐No ☐N/A	3.
Sampler Name & Signature on COC:	☑Yes ☐No ☐N/A	4.
Samples Arrived within Hold Time:	☑Yes ☐No	5.
- VOA Samples frozen upon receipt	☐Yes ☐No	Date/Time:
Short Hold Time Analysis (<72hr):	☑Yes ☐No	6.
Rush Turn Around Time Requested:	☐Yes ☑No	7.
Sufficient Volume: For Analysis: ☑Yes ☐No MS/MSD: ☐Yes ☑No ☐N/A		8.
Correct Containers Used:	☑Yes ☐No	9.
-Pace Containers Used:	☑Yes ☐No ☐N/A	
-Pace IR Containers Used:	☐Yes ☐No ☑N/A	
Containers Intact:	☑Yes ☐No	10.
Filtered volume received for Dissolved tests	☐Yes ☐No ☑N/A	11.
Sample Labels match COC: -Includes date/time/ID/Analysis Matrix: W	☐Yes ☑No ☐N/A	12. 004-ID is Field Blank MOD134LF 009-No date + time on 250mlpD. 4-4-19 SL
Trip Blank Present:	☐Yes ☐No ☑N/A	13.
Trip Blank Custody Seals Present	☐Yes ☐No ☑N/A	
Pace Trip Blank Lot # (if purchased):		

Client Notification/ Resolution: If checked, see attached form for additional comments ☐

Person Contacted: Date/Time:

Comments/ Resolution:

Project Manager Review: AL for DM **Date:** 4/4/19

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

April 25, 2019

Meghan Blodgett
SCS ENGINEERS
2830 Dairy Drive
Madison, WI 53718

RE: Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185256

Dear Meghan Blodgett:
Enclosed are the analytical results for sample(s) received by the laboratory on April 04, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Dan Milewsky
dan.milewsky@pacelabs.com
(920)469-2436
Project Manager

Enclosures

cc: Tom Karwoski, SCS ENGINEERS
Nicole Kron, SCS ENGINEERS
Jeff Maxted, ALLIANT ENERGY
Marc Morandi, ALLIANT ENERGY

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

CERTIFICATIONS

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185256

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
ANAB DOD-ELAP Rad Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification #: PA01547
Connecticut Certification #: PH-0694
Delaware Certification
EPA Region 4 DW Rad
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Florida: Cert E871149 SEKS WET
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: KY90133
KY WW Permit #: KY0098221
KY WW Permit #: KY0000221
Louisiana DHH/TNI Certification #: LA180012
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: 2017020
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification #: 9991
Missouri Certification #: 235
Montana Certification #: Cert0082
Nebraska Certification #: NE-OS-29-14
Nevada Certification #: PA014572018-1
New Hampshire/TNI Certification #: 297617
New Jersey/TNI Certification #: PA051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Ohio EPA Rad Approval: #41249
Oregon/TNI Certification #: PA200002-010
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: 02867
Texas/TNI Certification #: T104704188-17-3
Utah/TNI Certification #: PA014572017-9
USDA Soil Permit #: P330-17-00091
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 9526
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Approve List for Rad
Wyoming Certification #: 8TMS-L

Green Bay Certification IDs

1241 Bellevue Street, Green Bay, WI 54302
Florida/NELAP Certification #: E87948
Illinois Certification #: 200050
Kentucky UST Certification #: 82
Louisiana Certification #: 04168
Minnesota Certification #: 055-999-334
New York Certification #: 12064
North Dakota Certification #: R-150
Virginia VELAP ID: 460263
South Carolina Certification #: 83006001
Texas Certification #: T104704529-14-1
Wisconsin Certification #: 405132750
Wisconsin DATCP Certification #: 105-444
USDA Soil Permit #: P330-16-00157
Federal Fish & Wildlife Permit #: LE51774A-0

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

SAMPLE SUMMARY

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185256

Lab ID	Sample ID	Matrix	Date Collected	Date Received
40185256001	**MW-301**	Water	04/02/19 17:20	04/04/19 09:30
40185256002	**MW-84A**	Water	04/03/19 09:40	04/04/19 09:30

REPORT OF LABORATORY ANALYSIS

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SAMPLE ANALYTE COUNT

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185256

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
40185256001	**MW-301**	EPA 6020	KXS	14	PASI-G
		EPA 7470	AJT	1	PASI-G
			AXL	7	PASI-G
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C	TMK	1	PASI-G
		EPA 9040	ALY	1	PASI-G
		EPA 300.0	HMB	3	PASI-G
40185256002	**MW-84A**	EPA 6020	KXS	14	PASI-G
		EPA 7470	AJT	1	PASI-G
			AXL	7	PASI-G
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C	TMK	1	PASI-G
		EPA 9040	ALY	1	PASI-G
		EPA 300.0	HMB	3	PASI-G

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ANALYTICAL RESULTS

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185256

Sample: MW-301 **Lab ID: 40185256001** Collected: 04/02/19 17:20 Received: 04/04/19 09:30 Matrix: Water

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
6020 MET ICPMS	Analytical Method: EPA 6020 Preparation Method: EPA 3010								
Antimony	**0.32J**	ug/L	1.0	0.15	1	04/05/19 08:40	04/09/19 06:15	7440-36-0	
Arsenic	**0.40J**	ug/L	1.0	0.28	1	04/05/19 08:40	04/09/19 06:15	7440-38-2	
Barium	**11.8**	ug/L	4.9	1.5	1	04/05/19 08:40	04/09/19 06:15	7440-39-3	
Beryllium	**0.28J**	ug/L	1.0	0.18	1	04/05/19 08:40	04/09/19 06:15	7440-41-7	
Boron	**26.9**	ug/L	11.0	3.3	1	04/05/19 08:40	04/09/19 06:15	7440-42-8	
Cadmium	**0.21J**	ug/L	1.0	0.15	1	04/05/19 08:40	04/09/19 06:15	7440-43-9	
Calcium	**126000**	ug/L	2500	698	10	04/05/19 08:40	04/09/19 05:48	7440-70-2	P6
Chromium	**<1.0**	ug/L	3.4	1.0	1	04/05/19 08:40	04/09/19 06:15	7440-47-3	
Cobalt	**0.35J**	ug/L	1.0	0.12	1	04/05/19 08:40	04/09/19 06:15	7440-48-4	
Lead	**0.30J**	ug/L	1.0	0.24	1	04/05/19 08:40	04/09/19 06:15	7439-92-1	
Lithium	**0.90J**	ug/L	1.0	0.19	1	04/05/19 08:40	04/09/19 06:15	7439-93-2	
Molybdenum	**<0.44**	ug/L	1.5	0.44	1	04/05/19 08:40	04/09/19 06:15	7439-98-7	
Selenium	**0.49J**	ug/L	1.1	0.32	1	04/05/19 08:40	04/09/19 06:15	7782-49-2	
Thallium	**0.48J**	ug/L	1.0	0.14	1	04/05/19 08:40	04/09/19 06:15	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470								
Mercury	**<0.084**	ug/L	0.28	0.084	1	04/12/19 09:55	04/15/19 10:05	7439-97-6	
Field Data	Analytical Method:								
Field pH	**6.62**	Std. Units			1		04/02/19 17:20		
Field Specific Conductance	**883**	umhos/cm			1		04/02/19 17:20		
Oxygen, Dissolved	**2.20**	mg/L			1		04/02/19 17:20	7782-44-7	
REDOX	**152.1**	mV			1		04/02/19 17:20		
Turbidity	**2.02**	NTU			1		04/02/19 17:20		
Static Water Level	**787.04**	feet			1		04/02/19 17:20		
Temperature, Water (C)	**7.5**	deg C			1		04/02/19 17:20		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**462**	mg/L	20.0	8.7	1		04/09/19 12:34		
9040 pH	Analytical Method: EPA 9040								
pH at 25 Degrees C	**6.8**	Std. Units	0.10	0.010	1		04/08/19 11:21		H6
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**2.9J**	mg/L	10.0	2.5	5		04/16/19 19:51	16887-00-6	B,D3
Fluoride	**<0.50**	mg/L	1.5	0.50	5		04/16/19 19:51	16984-48-8	D3
Sulfate	**5.3J**	mg/L	15.0	5.0	5		04/16/19 19:51	14808-79-8	D3

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185256

Sample: MW-84A **Lab ID: 40185256002** Collected: 04/03/19 09:40 Received: 04/04/19 09:30 Matrix: Water

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
6020 MET ICPMS	Analytical Method: EPA 6020 Preparation Method: EPA 3010								
Antimony	**<0.15**	ug/L	1.0	0.15	1	04/05/19 08:40	04/09/19 06:42	7440-36-0	
Arsenic	**<0.28**	ug/L	1.0	0.28	1	04/05/19 08:40	04/09/19 06:42	7440-38-2	
Barium	**14.7**	ug/L	4.9	1.5	1	04/05/19 08:40	04/09/19 06:42	7440-39-3	
Beryllium	**<0.18**	ug/L	1.0	0.18	1	04/05/19 08:40	04/09/19 06:42	7440-41-7	
Boron	**13.6**	ug/L	11.0	3.3	1	04/05/19 08:40	04/09/19 06:42	7440-42-8	
Cadmium	**<0.15**	ug/L	1.0	0.15	1	04/05/19 08:40	04/09/19 06:42	7440-43-9	
Calcium	**80100**	ug/L	250	69.8	1	04/05/19 08:40	04/09/19 06:42	7440-70-2	
Chromium	**1.8J**	ug/L	3.4	1.0	1	04/05/19 08:40	04/09/19 06:42	7440-47-3	
Cobalt	**<0.12**	ug/L	1.0	0.12	1	04/05/19 08:40	04/09/19 06:42	7440-48-4	
Lead	**<0.24**	ug/L	1.0	0.24	1	04/05/19 08:40	04/09/19 06:42	7439-92-1	
Lithium	**0.56J**	ug/L	1.0	0.19	1	04/05/19 08:40	04/09/19 06:42	7439-93-2	
Molybdenum	**<0.44**	ug/L	1.5	0.44	1	04/05/19 08:40	04/09/19 06:42	7439-98-7	
Selenium	**<0.32**	ug/L	1.1	0.32	1	04/05/19 08:40	04/09/19 06:42	7782-49-2	
Thallium	**<0.14**	ug/L	1.0	0.14	1	04/05/19 08:40	04/09/19 06:42	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470								
Mercury	**<0.084**	ug/L	0.28	0.084	1	04/12/19 09:55	04/15/19 10:07	7439-97-6	
Field Data	Analytical Method:								
Field pH	**7.03**	Std. Units			1		04/03/19 09:40		
Field Specific Conductance	**637.2**	umhos/cm			1		04/03/19 09:40		
Oxygen, Dissolved	**9.49**	mg/L			1		04/03/19 09:40	7782-44-7	
REDOX	**103.4**	mV			1		04/03/19 09:40		
Turbidity	**1.90**	NTU			1		04/03/19 09:40		
Static Water Level	**787.35**	feet			1		04/03/19 09:40		
Temperature, Water (C)	**10.2**	deg C			1		04/03/19 09:40		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**318**	mg/L	20.0	8.7	1		04/09/19 12:34		
9040 pH	Analytical Method: EPA 9040								
pH at 25 Degrees C	**7.4**	Std. Units	0.10	0.010	1		04/08/19 11:24		H6
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**3.6**	mg/L	2.0	0.50	1		04/16/19 20:03	16887-00-6	B
Fluoride	**<0.10**	mg/L	0.30	0.10	1		04/16/19 20:03	16984-48-8	
Sulfate	**1.4J**	mg/L	3.0	1.0	1		04/16/19 20:03	14808-79-8	

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185256

QC Batch: 318138 Analysis Method: EPA 7470
QC Batch Method: EPA 7470 Analysis Description: 7470 Mercury
Associated Lab Samples: 40185256001, 40185256002

METHOD BLANK: 1849587 Matrix: Water
Associated Lab Samples: 40185256001, 40185256002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	<0.084	0.28	04/15/19 09:25	

LABORATORY CONTROL SAMPLE: 1849588

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	5	5.3	105	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1849589 1849590

Parameter	Units	40185483005 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	0.00016J mg/L	5	5	5.4	5.2	105	101	85-115	4	20	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185256

QC Batch: 317485 Analysis Method: EPA 6020
QC Batch Method: EPA 3010 Analysis Description: 6020 MET
Associated Lab Samples: 40185256001, 40185256002

METHOD BLANK: 1846066 Matrix: Water
Associated Lab Samples: 40185256001, 40185256002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	<0.15	1.0	04/09/19 04:47	
Arsenic	ug/L	<0.28	1.0	04/09/19 04:47	
Barium	ug/L	<1.5	4.9	04/09/19 04:47	
Beryllium	ug/L	<0.18	1.0	04/09/19 04:47	
Boron	ug/L	<3.3	11.0	04/09/19 04:47	
Cadmium	ug/L	<0.15	1.0	04/09/19 04:47	
Calcium	ug/L	<69.8	250	04/09/19 04:47	
Chromium	ug/L	<1.0	3.4	04/09/19 04:47	
Cobalt	ug/L	<0.12	1.0	04/09/19 04:47	
Lead	ug/L	<0.24	1.0	04/09/19 04:47	
Lithium	ug/L	<0.19	1.0	04/09/19 04:47	
Molybdenum	ug/L	<0.44	1.5	04/09/19 04:47	
Selenium	ug/L	<0.32	1.1	04/09/19 04:47	
Thallium	ug/L	<0.14	1.0	04/09/19 04:47	

LABORATORY CONTROL SAMPLE: 1846067

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	500	500	100	80-120	
Arsenic	ug/L	500	474	95	80-120	
Barium	ug/L	500	487	97	80-120	
Beryllium	ug/L	500	492	98	80-120	
Boron	ug/L	500	486	97	80-120	
Cadmium	ug/L	500	500	100	80-120	
Calcium	ug/L	5000	4990	100	80-120	
Chromium	ug/L	500	492	98	80-120	
Cobalt	ug/L	500	485	97	80-120	
Lead	ug/L	500	463	93	80-120	
Lithium	ug/L	500	467	93	80-120	
Molybdenum	ug/L	500	465	93	80-120	
Selenium	ug/L	500	508	102	80-120	
Thallium	ug/L	500	464	93	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1846068 1846069

Parameter	Units	40185256001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	0.32J	500	500	496	496	99	99	75-125	0	20	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185256

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1846068 1846069

Parameter	Units	40185256001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Arsenic	ug/L	0.40J	500	500	480	478	96	95	75-125	0	20	
Barium	ug/L	11.8	500	500	496	498	97	97	75-125	0	20	
Beryllium	ug/L	0.28J	500	500	481	480	96	96	75-125	0	20	
Boron	ug/L	26.9	500	500	492	498	93	94	75-125	1	20	
Cadmium	ug/L	0.21J	500	500	491	490	98	98	75-125	0	20	
Calcium	ug/L	126000	5000	5000	126000	123000	12	-46	75-125	2	20	P6
Chromium	ug/L	<1.0	500	500	484	483	97	96	75-125	0	20	
Cobalt	ug/L	0.35J	500	500	476	473	95	95	75-125	1	20	
Lead	ug/L	0.30J	500	500	467	468	93	94	75-125	0	20	
Lithium	ug/L	0.90J	500	500	463	463	92	92	75-125	0	20	
Molybdenum	ug/L	<0.44	500	500	465	464	93	93	75-125	0	20	
Selenium	ug/L	0.49J	500	500	512	513	102	103	75-125	0	20	
Thallium	ug/L	0.48J	500	500	474	476	95	95	75-125	0	20	

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QUALITY CONTROL DATA

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185256

QC Batch: 317813 Analysis Method: SM 2540C
QC Batch Method: SM 2540C Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 40185256001, 40185256002

METHOD BLANK: 1847582 Matrix: Water
Associated Lab Samples: 40185256001, 40185256002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	<8.7	20.0	04/09/19 12:32	

LABORATORY CONTROL SAMPLE: 1847583

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	577	552	96	80-120	

SAMPLE DUPLICATE: 1847584

Parameter	Units	40185256001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	462	462	0	5	

SAMPLE DUPLICATE: 1847585

Parameter	Units	40185260001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	290	284	2	5	

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QUALITY CONTROL DATA

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185256

QC Batch: 317619 Analysis Method: EPA 9040
QC Batch Method: EPA 9040 Analysis Description: 9040 pH
Associated Lab Samples: 40185256001, 40185256002

SAMPLE DUPLICATE: 1846956

Parameter	Units	40185113001 Result	Dup Result	RPD	Max RPD	Qualifiers
pH at 25 Degrees C	Std. Units	1.1	1.1	7	20	H6

SAMPLE DUPLICATE: 1846957

Parameter	Units	40185204001 Result	Dup Result	RPD	Max RPD	Qualifiers
pH at 25 Degrees C	Std. Units	7.2	7.2	0	20	H6

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185256

QC Batch: 317955 Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 Analysis Description: 300.0 IC Anions
Associated Lab Samples: 40185256001, 40185256002

METHOD BLANK: 1848305 Matrix: Water
Associated Lab Samples: 40185256001, 40185256002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	0.52J	2.0	04/16/19 10:22	
Fluoride	mg/L	<0.10	0.30	04/16/19 10:22	
Sulfate	mg/L	<1.0	3.0	04/16/19 10:22	

LABORATORY CONTROL SAMPLE: 1848306

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	20	21.6	108	90-110	
Fluoride	mg/L	2	2.0	98	90-110	
Sulfate	mg/L	20	21.7	109	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1848307 1848308

Parameter	Units	40185204004 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	43.0	100	100	149	148	106	105	90-110	1	15	
Fluoride	mg/L	<0.50	10	10	10.3	10.4	103	104	90-110	1	15	
Sulfate	mg/L	<5.0	100	100	109	109	105	105	90-110	0	15	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1848309 1848310

Parameter	Units	40185260002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	229	200	200	439	425	105	98	90-110	3	15	
Fluoride	mg/L	<0.10	2	2	1.9	2.0	97	99	90-110	2	15	
Sulfate	mg/L	201	200	200	411	397	105	98	90-110	3	15	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185256

Sample: MW-301 **Lab ID: 40185256001** Collected: 04/02/19 17:20 Received: 04/04/19 09:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.000 ± 0.278 (0.565) C:NA T:94%**	pCi/L	04/22/19 23:16	13982-63-3	
Radium-228	EPA 904.0	**0.552 ± 0.391 (0.759) C:75% T:91%**	pCi/L	04/19/19 12:45	15262-20-1	
Total Radium	Total Radium Calculation	**0.552 ± 0.669 (1.32)**	pCi/L	04/25/19 11:01	7440-14-4	

Sample: MW-84A **Lab ID: 40185256002** Collected: 04/03/19 09:40 Received: 04/04/19 09:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.199 ± 0.391 (0.715) C:NA T:93%**	pCi/L	04/22/19 23:16	13982-63-3	
Radium-228	EPA 904.0	**0.482 ± 0.511 (1.07) C:72% T:80%**	pCi/L	04/19/19 12:45	15262-20-1	
Total Radium	Total Radium Calculation	**0.681 ± 0.902 (1.79)**	pCi/L	04/25/19 11:01	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL - RADIOCHEMISTRY

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185256

QC Batch: 338211 Analysis Method: EPA 904.0
QC Batch Method: EPA 904.0 Analysis Description: 904.0 Radium 228
Associated Lab Samples: 40185256001, 40185256002

METHOD BLANK: 1646527 Matrix: Water
Associated Lab Samples: 40185256001, 40185256002

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	-0.0681 ± 0.343 (0.816) C:74% T:84%	pCi/L	04/19/19 12:45	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185256

QC Batch: 338210 Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1 Analysis Description: 903.1 Radium-226
Associated Lab Samples: 40185256001, 40185256002

METHOD BLANK: 1646526 Matrix: Water
Associated Lab Samples: 40185256001, 40185256002

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.212 ± 0.323 (0.520) C:NA T:90%	pCi/L	04/22/19 22:44	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALIFIERS

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185256

DEFINITIONS

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval). Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above LOD.

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

LOD - Limit of Detection adjusted for dilution factor, percent moisture, initial weight and final volume.

LOQ - Limit of Quantitation adjusted for dilution factor, percent moisture, initial weight and final volume.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected at or above the adjusted LOD.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-G	Pace Analytical Services - Green Bay
PASI-PA	Pace Analytical Services - Greensburg

ANALYTE QUALIFIERS

B	Analyte was detected in the associated method blank.
D3	Sample was diluted due to the presence of high levels of non-target analytes or other matrix interference.
H6	Analysis initiated outside of the 15 minute EPA required holding time.
P6	Matrix spike recovery was outside laboratory control limits due to a parent sample concentration notably higher than the spike level.

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: 25219067 ALLIANT-COLUMBIA CCR
Pace Project No.: 40185256

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
40185256001	**MW-301**	EPA 3010	317485	EPA 6020	317570
40185256002	**MW-84A**	EPA 3010	317485	EPA 6020	317570
40185256001	**MW-301**	EPA 7470	318138	EPA 7470	318191
40185256002	**MW-84A**	EPA 7470	318138	EPA 7470	318191
40185256001	**MW-301**				
40185256002	**MW-84A**				
40185256001	**MW-301**	EPA 903.1	338210		
40185256002	**MW-84A**	EPA 903.1	338210		
40185256001	**MW-301**	EPA 904.0	338211		
40185256002	**MW-84A**	EPA 904.0	338211		
40185256001	**MW-301**	Total Radium Calculation	339896		
40185256002	**MW-84A**	Total Radium Calculation	339897		
40185256001	**MW-301**	SM 2540C	317813		
40185256002	**MW-84A**	SM 2540C	317813		
40185256001	**MW-301**	EPA 9040	317619		
40185256002	**MW-84A**	EPA 9040	317619		
40185256001	**MW-301**	EPA 300.0	317955		
40185256002	**MW-84A**	EPA 300.0	317955		

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MH

4018256

CHAIN OF CUSTODY

*Preservation Codes
A=None B=HCL C=H2SO4 D=HNO3 E=DI Water F=Methanol G=NaOH
H=Sodium Bisulfate Solution I=Sodium Thiosulfate J=Other

(Please Print Clearly)	
Company Name:	SCS
Branch/Location:	Madison WI
Project Contact:	Meg Blodgett
Phone:	608 216 7362
Project Number:	25219067
Project Name:	Alliant - Columbia
Project State:	WI
Sampled By (Print):	Adam Watson
Sampled By (Sign):	Paul A. Groon for Adam Watson
PO #:	Regulatory Program:

Quote #:	
Mail To Contact:	
Mail To Company:	
Mail To Address:	
Invoice To Contact:	
Invoice To Company:	
Invoice To Address:	
Invoice To Phone:	

Data Package Options (billable)
☐ EPA Level III
☐ EPA Level IV

MS/MSD
☐ On your sample (billable)
☐ NOT needed on your sample

Matrix Codes
A = Air, B = Biota, C = Charcoal, O = Oil, S = Soil, SI = Sludge, W = Water, DW = Drinking Water, GW = Ground Water, SW = Surface Water, WW = Waste Water, WP = Wipe

PACE LAB #	CLIENT FIELD ID	COLLECTION DATE	COLLECTION TIME	MATRIX	FILTERED? (YES/NO)	Analyses Requested: Cl, Fluoride, PH, SO4, TDS	Metals	Radium 226	Radium 228	CLIENT COMMENTS	LAB COMMENTS (Lab Use Only)	Profile #
	Y/N					NS	ND	ND	ND			
	Pick Letter				PRESERVATION (CODE)*	A	C	C	C			
001	MW 301	4/3/19	1720	W		X	X	X	X			
002	MW 84A	4/3/19	0940			X	X	X	X			
003	MW 303	4/1/19	1800			X	X	X	X			
004	MW 304	4/2/19	1230									
005	MW 305	4/1/19	1410									
006	MW-4R	4/1/19	1515									
007	Field Blank Pond	4/2/19	1230									

① Filled in by Lab from labels 4/4/19 SNW

Rush Turnaround Time Requested - Prelims
(Rush TAT subject to approval/surcharge)
Date Needed:

Transmit Prelim Rush Results by (complete what you want):

Email #1:	
Email #2:	
Telephone:	
Fax:	

Samples on HOLD are subject to special pricing and release of liability

Relinquished By:	Date/Time:	Received By:	Date/Time:
Paul A. Groon	4-3-19 19:00		
Fed Ex	4/4/19 0930	Susan Kuffel	4/4/19 0930
		Paul	

PACE Project No.: 4018256
Receipt Temp = ROI °C
Sample Receipt pH: (OK) / Adjusted
Cooler Custody Seal: Present / (Not Present)
Intact / Not Intact

C019a(27Jun2006)
Version 6.0 06/14/06
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40185256

CHAIN OF CUSTODY

*Preservation Codes
A=None B=HCL C=H2SO4 D=HNO3 E=DI Water F=Methanol G=NaOH
H=Sodium Bisulfate Solution I=Sodium Thiosulfate J=Other

(Please Print Clearly)	
Company Name:	SCS
Branch/Location:	Madison WI
Project Contact:	Meg Blodgett
Phone:	608 216 7362
Project Number:	25219067
Project Name:	Alliant - Columbia
Project State:	WI
Sampled By (Print):	Adam Watson
Sampled By (Sign):	Paul A. Brown for Adam Watson
PO #:	Regulatory Program:

Quote #:	
Mail To Contact:	
Mail To Company:	
Mail To Address:	
Invoice To Contact:	
Invoice To Company:	
Invoice To Address:	
Invoice To Phone:	

Data Package Options (billable)
☐ EPA Level III
☐ EPA Level IV

MS/MSD
☐ On your sample (billable)
☐ NOT needed on your sample

Matrix Codes
A = Air; W = Water; B = Biota; DW = Drinking Water; C = Charcoal; GW = Ground Water; O = Oil; SW = Surface Water; S = Soil; WW = Waste Water; SI = Sludge; WP = Wipe

PACE LAB #	CLIENT FIELD ID	COLLECTION DATE	COLLECTION TIME	MATRIX	FILTERED? (YES/NO)	PRESERVATION (CODE)*	Analyses Requested: Cl, Floride, PH, SO4, TDS	Metals	Radium 226	Radium 228	CLIENT COMMENTS	LAB COMMENTS (Lab Use Only)	Profile #
					Y/N	Pick Letter							
							NO	NO	NO	NO			
							A	C	C	C			
	MW 301	4-2-19	17:20	GW			X	X	X	X			
	MW 84A	4-3-19	9:40	GW			X	X	X	X			
	MW 303	4-1-19	18:00	GW			X	X	X	X			
	MW 304	4-2-19	12:30										
	MW 305	4-1-19	14:10										
	M-4R	4-1-19	15:15										
	Field Blank Pond	4-2-19	12:30	DI									

Rush Turnaround Time Requested - Prelims
(Rush TAT subject to approval/surcharge)
Date Needed:

Transmit Prelim Rush Results by (complete what you want):
Email #1:
Email #2:
Telephone:
Fax:

Samples on HOLD are subject to special pricing and release of liability

Relinquished By:	Date/Time:	Received By:	Date/Time:
Paul A. Brown	4-3-19 19:00		
Relinquished By:	Date/Time:	Received By:	Date/Time:
Fed Ex	4/4/19 0930	Susan Wise Fed Ex	4/4/19 0930
Relinquished By:	Date/Time:	Received By:	Date/Time:
Relinquished By:	Date/Time:	Received By:	Date/Time:
Relinquished By:	Date/Time:	Received By:	Date/Time:

PACE Project No.
40185256

Receipt Temp = °C

Sample Receipt pH
OK / Adjusted

Cooler Custody Seal
Present / Not Present
Intact / Not Intact

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Pace Analytical Services, LLC
1241 Bellevue Street, Suite 9
Green Bay, WI 54302

Sample Preservation Receipt Form

Client Name: SCS Project # 40185256

All containers needing preservation have been checked and noted below: ☑Yes ☐No ☐N/A Initial when completed: SKW Date/ Time:

Lab Lot# of pH paper: 10453581 Lab Std #ID of preservation (if pH adjusted):

Pace Lab #	Glass							Plastic							Vials						Jars			General			VOA Vials (>6mm) *	H2SO4 pH ≤2	NaOH+Zn Act pH ≥9	NaOH pH ≥12	HNO3 pH ≤2	pH after adjusted	Volume (mL)
	AG1U	AG1H	AG4S	AG4U	AG5U	AG2S	BG3U	BP1U	BP2N	BP2Z	BP3U	BP3C	BP3N	BP3S	DG9A	DG9T	VG9U	VG9H	VG9M	VG9D	JGFU	WGFU	WPFU	SP5T	ZPLC	GN							
001									4		2		1																	X		2.5 / 5 / 10
002									4		2		1																	X		2.5 / 5 / 10
003									4		2		1																	X		2.5 / 5 / 10
004									4		2		1																	X		2.5 / 5 / 10
005									4		2		1																	X		2.5 / 5 / 10
006									4		2		1																	X		2.5 / 5 / 10
007									4		2		1																	X		2.5 / 5 / 10
008																																2.5 / 5 / 10
009																																2.5 / 5 / 10
010																																2.5 / 5 / 10
011																																2.5 / 5 / 10
012																																2.5 / 5 / 10
013																																2.5 / 5 / 10
014																																2.5 / 5 / 10
015																																2.5 / 5 / 10
016																																2.5 / 5 / 10
017																																2.5 / 5 / 10
018																																2.5 / 5 / 10
019																																2.5 / 5 / 10
020																																2.5 / 5 / 10

Exceptions to preservation check: VOA, Coliform, TOC, TOX, TOH, O&G, WI DRO, Phenolics, Other: _____ Headspace in VOA Vials (>6mm) : ☐Yes ☐No ☑N/A *If yes look in headspace column

AG1U	1 liter amber glass	BP1U	1 liter plastic unpres	DG9A	40 mL amber ascorbic	JGFU	4 oz amber jar unpres
AG1H	1 liter amber glass HCL	BP2N	500 mL plastic HNO3	DG9T	40 mL amber Na Thio	WGFU	4 oz clear jar unpres
AG4S	125 mL amber glass H2SO4	BP2Z	500 mL plastic NaOH, Znact	VG9U	40 mL clear vial unpres	WPFU	4 oz plastic jar unpres
AG4U	120 mL amber glass unpres	BP3U	250 mL plastic unpres	VG9H	40 mL clear vial HCL		
AG5U	100 mL amber glass unpres	BP3C	250 mL plastic NaOH	VG9M	40 mL clear vial MeOH	SP5T	120 mL plastic Na Thiosulfate
AG2S	500 mL amber glass H2SO4	BP3N	250 mL plastic HNO3	VG9D	40 mL clear vial DI	ZPLC	ziploc bag
BG3U	250 mL clear glass unpres	BP3S	250 mL plastic H2SO4			GN:	

Pace Analytical 1241 Bellevue Street, Green Bay, WI 54302	Document Name: **Sample Condition Upon Receipt (SCUR)**	Document Revised: 25Apr2018
	Document No.: **F-GB-C-031-Rev.07**	Issuing Authority: Pace Green Bay Quality Office

Sample Condition Upon Receipt Form (SCUR)

Client Name: SCS

Project #: **WO# : 40185256**

40185256

Courier: ☐ CS Logistics ☑ Fed Ex ☐ Speedee ☐ UPS ☐ Waltco ☐ Client ☐ Pace Other:

Tracking #: 786437200524

Custody Seal on Cooler/Box Present: ☐ yes ☒ no Seals intact: ☐ yes ☐ no

Custody Seal on Samples Present: ☐ yes ☑ no Seals intact: ☐ yes ☐ no

Packing Material: ☑ Bubble Wrap ☐ Bubble Bags ☐ None ☐ Other

Thermometer Used SR - N/A **Type of Ice:** (Wet) Blue Dry None ☑ Samples on ice, cooling process has begun

Cooler Temperature Uncorr: RCL /Corr:

Temp Blank Present: ☐ yes ☐ no **Biological Tissue is Frozen:** ☐ yes ☐ no

Person examining contents:
Date: 4-4-19
Initials: SKL

Temp should be above freezing to 6°C.
Biota Samples may be received at ≤ 0°C.

Chain of Custody Present:	☑Yes ☐No ☐N/A	1.
Chain of Custody Filled Out:	☐Yes ☑No ☐N/A	2. No PO # - Mail Invoice Collect 4-4-19 SKL
Chain of Custody Relinquished:	☑Yes ☐No ☐N/A	3. Date & Time + Lab added to COC SKL
Sampler Name & Signature on COC:	☑Yes ☐No ☐N/A	4. Recieved updated COC via email from client 4-4-19 SKL
Samples Arrived within Hold Time:	☑Yes ☐No	5.
- VOA Samples frozen upon receipt	☐Yes ☐No	Date/Time:
Short Hold Time Analysis (<72hr):	☑Yes ☐No	6.
Rush Turn Around Time Requested:	☐Yes ☑No	7.
Sufficient Volume: For Analysis: ☑Yes ☐No MS/MSD: ☐Yes ☑No ☐N/A		8.
Correct Containers Used:	☑Yes ☐No	9.
-Pace Containers Used:	☑Yes ☐No ☐N/A	
-Pace IR Containers Used:	☐Yes ☐No ☑N/A	
Containers Intact:	☑Yes ☐No	10.
Filtered volume received for Dissolved tests	☐Yes ☐No ☑N/A	11.
Sample Labels match COC: -Includes date/time/ID/Analysis Matrix: W	☑Yes ☐No ☐N/A	12.
Trip Blank Present:	☐Yes ☐No ☑N/A	13.
Trip Blank Custody Seals Present	☐Yes ☐No ☑N/A	
Pace Trip Blank Lot # (if purchased):		

Client Notification/ Resolution: If checked, see attached form for additional comments ☐

Person Contacted: Date/Time:

Comments/ Resolution:

Project Manager Review: AL for DM **Date:** 4/4/19

A2 October 2019 Detection Monitoring

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

October 28, 2019

Meghan Blodgett
SCS ENGINEERS
2830 Dairy Drive
Madison, WI 53718

RE: Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196971

Dear Meghan Blodgett:
Enclosed are the analytical results for sample(s) received by the laboratory on October 10, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Dan Milewsky
dan.milewsky@pacelabs.com
(920)469-2436
Project Manager

Enclosures

cc: Tom Karwoski, SCS ENGINEERS
Nicole Kron, SCS ENGINEERS
Jeff Maxted, ALLIANT ENERGY
Marc Morandi, ALLIANT ENERGY

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

CERTIFICATIONS

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196971

Green Bay Certification IDs

1241 Bellevue Street, Green Bay, WI 54302
Florida/NELAP Certification #: E87948
Illinois Certification #: 200050
Kentucky UST Certification #: 82
Louisiana Certification #: 04168
Minnesota Certification #: 055-999-334
New York Certification #: 12064
North Dakota Certification #: R-150
Virginia VELAP ID: 460263
South Carolina Certification #: 83006001
Texas Certification #: T104704529-14-1
Wisconsin Certification #: 405132750
Wisconsin DATCP Certification #: 105-444
USDA Soil Permit #: P330-16-00157
Federal Fish & Wildlife Permit #: LE51774A-0

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

SAMPLE SUMMARY

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196971

Lab ID	Sample ID	Matrix	Date Collected	Date Received
40196971001	**MW-302**	Water	10/09/19 11:00	10/10/19 09:15
40196971002	**MW-33AR**	Water	10/08/19 15:40	10/10/19 09:15
40196971003	**MW-34A**	Water	10/08/19 14:35	10/10/19 09:15
40196971004	**FIELD BLANK MOD 1-3 LF**	Water	10/08/19 14:35	10/10/19 09:15

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(920)469-2436

SAMPLE ANALYTE COUNT

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196971

Lab ID	Sample ID	Method	Analysts	Analytes Reported
40196971001	**MW-302**	EPA 6020	DS1	2
			HMG	7
		SM 2540C	TMK	1
		EPA 9040	ALY	1
		EPA 300.0	HMB	3
40196971002	**MW-33AR**	EPA 6020	DS1	2
			HMG	7
		SM 2540C	TMK	1
		EPA 9040	ALY	1
		EPA 300.0	HMB	3
40196971003	**MW-34A**	EPA 6020	DS1	2
			HMG	7
		SM 2540C	TMK	1
		EPA 9040	ALY	1
		EPA 300.0	HMB	3
40196971004	**FIELD BLANK MOD 1-3 LF**	EPA 6020	DS1	2
		SM 2540C	TMK	1
		EPA 9040	ALY	1
		EPA 300.0	HMB	3

Pace Analytical Services, LLC
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Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196971

Sample: MW-302 **Lab ID: 40196971001** Collected: 10/09/19 11:00 Received: 10/10/19 09:15 Matrix: Water

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
6020 MET ICPMS	Analytical Method: EPA 6020 Preparation Method: EPA 3010								
Boron	**246**	ug/L	10.0	3.0	1	10/11/19 07:55	10/15/19 10:39	7440-42-8	
Calcium	**61400**	ug/L	254	76.2	1	10/11/19 07:55	10/15/19 10:39	7440-70-2	
Field Data	Analytical Method:								
Field pH	**7.08**	Std. Units			1		10/09/19 11:00		
Field Specific Conductance	**515.4**	umhos/cm			1		10/09/19 11:00		
Oxygen, Dissolved	**11.38**	mg/L			1		10/09/19 11:00	7782-44-7	
REDOX	**134.5**	mV			1		10/09/19 11:00		
Turbidity	**2.01**	NTU			1		10/09/19 11:00		
Static Water Level	**788.31**	feet			1		10/09/19 11:00		
Temperature, Water (C)	**12.6**	deg C			1		10/09/19 11:00		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**274**	mg/L	20.0	8.7	1		10/11/19 18:20		
9040 pH	Analytical Method: EPA 9040								
pH at 25 Degrees C	**7.4**	Std. Units	0.10	0.010	1		10/18/19 09:46		H6
300.0 IC Anions	Analytical Method: EPA 300.0								
Chloride	**1.1J**	mg/L	2.0	0.50	1		10/21/19 19:32	16887-00-6	
Fluoride	**<0.10**	mg/L	0.30	0.10	1		10/21/19 19:32	16984-48-8	
Sulfate	**16.7**	mg/L	3.0	1.0	1		10/21/19 19:32	14808-79-8	

Sample: MW-33AR **Lab ID: 40196971002** Collected: 10/08/19 15:40 Received: 10/10/19 09:15 Matrix: Water

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
6020 MET ICPMS	Analytical Method: EPA 6020 Preparation Method: EPA 3010								
Boron	**548**	ug/L	10.0	3.0	1	10/11/19 07:55	10/15/19 10:46	7440-42-8	
Calcium	**121000**	ug/L	254	76.2	1	10/11/19 07:55	10/15/19 10:46	7440-70-2	
Field Data	Analytical Method:								
Field pH	**7.74**	Std. Units			1		10/08/19 15:40		
Field Specific Conductance	**1102**	umhos/cm			1		10/08/19 15:40		
Oxygen, Dissolved	**12.19**	mg/L			1		10/08/19 15:40	7782-44-7	
REDOX	**165.1**	mV			1		10/08/19 15:40		
Turbidity	**2.13**	NTU			1		10/08/19 15:40		
Static Water Level	**788.26**	feet			1		10/08/19 15:40		
Temperature, Water (C)	**12.8**	deg C			1		10/08/19 15:40		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**634**	mg/L	20.0	8.7	1		10/11/19 18:20		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196971

Sample: MW-33AR **Lab ID: 40196971002** Collected: 10/08/19 15:40 Received: 10/10/19 09:15 Matrix: Water

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
9040 pH	Analytical Method: EPA 9040								
pH at 25 Degrees C	**7.6**	Std. Units	0.10	0.010	1		10/18/19 09:48		H6
300.0 IC Anions	Analytical Method: EPA 300.0								
Chloride	**153**	mg/L	20.0	5.0	10		10/22/19 14:29	16887-00-6	
Fluoride	**<0.10**	mg/L	0.30	0.10	1		10/21/19 19:45	16984-48-8	
Sulfate	**182**	mg/L	30.0	10.0	10		10/22/19 14:29	14808-79-8	

Sample: MW-34A **Lab ID: 40196971003** Collected: 10/08/19 14:35 Received: 10/10/19 09:15 Matrix: Water

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
6020 MET ICPMS	Analytical Method: EPA 6020 Preparation Method: EPA 3010								
Boron	**207**	ug/L	10.0	3.0	1	10/11/19 07:55	10/15/19 10:52	7440-42-8	
Calcium	**78800**	ug/L	254	76.2	1	10/11/19 07:55	10/15/19 10:52	7440-70-2	
Field Data	Analytical Method:								
Field pH	**7.79**	Std. Units			1		10/08/19 14:35		
Field Specific Conductance	**572.9**	umhos/cm			1		10/08/19 14:35		
Oxygen, Dissolved	**11.71**	mg/L			1		10/08/19 14:35	7782-44-7	
REDOX	**150.9**	mV			1		10/08/19 14:35		
Turbidity	**52.88**	NTU			1		10/08/19 14:35		
Static Water Level	**787.92**	feet			1		10/08/19 14:35		
Temperature, Water (C)	**13.4**	deg C			1		10/08/19 14:35		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**314**	mg/L	20.0	8.7	1		10/11/19 18:21		
9040 pH	Analytical Method: EPA 9040								
pH at 25 Degrees C	**7.7**	Std. Units	0.10	0.010	1		10/18/19 09:50		H6
300.0 IC Anions	Analytical Method: EPA 300.0								
Chloride	**57.9**	mg/L	2.0	0.50	1		10/21/19 19:58	16887-00-6	
Fluoride	**<0.10**	mg/L	0.30	0.10	1		10/21/19 19:58	16984-48-8	
Sulfate	**39.8**	mg/L	3.0	1.0	1		10/21/19 19:58	14808-79-8	

Sample: FIELD BLANK MOD 1-3 LF **Lab ID: 40196971004** Collected: 10/08/19 14:35 Received: 10/10/19 09:15 Matrix: Water

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
6020 MET ICPMS	Analytical Method: EPA 6020 Preparation Method: EPA 3010								
Boron	**<3.0**	ug/L	10.0	3.0	1	10/11/19 07:55	10/15/19 08:07	7440-42-8	
Calcium	**<76.2**	ug/L	254	76.2	1	10/11/19 07:55	10/15/19 08:07	7440-70-2	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196971

Sample: FIELD BLANK MOD 1-3 LF **Lab ID: 40196971004** Collected: 10/08/19 14:35 Received: 10/10/19 09:15 Matrix: Water

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**<8.7**	mg/L	20.0	8.7	1		10/11/19 18:21		
9040 pH	Analytical Method: EPA 9040								
pH at 25 Degrees C	**6.3**	Std. Units	0.10	0.010	1		10/18/19 09:55		H6
300.0 IC Anions	Analytical Method: EPA 300.0								
Chloride	**<0.50**	mg/L	2.0	0.50	1		10/21/19 20:11	16887-00-6	
Fluoride	**<0.10**	mg/L	0.30	0.10	1		10/21/19 20:11	16984-48-8	
Sulfate	**<1.0**	mg/L	3.0	1.0	1		10/21/19 20:11	14808-79-8	

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196971

QC Batch: 337095 Analysis Method: EPA 6020
QC Batch Method: EPA 3010 Analysis Description: 6020 MET
Associated Lab Samples: 40196971001, 40196971002, 40196971003, 40196971004

METHOD BLANK: 1957892 Matrix: Water
Associated Lab Samples: 40196971001, 40196971002, 40196971003, 40196971004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Boron	ug/L	<3.0	10.0	10/15/19 07:53	
Calcium	ug/L	<76.2	254	10/15/19 07:53	

LABORATORY CONTROL SAMPLE: 1957893

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	500	474	95	80-120	
Calcium	ug/L	5000	5060	101	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1957894 1957895

Parameter	Units	40196734001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	7220	500	500	7950	8800	146	316	75-125	10	20	P6
Calcium	ug/L	87600	5000	5000	95700	98200	161	210	75-125	3	20	P6

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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QUALITY CONTROL DATA

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196971

QC Batch: 337218 Analysis Method: SM 2540C
QC Batch Method: SM 2540C Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 40196971001, 40196971002, 40196971003, 40196971004

METHOD BLANK: 1959158 Matrix: Water
Associated Lab Samples: 40196971001, 40196971002, 40196971003, 40196971004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	<8.7	20.0	10/11/19 18:18	

LABORATORY CONTROL SAMPLE: 1959159

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	547	560	102	80-120	

SAMPLE DUPLICATE: 1959160

Parameter	Units	40196967001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	574	564	2	10	

SAMPLE DUPLICATE: 1959161

Parameter	Units	40196971001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	274	278	1	10	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196971

QC Batch: 337952 Analysis Method: EPA 9040
QC Batch Method: EPA 9040 Analysis Description: 9040 pH
Associated Lab Samples: 40196971001, 40196971002, 40196971003, 40196971004

SAMPLE DUPLICATE: 1962801

Parameter	Units	40196967002 Result	Dup Result	RPD	Max RPD	Qualifiers
pH at 25 Degrees C	Std. Units	7.3	7.3	0	20	H6

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196971

QC Batch: 337822 Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 Analysis Description: 300.0 IC Anions
Associated Lab Samples: 40196971001, 40196971002, 40196971003, 40196971004

METHOD BLANK: 1962191 Matrix: Water
Associated Lab Samples: 40196971001, 40196971002, 40196971003, 40196971004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	<0.50	2.0	10/21/19 11:34	
Fluoride	mg/L	<0.10	0.30	10/21/19 11:34	
Sulfate	mg/L	<1.0	3.0	10/21/19 11:34	

LABORATORY CONTROL SAMPLE: 1962192

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	20	20.1	101	90-110	
Fluoride	mg/L	2	2.0	102	90-110	
Sulfate	mg/L	20	20.1	100	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1962193 1962194

Parameter	Units	40196954007 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	14.1	20	20	33.8	33.6	99	98	90-110	1	15	
Fluoride	mg/L	<0.10	2	2	2.1	2.1	102	102	90-110	0	15	
Sulfate	mg/L	7.2	20	20	27.0	26.9	99	98	90-110	0	15	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1962195 1962196

Parameter	Units	40196971011 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	1.6J	20	20	20.9	21.3	97	99	90-110	2	15	
Fluoride	mg/L	<0.10	2	2	2.1	2.1	102	102	90-110	0	15	
Sulfate	mg/L	<1.0	20	20	20.6	20.4	102	101	90-110	1	15	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALIFIERS

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196971

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above LOD.

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

LOD - Limit of Detection adjusted for dilution factor, percent moisture, initial weight and final volume.

LOQ - Limit of Quantitation adjusted for dilution factor, percent moisture, initial weight and final volume.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected at or above the adjusted LOD.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

ANALYTE QUALIFIERS

H6	Analysis initiated outside of the 15 minute EPA required holding time.
P6	Matrix spike recovery was outside laboratory control limits due to a parent sample concentration notably higher than the spike level.

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196971

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
40196971001	**MW-302**	EPA 3010	337095	EPA 6020	337193
40196971002	**MW-33AR**	EPA 3010	337095	EPA 6020	337193
40196971003	**MW-34A**	EPA 3010	337095	EPA 6020	337193
40196971004	**FIELD BLANK MOD 1-3 LF**	EPA 3010	337095	EPA 6020	337193
40196971001	**MW-302**				
40196971002	**MW-33AR**				
40196971003	**MW-34A**				
40196971001	**MW-302**	SM 2540C	337218		
40196971002	**MW-33AR**	SM 2540C	337218		
40196971003	**MW-34A**	SM 2540C	337218		
40196971004	**FIELD BLANK MOD 1-3 LF**	SM 2540C	337218		
40196971001	**MW-302**	EPA 9040	337952		
40196971002	**MW-33AR**	EPA 9040	337952		
40196971003	**MW-34A**	EPA 9040	337952		
40196971004	**FIELD BLANK MOD 1-3 LF**	EPA 9040	337952		
40196971001	**MW-302**	EPA 300.0	337822		
40196971002	**MW-33AR**	EPA 300.0	337822		
40196971003	**MW-34A**	EPA 300.0	337822		
40196971004	**FIELD BLANK MOD 1-3 LF**	EPA 300.0	337822		

(Please Print Clearly)	
Company Name:	SCS Engineers
Branch/Location:	Madison, WI.
Project Contact:	Tom Karwoski
Phone:	608-224-2830
Project Number:	25219067.00
Project Name:	Columbia
Project State:	Wisconsin
Sampled By (Print):	Adam Watson
Sampled By (Sign):	
PO #:	Regulatory Program:

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UPPER MIDWEST REGION
MN: 612-607-1700 WI: 920-469-2436

Page 1 of

CHAIN OF CUSTODY

*Preservation Codes
A=None B=HCL C=H2SO4 D=HNO3 E=DI Water F=Methanol G=NaOH
H=Sodium Bisulfate Solution I=Sodium Thiosulfate J=Other

Quote #:	
Mail To Contact:	Tom Karwoski
Mail To Company:	SCS Engineers
Mail To Address:	2830 Dairy Dr Madison, WI 53718
Invoice To Contact:	
Invoice To Company:	
Invoice To Address:	Same
Invoice To Phone:	

Data Package Options (billable)
☐ EPA Level III
☐ EPA Level IV

MS/MSD
☐ On your sample (billable)
☐ NOT needed on your sample

Matrix Codes

A = Air	W = Water
B = Biota	DW = Drinking Water
C = Charcoal	GW = Ground Water
O = Oil	SW = Surface Water
S = Soil	WW = Waste Water
SI = Sludge	WP = Wipe

PACE LAB #	CLIENT FIELD ID	COLLECTION DATE	COLLECTION TIME	MATRIX	Analyses Requested	FILTERED? (YES/NO) Y/N	PRESERVATION (CODE)* Pick Letter	Boron / Calcium	pH	TDS, Cl, F, SO4	CLIENT COMMENTS	LAB COMMENTS (Lab Use Only)	Profile #
	MW-302	10/9/19	1100	W		N	D	X	X	X		001	
	MW-33AR	10/8/19	1540	W		N	A	X	X	X		002	
	MW-34A	10/8/19	1435	W		N	A	X	X	X		003	
	Field Blank Mod1-3LF	10/8/19	1435	W		N	A	X	X	X		004	
	MW-309	10/8/19	1150	W		N	A	X	X	X		005	
	MW-310	10/8/19	1250	W		N	A	X	X	X		006	
	MW-311	10/8/19	1340	W		N	A	X	X	X		007	
	Field blank Mod4	10/8/19	1450	W		N	A	X	X	X		008	
	MW-306	10/8/19	1055	W		N	A	X	X	X		009	
	MW-307	10/7/19	1005	W		N	A	X	X	X		010	
	MW-308	10/7/19	1355	W		N	A	X	X	X		011	
	Field blank SCPOND	10/8/19	1055	W		N	A	X	X	X		012	

Rush Turnaround Time Requested - Prelims
(Rush TAT subject to approval/surcharge)
Date Needed:

Transmit Prelim Rush Results by (complete what you want):

Email #1:	
Email #2:	
Telephone:	
Fax:	

Samples on HOLD are subject to special pricing and release of liability

Relinquished By:	Date/Time:	Received By:	Date/Time:
	10/9/19 1600		
CS Logistics	10/10/19 0915		10/10/19 0915

PACE Project No.: 4019691

Receipt Temp = 2.0I °C

Sample Receipt pH: OK / Adjusted

Cooler Custody Seal: Present / Not Present

Intact / Not Intact

Version 6.0 06/14/06

C019a(27Jun2006)

ORIGINAL

Pace Analytical Services, LLC
1241 Bellevue Street, Suite 9
Green Bay, WI 54302

Sample Preservation Receipt Form

Client Name: SCS Engineers Project # 4019697.1

All containers needing preservation have been checked and noted below: ☑Yes ☐No ☐N/A Initial when completed: [signature] Date/ Time:

Lab Lot# of pH paper: 10US0891 Lab Std #ID of preservation (if pH adjusted):

Pace Lab #	Glass							Plastic							Vials						Jars			General			VOA Vials (>6mm) *	H2SO4 pH ≤2	NaOH+Zn Act pH ≥9	NaOH pH ≥12	HNO3 pH ≤2	pH after adjusted	Volume (mL)
	AG1U	AG1H	AG4S	AG4U	AG5U	AG2S	BG3U	BP1U	BP2N	BP2Z	BP3U	BP3B	BP3N	BP3S	DG9A	DG9T	VG9U	VG9H	VG9M	VG9D	JGFU	WGFU	WPFU	SP5T	ZPLC	GN							
001											2		1																	X		2.5 / 5 / 10
002											2		1																	X		2.5 / 5 / 10
003											2		1																	X		2.5 / 5 / 10
004											2		1																	X		2.5 / 5 / 10
005											2		1																	X		2.5 / 5 / 10
006											2		1																	X		2.5 / 5 / 10
007											2		1																	X		2.5 / 5 / 10
008											2		1																	X		2.5 / 5 / 10
009											2		1																	X		2.5 / 5 / 10
010											2		1																	X		2.5 / 5 / 10
011											2		1																	X		2.5 / 5 / 10
012											2		1																	X		2.5 / 5 / 10
013																																2.5 / 5 / 10
014																																2.5 / 5 / 10
015																																2.5 / 5 / 10
016																																2.5 / 5 / 10
017																																2.5 / 5 / 10
018																																2.5 / 5 / 10
019																																2.5 / 5 / 10
020																																2.5 / 5 / 10

10/12/17 BD

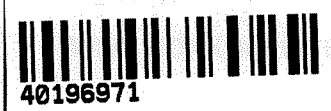
Exceptions to preservation check: VOA, Coliform, TOC, TOX, TOH, O&G, WI DRO, Phenolics, Other: _____ Headspace in VOA Vials (>6mm) : ☐Yes ☐No ☒N/A ***If yes look in headspace column**

AG1U	1 liter amber glass	BP1U	1 liter plastic unpres	DG9A	40 mL amber ascorbic	JGFU	4 oz amber jar unpres
AG1H	1 liter amber glass HCL	BP2N	500 mL plastic HNO3	DG9T	40 mL amber Na Thio	WGFU	4 oz clear jar unpres
AG4S	125 mL amber glass H2SO4	BP2Z	500 mL plastic NaOH, Znact	VG9U	40 mL clear vial unpres	WPFU	4 oz plastic jar unpres
AG4U	120 mL amber glass unpres	BP3U	250 mL plastic unpres	VG9H	40 mL clear vial HCL		
AG5U	100 mL amber glass unpres	BP3B	250 mL plastic NaOH	VG9M	40 mL clear vial MeOH	SP5T	120 mL plastic Na Thiosulfate
AG2S	500 mL amber glass H2SO4	BP3N	250 mL plastic HNO3	VG9D	40 mL clear vial DI	ZPLC	ziploc bag
BG3U	250 mL clear glass unpres	BP3S	250 mL plastic H2SO4			GN:	

Pace Analytical 1241 Bellevue Street, Green Bay, WI 54302	Document Name: **Sample Condition Upon Receipt (SCUR)**	Document Revised: 25Apr2018
	Document No.: **F-GB-C-031-Rev.07**	Issuing Authority: Pace Green Bay Quality Office

Sample Condition Upon Receipt Form (SCUR)

Project #: **WO#: 40196971**



Client Name: SCS Engineers

Courier: ☒ CS Logistics ☐ Fed Ex ☐ Speedee ☐ UPS ☐ Waltco
☐ Client ☐ Pace Other: _____

Tracking #: 2120. 1009 1 9

Custody Seal on Cooler/Box Present: ☐ yes ☒ no Seals intact: ☐ yes ☐ no

Custody Seal on Samples Present: ☐ yes ☒ no Seals intact: ☐ yes ☐ no

Packing Material: ☐ Bubble Wrap ☐ Bubble Bags ☐ None ☒ Other Plastic bag

Thermometer Used SR - NA **Type of Ice:** (Wet) Blue Dry None ☒ Samples on ice, cooling process has begun

Cooler Temperature Uncorr: ROI /Corr: —

Temp Blank Present: ☐ yes ☒ no **Biological Tissue is Frozen:** ☐ yes ☐ no

Temp should be above freezing to 6°C.
Biota Samples may be received at ≤ 0°C.

Person examining contents:
Date: 10/10/19
Initials: JW

Chain of Custody Present:	☒Yes ☐No ☐N/A	1.
Chain of Custody Filled Out:	☒Yes ☐No ☐N/A	2.
Chain of Custody Relinquished:	☒Yes ☐No ☐N/A	3.
Sampler Name & Signature on COC:	☒Yes ☐No ☐N/A	4.
Samples Arrived within Hold Time:	☒Yes ☐No	5.
- VOA Samples frozen upon receipt	☐Yes ☐No	Date/Time:
Short Hold Time Analysis (<72hr):	☒Yes ☐No	6.
Rush Turn Around Time Requested:	☐Yes ☒No	7.
Sufficient Volume:		8.
For Analysis: ☒Yes ☐No MS/MSD:	☐Yes ☒No ☐N/A	
Correct Containers Used:	☒Yes ☐No	9.
-Pace Containers Used:	☒Yes ☐No ☐N/A	
-Pace IR Containers Used:	☐Yes ☐No ☒N/A	
Containers Intact:	☒Yes ☐No	10.
Filtered volume received for Dissolved tests	☐Yes ☐No ☒N/A	11.
Sample Labels match COC:	☒Yes ☐No ☐N/A	12.
-Includes date/time/ID/Analysis Matrix: WW		
Trip Blank Present:	☐Yes ☐No ☒N/A	13.
Trip Blank Custody Seals Present	☐Yes ☐No ☒N/A	
Pace Trip Blank Lot # (if purchased):		

Client Notification/ Resolution: If checked, see attached form for additional comments ☐

Person Contacted: _____ Date/Time: _____

Comments/ Resolution: _____

Project Manager Review: for DM **Date:** 10-10-19

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

November 01, 2019

Meghan Blodgett
SCS ENGINEERS
2830 Dairy Drive
Madison, WI 53718

RE: Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196970

Dear Meghan Blodgett:
Enclosed are the analytical results for sample(s) received by the laboratory on October 10, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Dan Milewsky
dan.milewsky@pacelabs.com
(920)469-2436
Project Manager

Enclosures

cc: Tom Karwoski, SCS ENGINEERS
Nicole Kron, SCS ENGINEERS
Jeff Maxted, ALLIANT ENERGY
Marc Morandi, ALLIANT ENERGY

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

CERTIFICATIONS

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196970

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
ANAB DOD-ELAP Rad Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification #: PA01547
Connecticut Certification #: PH-0694
Delaware Certification
EPA Region 4 DW Rad
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Florida: Cert E871149 SEKS WET
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: KY90133
KY WW Permit #: KY0098221
KY WW Permit #: KY0000221
Louisiana DHH/TNI Certification #: LA180012
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: 2017020
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification #: 9991
Missouri Certification #: 235
Montana Certification #: Cert0082
Nebraska Certification #: NE-OS-29-14
Nevada Certification #: PA014572018-1
New Hampshire/TNI Certification #: 297617
New Jersey/TNI Certification #: PA051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Ohio EPA Rad Approval: #41249
Oregon/TNI Certification #: PA200002-010
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: 02867
Texas/TNI Certification #: T104704188-17-3
Utah/TNI Certification #: PA014572017-9
USDA Soil Permit #: P330-17-00091
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 9526
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Approve List for Rad
Wyoming Certification #: 8TMS-L

Green Bay Certification IDs

1241 Bellevue Street, Green Bay, WI 54302
Florida/NELAP Certification #: E87948
Illinois Certification #: 200050
Kentucky UST Certification #: 82
Louisiana Certification #: 04168
Minnesota Certification #: 055-999-334
New York Certification #: 12064
North Dakota Certification #: R-150
Virginia VELAP ID: 460263
South Carolina Certification #: 83006001
Texas Certification #: T104704529-14-1
Wisconsin Certification #: 405132750
Wisconsin DATCP Certification #: 105-444
USDA Soil Permit #: P330-16-00157
Federal Fish & Wildlife Permit #: LE51774A-0

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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(920)469-2436

SAMPLE SUMMARY

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196970

Lab ID	Sample ID	Matrix	Date Collected	Date Received
40196970001	**MW-301**	Water	10/09/19 12:00	10/10/19 09:15
40196970002	**MW-84A**	Water	10/09/19 13:10	10/10/19 09:15

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SAMPLE ANALYTE COUNT

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196970

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
40196970001	**MW-301**	EPA 6020	DS1	14	PASI-G
		EPA 7470	AJT	1	PASI-G
			HMG	7	PASI-G
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C	TMK	1	PASI-G
		EPA 9040	ALY	1	PASI-G
		EPA 300.0	HMB	3	PASI-G
40196970002	**MW-84A**	EPA 6020	DS1	14	PASI-G
		EPA 7470	AJT	1	PASI-G
			HMG	7	PASI-G
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C	TMK	1	PASI-G
		EPA 9040	ALY	1	PASI-G
		EPA 300.0	HMB	3	PASI-G

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ANALYTICAL RESULTS

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196970

Sample: MW-301 **Lab ID: 40196970001** Collected: 10/09/19 12:00 Received: 10/10/19 09:15 Matrix: Water

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
6020 MET ICPMS	Analytical Method: EPA 6020 Preparation Method: EPA 3010								
Antimony	**<0.15**	ug/L	1.0	0.15	1	10/14/19 07:07	10/14/19 23:25	7440-36-0	
Arsenic	**0.42J**	ug/L	1.0	0.28	1	10/14/19 07:07	10/15/19 12:57	7440-38-2	
Barium	**10**	ug/L	2.3	0.70	1	10/14/19 07:07	10/14/19 23:25	7440-39-3	
Beryllium	**<0.25**	ug/L	1.0	0.25	1	10/14/19 07:07	10/15/19 12:57	7440-41-7	
Boron	**35.9**	ug/L	10.0	3.0	1	10/14/19 07:07	10/15/19 12:57	7440-42-8	
Cadmium	**<0.15**	ug/L	1.0	0.15	1	10/14/19 07:07	10/14/19 23:25	7440-43-9	
Calcium	**114000**	ug/L	254	76.2	1	10/14/19 07:07	10/15/19 12:57	7440-70-2	
Chromium	**<1.0**	ug/L	3.4	1.0	1	10/14/19 07:07	10/15/19 12:57	7440-47-3	
Cobalt	**<0.12**	ug/L	1.0	0.12	1	10/14/19 07:07	10/15/19 12:57	7440-48-4	
Lead	**<0.24**	ug/L	1.0	0.24	1	10/14/19 07:07	10/14/19 23:25	7439-92-1	
Lithium	**0.61J**	ug/L	1.0	0.22	1	10/14/19 07:07	10/15/19 12:57	7439-93-2	
Molybdenum	**<0.44**	ug/L	1.5	0.44	1	10/14/19 07:07	10/14/19 23:25	7439-98-7	
Selenium	**<0.32**	ug/L	1.1	0.32	1	10/14/19 07:07	10/15/19 12:57	7782-49-2	
Thallium	**<0.14**	ug/L	1.0	0.14	1	10/14/19 07:07	10/14/19 23:25	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470								
Mercury	**<0.084**	ug/L	0.28	0.084	1	10/22/19 14:50	10/23/19 09:18	7439-97-6	
Field Data	Analytical Method:								
Field pH	**6.67**	Std. Units			1		10/09/19 12:00		
Field Specific Conductance	**801**	umhos/cm			1		10/09/19 12:00		
Oxygen, Dissolved	**1.67**	mg/L			1		10/09/19 12:00	7782-44-7	
REDOX	**173.0**	mV			1		10/09/19 12:00		
Turbidity	**2.12**	NTU			1		10/09/19 12:00		
Static Water Level	**788.47**	feet			1		10/09/19 12:00		
Temperature, Water (C)	**11.3**	deg C			1		10/09/19 12:00		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**418**	mg/L	20.0	8.7	1		10/15/19 16:41		
9040 pH	Analytical Method: EPA 9040								
pH at 25 Degrees C	**7.0**	Std. Units	0.10	0.010	1		10/18/19 09:42		H6
300.0 IC Anions	Analytical Method: EPA 300.0								
Chloride	**1.7J**	mg/L	2.0	0.50	1		10/21/19 18:26	16887-00-6	
Fluoride	**<0.10**	mg/L	0.30	0.10	1		10/21/19 18:26	16984-48-8	
Sulfate	**8.4**	mg/L	3.0	1.0	1		10/21/19 18:26	14808-79-8	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196970

Sample: MW-84A **Lab ID: 40196970002** Collected: 10/09/19 13:10 Received: 10/10/19 09:15 Matrix: Water

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
6020 MET ICPMS	Analytical Method: EPA 6020 Preparation Method: EPA 3010								
Antimony	**<0.15**	ug/L	1.0	0.15	1	10/14/19 07:07	10/14/19 23:46	7440-36-0	
Arsenic	**0.46J**	ug/L	1.0	0.28	1	10/14/19 07:07	10/15/19 13:34	7440-38-2	
Barium	**13.2**	ug/L	2.3	0.70	1	10/14/19 07:07	10/14/19 23:46	7440-39-3	
Beryllium	**<0.25**	ug/L	1.0	0.25	1	10/14/19 07:07	10/15/19 13:34	7440-41-7	
Boron	**12.0**	ug/L	10.0	3.0	1	10/14/19 07:07	10/15/19 13:34	7440-42-8	
Cadmium	**<0.15**	ug/L	1.0	0.15	1	10/14/19 07:07	10/15/19 13:34	7440-43-9	
Calcium	**73500**	ug/L	254	76.2	1	10/14/19 07:07	10/15/19 13:34	7440-70-2	
Chromium	**1.6J**	ug/L	3.4	1.0	1	10/14/19 07:07	10/15/19 13:34	7440-47-3	
Cobalt	**<0.12**	ug/L	1.0	0.12	1	10/14/19 07:07	10/15/19 13:34	7440-48-4	
Lead	**<0.24**	ug/L	1.0	0.24	1	10/14/19 07:07	10/14/19 23:46	7439-92-1	
Lithium	**0.52J**	ug/L	1.0	0.22	1	10/14/19 07:07	10/15/19 13:34	7439-93-2	
Molybdenum	**<0.44**	ug/L	1.5	0.44	1	10/14/19 07:07	10/15/19 13:34	7439-98-7	
Selenium	**<0.32**	ug/L	1.1	0.32	1	10/14/19 07:07	10/15/19 13:34	7782-49-2	
Thallium	**<0.14**	ug/L	1.0	0.14	1	10/14/19 07:07	10/14/19 23:46	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470								
Mercury	**<0.084**	ug/L	0.28	0.084	1	10/22/19 14:50	10/23/19 09:25	7439-97-6	
Field Data	Analytical Method:								
Field pH	**7.23**	Std. Units			1		10/09/19 13:10		
Field Specific Conductance	**614.1**	umhos/cm			1		10/09/19 13:10		
Oxygen, Dissolved	**11.36**	mg/L			1		10/09/19 13:10	7782-44-7	
REDOX	**181.7**	mV			1		10/09/19 13:10		
Turbidity	**2.41**	NTU			1		10/09/19 13:10		
Static Water Level	**787.79**	feet			1		10/09/19 13:10		
Temperature, Water (C)	**11.8**	deg C			1		10/09/19 13:10		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**310**	mg/L	20.0	8.7	1		10/15/19 16:41		
9040 pH	Analytical Method: EPA 9040								
pH at 25 Degrees C	**7.5**	Std. Units	0.10	0.010	1		10/18/19 09:44		H6
300.0 IC Anions	Analytical Method: EPA 300.0								
Chloride	**3.9**	mg/L	2.0	0.50	1		10/21/19 19:19	16887-00-6	
Fluoride	**<0.10**	mg/L	0.30	0.10	1		10/21/19 19:19	16984-48-8	
Sulfate	**1.3J**	mg/L	3.0	1.0	1		10/21/19 19:19	14808-79-8	

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196970

QC Batch: 338359 Analysis Method: EPA 7470
QC Batch Method: EPA 7470 Analysis Description: 7470 Mercury
Associated Lab Samples: 40196970001, 40196970002

METHOD BLANK: 1964880 Matrix: Water
Associated Lab Samples: 40196970001, 40196970002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	<0.084	0.28	10/23/19 09:14	

LABORATORY CONTROL SAMPLE: 1964881

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	5	5.3	105	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1964882 1964883

Parameter	Units	40196970001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	<0.084	5	5	5.1	5.0	101	100	85-115	1	20	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196970

QC Batch: 337277 Analysis Method: EPA 6020
QC Batch Method: EPA 3010 Analysis Description: 6020 MET
Associated Lab Samples: 40196970001, 40196970002

METHOD BLANK: 1959950 Matrix: Water
Associated Lab Samples: 40196970001, 40196970002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	<0.15	1.0	10/14/19 18:40	
Arsenic	ug/L	<0.28	1.0	10/14/19 18:40	
Barium	ug/L	<0.70	2.3	10/14/19 18:40	
Beryllium	ug/L	<0.25	1.0	10/14/19 18:40	
Boron	ug/L	<3.0	10.0	10/14/19 18:40	
Cadmium	ug/L	<0.15	1.0	10/14/19 18:40	
Calcium	ug/L	<76.2	254	10/14/19 18:40	
Chromium	ug/L	<1.0	3.4	10/14/19 18:40	
Cobalt	ug/L	<0.12	1.0	10/14/19 18:40	
Lead	ug/L	<0.24	1.0	10/14/19 18:40	
Lithium	ug/L	<0.22	1.0	10/14/19 18:40	
Molybdenum	ug/L	<0.44	1.5	10/14/19 18:40	
Selenium	ug/L	<0.32	1.1	10/14/19 18:40	
Thallium	ug/L	<0.14	1.0	10/14/19 18:40	

LABORATORY CONTROL SAMPLE: 1959951

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	500	497	99	80-120	
Arsenic	ug/L	500	478	96	80-120	
Barium	ug/L	500	477	95	80-120	
Beryllium	ug/L	500	488	98	80-120	
Boron	ug/L	500	464	93	80-120	
Cadmium	ug/L	500	501	100	80-120	
Calcium	ug/L	5000	5080	102	80-120	
Chromium	ug/L	500	478	96	80-120	
Cobalt	ug/L	500	467	93	80-120	
Lead	ug/L	500	470	94	80-120	
Lithium	ug/L	500	477	95	80-120	
Molybdenum	ug/L	500	452	90	80-120	
Selenium	ug/L	500	494	99	80-120	
Thallium	ug/L	500	476	95	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1959952 1959953

Parameter	Units	40196861005 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	<0.15	500	500	513	510	103	102	75-125	1	20	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196970

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1959952 1959953

Parameter	Units	40196861005 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Arsenic	ug/L	2.4	500	500	512	504	102	100	75-125	2	20	
Barium	ug/L	169	500	500	671	672	100	101	75-125	0	20	
Beryllium	ug/L	<0.25	500	500	513	469	103	94	75-125	9	20	
Boron	ug/L	73.0	500	500	582	529	102	91	75-125	10	20	
Cadmium	ug/L	<0.15	500	500	514	512	103	102	75-125	0	20	
Calcium	ug/L	90300	5000	5000	96800	99900	130	192	75-125	3	20	P6
Chromium	ug/L	<1.0	500	500	492	486	98	97	75-125	1	20	
Cobalt	ug/L	<0.12	500	500	488	484	98	97	75-125	1	20	
Lead	ug/L	<0.24	500	500	489	489	98	98	75-125	0	20	
Lithium	ug/L	12.4	500	500	518	476	101	93	75-125	8	20	
Molybdenum	ug/L	2.6	500	500	477	476	95	95	75-125	0	20	
Selenium	ug/L	<0.32	500	500	524	521	105	104	75-125	1	20	
Thallium	ug/L	<0.14	500	500	502	502	100	100	75-125	0	20	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196970

QC Batch: 337571 Analysis Method: SM 2540C
QC Batch Method: SM 2540C Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 40196970001, 40196970002

METHOD BLANK: 1960873 Matrix: Water
Associated Lab Samples: 40196970001, 40196970002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	<8.7	20.0	10/15/19 16:39	

LABORATORY CONTROL SAMPLE: 1960874

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	547	558	102	80-120	

SAMPLE DUPLICATE: 1960875

Parameter	Units	40196939001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	354	368	4	10	

SAMPLE DUPLICATE: 1960876

Parameter	Units	40196970001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	418	406	3	10	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196970

QC Batch: 337952 Analysis Method: EPA 9040
QC Batch Method: EPA 9040 Analysis Description: 9040 pH
Associated Lab Samples: 40196970001, 40196970002

SAMPLE DUPLICATE: 1962801

Parameter	Units	40196967002 Result	Dup Result	RPD	Max RPD	Qualifiers
pH at 25 Degrees C	Std. Units	7.3	7.3	0	20	H6

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196970

QC Batch: 337822
QC Batch Method: EPA 300.0
Analysis Method: EPA 300.0
Analysis Description: 300.0 IC Anions
Associated Lab Samples: 40196970001, 40196970002

METHOD BLANK: 1962191 Matrix: Water
Associated Lab Samples: 40196970001, 40196970002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	<0.50	2.0	10/21/19 11:34	
Fluoride	mg/L	<0.10	0.30	10/21/19 11:34	
Sulfate	mg/L	<1.0	3.0	10/21/19 11:34	

LABORATORY CONTROL SAMPLE: 1962192

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	20	20.1	101	90-110	
Fluoride	mg/L	2	2.0	102	90-110	
Sulfate	mg/L	20	20.1	100	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1962193 1962194

Parameter	Units	40196954007 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	14.1	20	20	33.8	33.6	99	98	90-110	1	15	
Fluoride	mg/L	<0.10	2	2	2.1	2.1	102	102	90-110	0	15	
Sulfate	mg/L	7.2	20	20	27.0	26.9	99	98	90-110	0	15	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1962195 1962196

Parameter	Units	40196971011 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	1.6J	20	20	20.9	21.3	97	99	90-110	2	15	
Fluoride	mg/L	<0.10	2	2	2.1	2.1	102	102	90-110	0	15	
Sulfate	mg/L	<1.0	20	20	20.6	20.4	102	101	90-110	1	15	

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REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196970

Sample: MW-301 **Lab ID: 40196970001** Collected: 10/09/19 12:00 Received: 10/10/19 09:15 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.252 ± 0.351 (0.585) C:NA T:83%**	pCi/L	10/31/19 12:20	13982-63-3	
Radium-228	EPA 904.0	**0.449 ± 0.363 (0.723) C:77% T:95%**	pCi/L	10/30/19 14:23	15262-20-1	
Total Radium	Total Radium Calculation	**0.701 ± 0.714 (1.31)**	pCi/L	11/01/19 15:00	7440-14-4	

Sample: MW-84A **Lab ID: 40196970002** Collected: 10/09/19 13:10 Received: 10/10/19 09:15 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.247 ± 0.292 (0.459) C:NA T:101%**	pCi/L	10/31/19 12:20	13982-63-3	
Radium-228	EPA 904.0	**-0.0240 ± 0.355 (0.827) C:78% T:89%**	pCi/L	10/30/19 14:24	15262-20-1	
Total Radium	Total Radium Calculation	**0.247 ± 0.647 (1.29)**	pCi/L	11/01/19 15:00	7440-14-4	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196970

QC Batch: 366494 Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1 Analysis Description: 903.1 Radium-226
Associated Lab Samples: 40196970001, 40196970002

METHOD BLANK: 1777728 Matrix: Water
Associated Lab Samples: 40196970001, 40196970002

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.0468 ± 0.331 (0.660) C:NA T:87%	pCi/L	10/31/19 12:20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL - RADIOCHEMISTRY

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196970

QC Batch: 366493 Analysis Method: EPA 904.0
QC Batch Method: EPA 904.0 Analysis Description: 904.0 Radium 228
Associated Lab Samples: 40196970001, 40196970002

METHOD BLANK: 1777725 Matrix: Water
Associated Lab Samples: 40196970001, 40196970002

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	-0.00340 ± 0.362 (0.843) C:80% T:79%	pCi/L	10/30/19 14:21	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALIFIERS

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196970

DEFINITIONS

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval). Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above LOD.

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

LOD - Limit of Detection adjusted for dilution factor, percent moisture, initial weight and final volume.

LOQ - Limit of Quantitation adjusted for dilution factor, percent moisture, initial weight and final volume.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected at or above the adjusted LOD.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-G	Pace Analytical Services - Green Bay
PASI-PA	Pace Analytical Services - Greensburg

ANALYTE QUALIFIERS

H6	Analysis initiated outside of the 15 minute EPA required holding time.
P6	Matrix spike recovery was outside laboratory control limits due to a parent sample concentration notably higher than the spike level.

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: 25219067.00 COLUMBIA CCR
Pace Project No.: 40196970

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
40196970001	**MW-301**	EPA 3010	337277	EPA 6020	337400
40196970002	**MW-84A**	EPA 3010	337277	EPA 6020	337400
40196970001	**MW-301**	EPA 7470	338359	EPA 7470	338406
40196970002	**MW-84A**	EPA 7470	338359	EPA 7470	338406
40196970001	**MW-301**				
40196970002	**MW-84A**				
40196970001	**MW-301**	EPA 903.1	366494		
40196970002	**MW-84A**	EPA 903.1	366494		
40196970001	**MW-301**	EPA 904.0	366493		
40196970002	**MW-84A**	EPA 904.0	366493		
40196970001	**MW-301**	Total Radium Calculation	369027		
40196970002	**MW-84A**	Total Radium Calculation	369027		
40196970001	**MW-301**	SM 2540C	337571		
40196970002	**MW-84A**	SM 2540C	337571		
40196970001	**MW-301**	EPA 9040	337952		
40196970002	**MW-84A**	EPA 9040	337952		
40196970001	**MW-301**	EPA 300.0	337822		
40196970002	**MW-84A**	EPA 300.0	337822		

Pace Analytical
www.pacelabs.com

UPPER MIDWEST REGION
MN: 612-607-1700 WI: 920-469-2436

Page 1 of

CHAIN OF CUSTODY

*Preservation Codes
A=None B=HCL C=H2SO4 D=HNO3 E=DI Water F=Methanol G=NaOH
H=Sodium Bisulfate Solution I=Sodium Thiosulfate J=Other

(Please Print Clearly)	
Company Name:	SCS Engineers
Branch/Location:	Madison, WI
Project Contact:	Tom Karwoski
Phone:	608-224-2830
Project Number:	25219067.00
Project Name:	Columbia
Project State:	Wisconsin
Sampled By (Print):	Adam Watson
Sampled By (Sign):	
PO #:	Regulatory Program:

Quote #:	
Mail To Contact:	Tom Karwoski
Mail To Company:	SCS Engineers
Mail To Address:	2830 Dairy Dr. Madison WI 53718
Invoice To Contact:	
Invoice To Company:	
Invoice To Address:	
Invoice To Phone:	

Data Package Options (billable)
☐ EPA Level III
☐ EPA Level IV

MS/MSD
☐ On your sample (billable)
☐ NOT needed on your sample

Matrix Codes

A = Air	W = Water
B = Biota	DW = Drinking Water
C = Charcoal	GW = Ground Water
O = Oil	SW = Surface Water
S = Soil	WW = Waste Water
SI = Sludge	WP = Wipe

PACE LAB #	CLIENT FIELD ID	COLLECTION DATE	COLLECTION TIME	MATRIX	FILTERED? (YES/NO)	PRESERVATION (CODE)*	Analyses Requested: Radium 226 & 228	Metals see attached table	pH	TDS, Cl, F, SO4	CLIENT COMMENTS	LAB COMMENTS (Lab Use Only)	Profile #
					Y/N	Pick Letter							
001	MW-301	10/9/19	1200	GW	N	D	X	X	X	X		001	
002	MW-84A	10/9/19	1316	GW	N	D	X	X	X	X		002	

Rush Turnaround Time Requested - Prelims
(Rush TAT subject to approval/surcharge)
Date Needed:

Transmit Prelim Rush Results by (complete what you want):

Email #1:	
Email #2:	
Telephone:	
Fax:	

Samples on HOLD are subject to special pricing and release of liability

Relinquished By:	Date/Time:	Received By:	Date/Time:
	10/9/19 1600		
CS Logistics	10/10/19 0915	FAX	10/10/19 0915

PACE Project No.: 40196970

Receipt Temp = 2.0 °C

Sample Receipt pH: (OK) Adjusted

Cooler Custody Seal: Present / (Not Present)

Intact / Not Intact

Version 6.0 06/14/06

C019a(27Jun2006)

ORIGINAL

4019697O

Table 2. Sampling Points and Parameters - CCR Rule Sampling Program
Groundwater Monitoring - Columbia Energy Center / SCS Engineers Project #25219067

		COC #1 - Background Wells		COC #2 - Landfill Modules 1-3				COC #3 - Landfill Module 4				COC #4 - Primary Pond					COC #5 - Secondary Pond			
	Parameter	MW-301	MW-84A	MW-302	MW-33AR	MW-34A	FIELD BLANK - MOD1-3LF	MW-309	MW-310	MW-311	FIELD BLANK-MOD4	MW-303	MW-304	MW-305	MW-4R	FIELD BLANK - PPOND	MW-306	MW-307	MW-308	FIELD BLANK - SCPOND
Appendix III Parameters (Detection Monitoring)	Boron	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Calcium	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Chloride	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Fluoride	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	pH	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Sulfate	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	TDS	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Appendix IV Parameters (Assessment Monitoring)	Antimony	x	x									x	x	x	x	x				
	Arsenic	x	x									x	x	x	x	x				
	Barium	x	x									x	x	x	x	x				
	Beryllium	x	x									x	x	x	x	x				
	Cadmium	x	x									x	x	x	x	x				
	Chromium	x	x									x	x	x	x	x				
	Cobalt	x	x									x	x	x	x	x				
	Fluoride	x	x									x	x	x	x	x				
	Lead	x	x									x	x	x	x	x				
	Lithium	x	x									x	x	x	x	x				
	Mercury	x	x									x	x	x	x	x				
	Molybdenum	x	x									x	x	x	x	x				
	Selenium	x	x									x	x	x	x	x				
	Thallium	x	x									x	x	x	x	x				
	Radium 226+228	x	x									x	x	x	x	x				
CCR Rule Field Parameters	Groundwater Elevation	x	x	x	x	x		x	x	x		x	x	x	x		x	x	x	
	pH	x	x	x	x	x		x	x	x		x	x	x	x		x	x	x	
Low-Flow Sampling Field Parameters	Well Depth	x	x	x	x	x		x	x	x		x	x	x	x		x	x	x	
	Specific Conductance	x	x	x	x	x		x	x	x		x	x	x	x		x	x	x	
	Dissolved Oxygen	x	x	x	x	x		x	x	x		x	x	x	x		x	x	x	
	ORP	x	x	x	x	x		x	x	x		x	x	x	x		x	x	x	
	Temperature	x	x	x	x	x		x	x	x		x	x	x	x		x	x	x	
	Turbidity	x	x	x	x	x		x	x	x		x	x	x	x		x	x	x	
	Color	x	x	x	x	x		x	x	x		x	x	x	x		x	x	x	
	Odor	x	x	x	x	x		x	x	x		x	x	x	x		x	x	x	

Notes: All samples are unfiltered (total).

I:\25219067.00\Data and Calculations\Tables\Lab Bottle Orders\[2019 April_COL CCR.xls]Sheet1

Pace Analytical Services, LLC
1241 Bellevue Street, Suite 9
Green Bay, WI 54302

Sample Preservation Receipt Form

Client Name: SC Engineers Project # 40196970

All containers needing preservation have been checked and noted below: X Yes ☐No ☐N/A

Lab Lot# of pH paper: 1 0450891 Lab Std #ID of preservation (if pH adjusted):

Initial when completed: JD Date/ Time:

	Glass							Plastic							Vials						Jars			General								
Pace Lab #	AG1U	AG1H	AG4S	AG4U	AG5U	AG2S	BG3U	BP1U	BP2N	BP2Z	BP3U	BP3B	BP3N	BP3S	DG9A	DG9T	VG9U	VG9H	VG9M	VG9D	JGFU	WGFU	WPFU	SP5T	ZPLC	GN	VOA Vials (>6mm) *	H2SO4 pH ≤2	NaOH+Zn Act pH ≥9	NaOH pH ≥12	HNO3 pH ≤2	pH after adjusted	Volume (mL)
001											2		1													2					X		2.5 / 5 / 10
002											2		1													2					X		2.5 / 5 / 10
003																																	2.5 / 5 / 10
004																																	2.5 / 5 / 10
005																																	2.5 / 5 / 10
006																																	2.5 / 5 / 10
007																																	2.5 / 5 / 10
008																																	2.5 / 5 / 10
009																																	2.5 / 5 / 10
010																																	2.5 / 5 / 10
011																																	2.5 / 5 / 10
012																																	2.5 / 5 / 10
013																																	2.5 / 5 / 10
014																																	2.5 / 5 / 10
015																																	2.5 / 5 / 10
016																																	2.5 / 5 / 10
017																																	2.5 / 5 / 10
018																																	2.5 / 5 / 10
019																																	2.5 / 5 / 10
020																																	2.5 / 5 / 10

10/10/17 JD

Exceptions to preservation check: VOA, Coliform, TOC, TOX, TOH, O&G, WI DRO, Phenolics, Other: _____ Headspace in VOA Vials (>6mm) : ☐Yes ☐No ☒N/A ***If yes look in headspace column**

AG1U	1 liter amber glass	BP1U	1 liter plastic unpres	DG9A	40 mL amber ascorbic	JGFU	4 oz amber jar unpres
AG1H	1 liter amber glass HCL	BP2N	500 mL plastic HNO3	DG9T	40 mL amber Na Thio	WGFU	4 oz clear jar unpres
AG4S	125 mL amber glass H2SO4	BP2Z	500 mL plastic NaOH, Znact	VG9U	40 mL clear vial unpres	WPFU	4 oz plastic jar unpres
AG4U	120 mL amber glass unpres	BP3U	250 mL plastic unpres	VG9H	40 mL clear vial HCL		
AG5U	100 mL amber glass unpres	BP3B	250 mL plastic NaOH	VG9M	40 mL clear vial MeOH	SP5T	120 mL plastic Na Thiosulfate
AG2S	500 mL amber glass H2SO4	BP3N	250 mL plastic HNO3	VG9D	40 mL clear vial DI	ZPLC	ziploc bag
BG3U	250 mL clear glass unpres	BP3S	250 mL plastic H2SO4			GN:	1 liter plastic HNO3 pres

Pace Analytical 1241 Bellevue Street, Green Bay, WI 54302	Document Name: **Sample Condition Upon Receipt (SCUR)**	Document Revised: 25Apr2018
	Document No.: **F-GB-C-031-Rev.07**	Issuing Authority: Pace Green Bay Quality Office

Sample Condition Upon Receipt Form (SCUR)

Project #:

WO# : 40196970

40196970

Client Name: SCS Engineers

Courier: ☒ CS Logistics ☐ Fed Ex ☐ Speedee ☐ UPS ☐ Waltco
☐ Client ☐ Pace Other:

Tracking #: 2120.100919

Custody Seal on Cooler/Box Present: ☐ yes ☒ no Seals intact: ☐ yes ☐ no

Custody Seal on Samples Present: ☐ yes ☒ no Seals intact: ☐ yes ☐ no

Packing Material: ☐ Bubble Wrap ☐ Bubble Bags ☐ None ☒ Other Zip lock / plastic bag

Thermometer Used SR - NA **Type of Ice:** (Wet) Blue Dry None ☒ Samples on ice, cooling process has begun

Cooler Temperature Uncorr: 20.1 /Corr: —

Temp Blank Present: ☐ yes ☒ no **Biological Tissue is Frozen:** ☐ yes ☐ no

Temp should be above freezing to 6°C.
Biota Samples may be received at ≤ 0°C.

Person examining contents:
Date: 10/10/19
Initials: SW

Chain of Custody Present:	☒Yes ☐No ☐N/A	1.
Chain of Custody Filled Out:	☐Yes ☒No ☐N/A	2. Invoice details not documented 10/10/19 SW
Chain of Custody Relinquished:	☒Yes ☐No ☐N/A	3.
Sampler Name & Signature on COC:	☒Yes ☐No ☐N/A	4.
Samples Arrived within Hold Time:	☒Yes ☐No	5.
- VOA Samples frozen upon receipt	☐Yes ☐No	Date/Time:
Short Hold Time Analysis (<72hr):	☐Yes ☒No	6.
Rush Turn Around Time Requested:	☐Yes ☒No	7.
Sufficient Volume:		8.
For Analysis: ☒Yes ☐No MS/MSD:	☐Yes ☒No ☐N/A	
Correct Containers Used:	☒Yes ☐No	9.
-Pace Containers Used:	☒Yes ☐No ☐N/A	
-Pace IR Containers Used:	☐Yes ☐No ☒N/A	
Containers Intact:	☒Yes ☐No	10.
Filtered volume received for Dissolved tests	☐Yes ☐No ☒N/A	11.
Sample Labels match COC:	☒Yes ☐No ☐N/A	12.
-Includes date/time/ID/Analysis Matrix: W		
Trip Blank Present:	☐Yes ☐No ☒N/A	13.
Trip Blank Custody Seals Present	☐Yes ☐No ☒N/A	
Pace Trip Blank Lot # (if purchased):		

Client Notification/ Resolution: If checked, see attached form for additional comments ☐

Person Contacted: Date/Time:

Comments/ Resolution:

Project Manager Review: for DM **Date:** 10-10-19

Appendix B

Alternative Source Demonstrations

B1 Alternative Source Demonstration, October 2018 Detection Monitoring

Alternative Source Demonstration
October 2018 Detection Monitoring

Columbia Energy Center
Dry Ash Disposal Facility, Modules 1-3
Pardeeville, Wisconsin

Prepared for:

Alliant Energy

SCS ENGINEERS

25216067.18 | April 15, 2019

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

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Tables

Figures

Appendices

I:\25216067.00\Deliverables\2019 ASD LF 1-3 1810\190415_ASD_COLLF1-3_1810_FINAL.docx

PE CERTIFICATION

I, Sherren Clark, hereby certify that that the information in this alternate source demonstration is accurate and meets the requirements of 40 CFR 257.94(e)(2). This certification is based on my review of the groundwater data and related site information available for the Columbia Energy Center Dry Ash Disposal Facility. I am a duly licensed Professional Engineer under the laws of the State of Wisconsin.

SC — 4-12-19

(signature) (date)

Sherren Clark

(printed or typed name)

License number E-29863

My license renewal date is July 31, 2020.

Pages or sheets covered by this seal:

Alternative Source Demonstration, all pages.

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1.0 INTRODUCTION

This Alternative Source Demonstration (ASD) was prepared to support compliance with the groundwater monitoring requirements of the "Coal Combustion Residuals (CCR) Final Rule" published by the U.S. Environmental Protection Agency (USEPA) in the *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule*, dated April 17, 2015 (USEPA, 2015), and subsequent amendments. Specifically, this report was prepared to fulfill the requirements of 40 CFR 257.94(e)(2). The applicable sections of the Rule are provided below in *italics*.

1.1 §257.94(E)(2) ALTERNATIVE SOURCE DEMONSTRATION REQUIREMENTS

The owner and operator may demonstrate that a source other than the CCR Unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The owner or operator must complete the written demonstration within 90 days of detecting a statistically significant increase over background levels.

An ASD is completed when there are exceedances of one or more benchmarks established within the groundwater monitoring program. The ASD is completed to determine if any other sources are likely causes of the identified exceedance(s) of established benchmark(s) at the site. This ASD was performed in response to results indicating a statistically significant increase (SSI) over background levels during detection monitoring under the CCR Rule.

This ASD report is evaluating the SSIs observed in the statistical evaluation of the October 2018 detection monitoring event at the Columbia Energy Center (COL) Dry Ash Disposal Facility, Modules 1-3 CCR Units. Previous ASDs were prepared for this facility evaluating the SSIs observed in the statistical evaluation of the October 2017 and the April 2018 detection monitoring events (SCS Engineers [SCS], 2018b and 2018c). The October 2017 ASD (dated April 2018) and the April 2018 ASD (dated December 2018) concluded that several lines of evidence demonstrated that SSIs reported for boron, chloride, sulfate, and total dissolved solids (TDS) concentrations in the downgradient monitoring wells were likely due to man-made sources other than the CCR units and/or naturally occurring constituents in the alluvial aquifer.

As discussed in more detail in **Section 4.2** of this ASD, the findings for the October 2018 monitoring event were consistent with those for the previous events.

1.2 SITE INFORMATION AND MAP

The COL site is located at W8375 Murray Road, Pardeeville, Columbia County, Wisconsin (**Figure 1**). The COL site is an active coal-burning generating station which has been burning coal and disposing of CCR on site since the mid-1970s. The layout of the site is shown on **Figure 2**. The COL property includes two areas of CCR storage and disposal. These are the Dry Ash Disposal Facility (ADF) and the Ash Ponds Facility. This ASD will evaluate the conditions at the site for Modules 1-3 of the ADF only. The ADF is operated under the Wisconsin Department of Natural Resources (WDNR) License No. 3025.

The groundwater monitoring system for the COL ADF Modules 1-3 is a multi-unit system, monitoring three existing CCR Units:

- COL Dry ADF – Module 1 (existing CCR Landfill)
- COL Dry ADF – Module 2 (existing CCR Landfill)
- COL Dry ADF – Module 3 (existing CCR Landfill)

A map showing the CCR Units and all background (or upgradient) and downgradient monitoring wells with identification numbers for the CCR groundwater monitoring program and the state monitoring program is provided as **Figure 2**. A separate monitoring system has been established for Module 4 of the COL ADF and for the primary ash pond and secondary ash pond.

1.3 STATISTICALLY SIGNIFICANT INCREASES IDENTIFIED

SSIs were identified for boron, chloride, and sulfate at one or more wells based on the October 2018 detection monitoring event.

A summary of the October 2018 constituent concentrations and the established benchmark concentrations is provided in **Table 1**. The constituent concentrations with SSIs above the background concentration are highlighted in the table. Concentration trends for the parameters with SSIs are shown in **Appendix A**.

1.4 OVERVIEW OF ASD

This ASD report includes:

- Background information (**Section 2.0**)
- Evaluation of potential that SSIs are due to methodology or analysis (**Section 3.0**)
- Evaluation of potential that SSIs are due to natural sources or man-made sources other than the CCR Units (**Section 4.0**)
- ASD conclusions (**Section 5.0**)
- Monitoring recommendations (**Section 6.0**)

The CCR Rule constituent results from background and compliance sampling for parameters with SSIs are provided in **Table 2**. Complete laboratory reports for the background monitoring events and the October 2017 detection monitoring event were included in the 2017 Annual Groundwater Monitoring and Corrective Action Report (SCS, 2018a). The laboratory reports for the 2018 events were included in the 2018 Annual Report (SCS, 2019).

2.0 BACKGROUND

To provide context for the ASD evaluation, the following background information is provided in this section of the report, prior to the ASD evaluation sections:

- Geologic and hydrogeologic setting
- CCR Rule monitoring system
- Other monitoring wells

A more detailed discussion of the background information for the site is provided in the ASD for the October 2017 event (SCS, 2018b).

2.1 REGIONAL GEOLOGY AND HYDROGEOLOGY

2.1.1 Regional Information

For the purposes of groundwater monitoring, the surficial sand and gravel aquifer is considered the uppermost aquifer, as defined under 40 CFR 257.53. Immediately underlying the surficial sand and gravel aquifer is the Cambrian-Ordovician sandstone aquifer.

Additional details on the regional geology and hydrogeology were provided in the October 2017 ASD (SCS, 2018b).

2.1.2 Site Information

Soils at the site are primarily sand to a depth of approximately 50 to 100 feet and overlie sandstone bedrock. Soils encountered during the site feasibility study for the COL ADF were described as generally sandy with interbedded silty clay lenses up to 20 feet thick (Warzyn, 1978). During drilling of CCR wells MW-301 and MW-302, the unconsolidated materials were identified as consisting primarily of silty sand. Boring logs for previously installed monitoring wells MW-33AR, MW-34A, MW-84A, and M-4R show silty sand and sand as the primary unconsolidated materials at these locations. All CCR monitoring wells are screened within the unconsolidated sand unit.

Shallow groundwater at the site generally flows to the northwest across the existing landfill area, then generally flows west toward the Wisconsin River. A groundwater flow map for October 2018 is shown on Figure 3. The groundwater elevation data for the CCR monitoring wells are provided in Table 3.

2.2 CCR RULE MONITORING SYSTEM

The groundwater monitoring system established in accordance with the CCR Rule consists of two upgradient (background) monitoring wells and three downgradient monitoring wells. The background wells include MW-301 and MW-84A. The downgradient wells include MW-302, MW-33AR, and MW-34A. The CCR Rule wells are installed within the sand and gravel aquifer. Well depths range from approximately 29 to 40 feet, measured from the top of the well casing.

2.3 OTHER MONITORING WELLS

Additional groundwater monitoring wells currently exist at COL as part of the monitoring systems developed for the state monitoring program and for the other CCR units.

Monitoring wells for the state monitoring program are installed in the unconsolidated sand and gravel unit, which is the uppermost aquifer as defined under 40 CFR 257.53. This shallow monitoring system includes water table wells and mid-depth piezometers. Well depths range from approximately 14 to 76 feet, measured from the top of the well casing.

3.0 METHODOLOGY AND ANALYSIS REVIEW

To evaluate the potential that an SSI is due to a source other than the regulated CCR Unit, SCS used a two-step evaluation process. First, the sample collection, field and laboratory analysis, and statistical evaluation were reviewed to identify any potential error or analysis that led to exceedance of the benchmark. Second, potential alternative sources, including natural variation and man-made sources other than the CCR unit, were evaluated. This section of the report provides the findings of

the methodology and analysis review. Section 4.0 of the report addresses the potential alternative sources.

3.1 SAMPLING AND FIELD ANALYSIS

Field notes and sampling results were reviewed to determine if any sampling error may have caused or contributed to the observed SSIs. Potential field sampling errors or issues could include mislabeling of samples, improper sample handling, missed holding times, cross contamination during sampling, or other field error. Field blank sample results were also reviewed for any indication of potential contamination from sampling equipment or containers. Based on the review of the field notes and results, SCS did not identify any indication that the SSI concentrations were due to a sampling error.

SCS did not identify any issues with the field pH analysis based on review of the data and field notes. Because boron, chloride, and sulfate are laboratory parameters, there is little potential for a field analysis error to contribute to an SSI.

3.2 LABORATORY ANALYSIS REVIEW

The laboratory reports for the October 2018 detection monitoring event were reviewed to determine if any laboratory analysis error or issue may have caused or contributed to an observed SSI for boron, chloride, or sulfate. The laboratory report review included reviewing the laboratory quality control flags and narrative, verifying that correct methods were used and desired detection limits were achieved, and checking the field and laboratory blank sample results.

Based on the review of the laboratory reports, SCS did not identify any indication that the SSIs were due to a laboratory analysis error. There were no laboratory quality control flags or issues identified in the laboratory report that affect the usability of the data for detection monitoring.

Time series plots of the SSI constituent analytical data were also reviewed for any anomalous results that might indicate a possible sampling or laboratory error (e.g., dilution error or incorrect sample labeling). The time series plots are provided in Appendix A.

3.3 STATISTICAL EVALUATION REVIEW

The review of the statistical results and methods include a quality control check of the following:

- Input analytical data vs. laboratory analytical reports
- Review statistical method and outlier concentration lists for each monitoring well/CCR Unit

Based on the review of the statistical evaluation, SCS did not identify any errors or issues in the statistical evaluation that caused or contributed to the determination of interwell SSIs for the October 2018 detection monitoring event.

3.4 SUMMARY OF METHODOLOGY AND ANALYSIS REVIEW FINDINGS

In summary, there were no changes to the SSI determinations for the October 2018 monitoring event based on the methodology and analysis review, and no errors or issues causing or contributing to the reported SSIs were identified.

4.0 ALTERNATIVE SOURCES

This section of the report discusses the potential alternative sources for the boron, chloride, and sulfate SSIs at MW-33AR, MW-34A, and MW-302; identifies the most likely alternative source(s); and presents the lines of evidence indicating that an alternative source is the most likely cause of the observed SSIs.

4.1 POTENTIAL CAUSES OF SSI

4.1.1 Natural Variation

The statistical analysis was completed using an interwell approach, comparing the October 2018 detection monitoring results to the upper prediction limits (UPLs) calculated based on sampling of the background wells (MW-84A and MW-301). If concentrations of a constituent that is naturally present in the aquifer vary spatially, then the potential exists that the downgradient concentrations may be higher than upgradient concentrations due to natural variation.

Although natural variation is present in the shallow aquifer, it does not appear likely that natural variation is the primary source causing the boron, chloride, and sulfate SSIs.

4.1.2 Man-Made Alternative Sources

Man-made alternative sources that could potentially contribute to the boron, chloride, and sulfate SSIs could include the closed ash pond landfill, the active ash ponds, the former ash pond effluent ditch, the coal storage area, road salt use, railroad operations, or other plant operations.

Based on the groundwater flow directions and on previous investigations at the site, the former ash pond effluent ditch appears to be the most likely cause of the boron and/or sulfate SSIs for wells MW-33AR, MW-34A, and MW-302. The ash pond effluent ditch also likely contributed to the chloride SSIs at MW-33AR and MW34A.

Based on the higher chloride concentrations previously detected at MW-33AR from 2016 through April 2018, a non-CCR alternative source may also contribute to the chloride SSIs.

4.2 LINES OF EVIDENCE

The lines of evidence indicating that the SSIs for boron, chloride, and/or sulfate in compliance wells MW-33AR, MW-34A, and MW-302, relative to the background wells, are due to an alternative source include:

1. Elevated concentrations of boron, chloride, and/or sulfate were present in the area west of the landfill, where the three compliance wells are located, before the landfill was constructed.

2. Monitoring performed under the state program documents that the concentrations of boron, chloride, and sulfate were elevated before CCR disposal in the landfill began, and have decreased since the landfill has been in operation.

3. Groundwater flow directions have changed through time due to changes in water management at the plant, so that groundwater impacted by the effluent ditch formerly flowed to the east, under the landfill, and is now flowing west.

4. The increase in chloride results for well B-33AR in the last 2 years has not correlated with an increase in boron, as would be expected for a CCR leachate source; therefore, an alternative source is more likely.

4.2.1 Pre-Landfill Water Quality

Elevated concentrations of boron, chloride, and sulfate were present in the area west of the landfill, where the three compliance wells are located, before the landfill was constructed. Groundwater monitoring performed in 1977 and 1978 as part of the feasibility study for the landfill permitting showed that wells located along the west side of the future landfill footprint, where the current compliance wells are located, had elevated results for sulfate, chloride, and specific conductance.

The 1978 Feasibility Study (Warzyn, 1978) for the dry ADF discusses the influence of the ash pond effluent ditch on groundwater west of the proposed site. The former ash pond effluent ditch, shown on **Figure 2**, carried effluent from the ash ponds located north of the plant, and flowed south between the west side of the current landfill and the substation. Groundwater monitoring in December 1977 indicated that sulfate was present at 1,200 milligrams per liter (mg/L) in MW-33A, which was located near the point where the ash pond effluent discharged from a culvert into the effluent ditch. The sulfate concentration at this well decreased to 830 mg/L in the December 1978 sampling (Warzyn, 1979). Current concentrations of sulfate in this area are much lower, but remain above background. The October 2018 sulfate result for MW-33AR (installed to replace MW-33A) was 112 mg/L and at MW-34A were 123 mg/L.

Selected text and tables from the 1978 Feasibility Study and the 1979 Supplementary Feasibility Study Report are included in **Appendix B**.

4.2.2 Long-Term Concentration Trends

Monitoring performed under the state program documents that the concentrations of boron and sulfate were elevated before CCR disposal in the landfill began, and have decreased since the landfill has been in operation. Routine groundwater monitoring for the COL ADF began after the Plan of Operation was approved and prior to initial CCR disposal. The earliest data available from the WDNR Groundwater Environmental Monitoring System (GEMS) database is from September 1984. Initial placement of CCR in test plots in Module 1 of the ADF was approved in October 1984 and CCR disposal began sometime after that. Therefore, the initial groundwater monitoring results in the GEMS database represent pre-disposal conditions for the landfill.

The historic monitoring data show that concentrations of boron and sulfate were significantly higher in the area west of the landfill where the compliance wells are located. Graphs of historical concentrations are provided in **Appendix C**. Results for compliance well MW-33AR are plotted with results from well MW-33A. MW-33AR was a replacement well for MW-33A at a slightly different location and depth. The well screen was installed approximately 10 feet higher in MW-33AR than in MW-33A, intersecting the water table, which may explain the increase in concentration that occurred with the well replacement. Results for compliance well MW-302 are plotted with results from monitoring well MW-85, which was located near the current MW-302 location (see **Figure 2**) and was monitored from September 1984 through September 1995.

The recent boron, chloride, and sulfate concentrations are consistent with generally decreasing or stable historical concentrations at MW-33AR and MW-34A (**Appendix A** and **Appendix C**).

4.2.3 Groundwater Flow Direction Changes

Groundwater flow directions have changed through time due to changes in water management at the plant, so that groundwater impacted by the effluent ditch formerly flowed to the east, under the landfill, and is now flowing west. The 1978 Feasibility Study report states that the southern 2/3 of the proposed fill area (including the area of the active CCR landfill phases) exhibits a southeast and southerly groundwater flow direction, toward an agricultural drainage ditch southeast and south of the landfill area. The 1981 Plan of Operation indicates that flow in the landfill area is to the east-southeast. A water table map prepared by RMT, based on October 2002 water level measurements, shows flow under the landfill generally to the east and northeast from a groundwater high near the effluent ditch and Wisconsin Pollutant Discharge Elimination System (WPDES) pond between the landfill and the substation. The 1981 and 2002 water table maps are provided in Appendix D.

Under current conditions, groundwater flow below the active landfill area is generally to the west and northwest. The flow changes with time reflect the termination of discharge to the ash pond effluent ditch in the mid-2000s. When discharge via this ditch was active, the ditch was a source of recharge to the groundwater and created a high groundwater area with flow moving away from the ditch to the east. After discharge to the ditch was terminated, water levels in this area decreased significantly and the groundwater flow direction changed.

With the changes in groundwater flow, historically impacted groundwater moved in alternating directions. While the effluent ditch was active, impacted groundwater likely moved eastward past the current compliance wells, as indicated by the long-term concentration data. Although the compliance wells are downgradient from the landfill under current flow conditions, the observed groundwater impacts may be residual from the past when the wells were downgradient from the effluent ditch.

4.2.4 Chloride and Boron Leachate Concentrations

The chloride results for well MW-33AR increased significantly in October 2016 through April 2018 and decreased between April and October 2018 to concentrations similar to those detected prior to October 2016. Corresponding changes in boron concentrations were not detected during 2016 through 2018, indicating that the source of the increasing chloride was not likely the CCR landfill. Sampling of the landfill leachate pond and the lysimeters indicates that boron and chloride concentrations are generally both elevated in leachate (Table 4). An alternative man-made source, such as salt, is a more likely source of chloride than the CCR Units.

5.0 ASD CONCLUSIONS

The lines of evidence discussed above regarding the SSIs reported for boron, chloride, and sulfate concentrations in downgradient monitoring wells MW-33AR, MW-34A, and/or MW-302 demonstrate that the SSIs are likely primarily due to sources other than the CCR Units. Boron, sulfate, and chloride concentrations were elevated prior to disposal of CCR in the landfill and are associated with historical discharges from the ash ponds via the effluent ditch located west of the landfill. Elevated chloride concentrations detected at well MW-33AR appear likely to be related to an alternative non-CCR source, such as salt.

6.0 SITE GROUNDWATER MONITORING RECOMMENDATIONS

In accordance with section 257.94(e)(2) of the CCR Rule, the COL landfill site may continue with detection monitoring based on this ASD. The ASD report will be included in the 2019 Annual Report due January 31, 2019.

7.0 REFERENCES

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Tables

Table 1. Groundwater Analytical Results - Detection Monitoring
Columbia Landfill MOD 1-3 / SCS Engineers Project #25218067.18

Parameter Name	Interwell Upper Prediction Limit (UPL)	Background Wells						Compliance Wells											
		MW-84A			MW-301			MW-33AR				MW-34A				MW-302			
		Oct-17	Apr-18	Oct-18	Oct-17	Apr-18	Oct-18	Oct-17	Apr-18		Oct-18	Oct-17	Apr-18		Oct-18	Oct-17	Apr-18		Oct-18
		10/24/2017	4/25/2018	10/22/2018	10/23/2017	4/25/2018	10/22/2018	10/24/2017	Original 4/24/2018	Retest 9/21/2018	10/22/2018	10/24/2017	Original 4/24/2018	Retest 9/21/2018	10/22/2018	10/24/2017	Original 4/24/2018	Retest 9/21/2018	10/22/2018
Boron, ug/L	37.4	13.8	25.0	10.1 J	34.3	24.3	27.8	678	601	683	682	208	209	241	233	691	1,950	203	296
Calcium, ug/L	138,400	77,500	76,600	74000	87,200	112,000	101,000	98,200	99,800	NA	66,900	69,600	69,600	NA	70,100	94,400	110,000	NA	56,900
Chloride, mg/L	6.52	5.1	4.8	4.2	4.0	2.3	3.2	119	188	32.6	14.4	7.6	8.2	17.1	19.9	6.9	15.0	1.7 J	1.8 J
Fluoride, mg/L	0.3	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	NA	<0.10	<0.10	<0.10	NA	<0.10	<0.10	<0.10	NA	<0.10
Field pH, Std. Units	7.93	7.68	7.45	7.24	7.37	6.76	6.79	7.81	7.74	8.16	7.69	7.67	7.80	8.12	7.64	8.23	7.21	7.74	7.22
Sulfate, mg/L	37.1	2.2 J	2.8 J	1.6 J	27.5	8.6	19.2	175	163	124	112	98	144	141	123	78.4	109	30.0	26.9
Total Dissolved Solids, mg/L	514	314	328	330	362	464	424	606	692	466	388	340	412	460	392	446	598	280	288

Highlighted cell indicates the compliance well result is an SSI. UPLs are based on a 1-of-2 retesting approach; therefore, for the April 2018 semiannual event an SSI is indicated only if both the original result and the September 2018 retest are above the UPL and the LOQ.

Abbreviations:
UPL = Upper Prediction Limit NA = Not Analyzed LOQ = Limit of Quantification LOD = Limit of Detection SSI = Statistically Significant Increase
J = Estimated concentration at or above the LOD and below the LOQ.

Notes:
1. Interwell UPL based on parametric prediction limit based on 1-of-2 retesting methodology for all parameters except fluoride and total dissolved solids. Parametric UPL for sulfate calculated using natural logarithm transformed data.
2. Interwell UPL for fluoride is non-parametric based on quantitation limit. UPL for total dissolved solids based on non-parametric prediction limit (highest background value). Non-parametric UPLs are based on 1-of-2 retesting methodology.
3. Interwell UPLs calculated from background well results for December 2015 through October 2017.

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Last revision by:	NDK	Date:	3/2/2019
Checked by:	NAS	Date:	3/6/2019

I:\25216067.00\Deliverables\2019 ASD LF 1-3 1810\Tables\1810_tables\[1_CCR GW Screening Summary_COL LF_updated.xlsx]Table

Table 2. Analytical Results - Appendix III Constituents with SSIs
CCR Landfills, Columbia Generation Station
Pardeeville, Wisconsin

Well Group	Well	Collection Date	Boron (µg/L)	Chloride (mg/L)	Sulfate (mg/L)
Background	MW-301	12/22/2015	26.5	3.7 J	9.3
		4/5/2016	25.2	4	15.3
		7/8/2016	23.6	3.5 J	15
		10/13/2016	30.6	2.2	13.9
		12/29/2016	32.8	2 J	12.3 J
		1/25/2017	32.6	1.5 J	6.5
		4/11/2017	28.8	2	10.3
		6/6/2017	21.3	3.5	17.1
		8/8/2017	30.6	5.5	31.6
		10/23/2017	34.3	4	27.5
		4/25/2018	24.3	2.3	8.6
		10/22/2018	27.8	3.2	19.2
	MW-84A	12/22/2015	11.9	4.9	4.9
		4/5/2016	14	4.7	4.3
		7/8/2016	14.7	5.1	3.7 J
		10/13/2016	11.1	4.3	2.6 J
		12/29/2016	14.7	4.7	2.7 J
		1/25/2017	16.1	4.6	3
		4/11/2017	12.9	4.9	2.8 J
		6/6/2017	14.8	5.5	2.7 J
		8/8/2017	22.9	5.5	2 J
		10/24/2017	13.8	5.1	2.2 J
		4/25/2018	25	4.8	2.8 J
		10/22/2018	10.1 J	4.2	1.6 J
Compliance	MW-302	12/22/2015	80	4.2	37.4
		4/5/2016	78.8	4.1	55.6
		7/7/2016	134	3.1 J	35.4
		10/13/2016	132	1.1 J	64.7
		12/29/2016	106	1.2 J	56.4
		1/25/2017	149	1.6 J	61.6
		4/11/2017	322	1.6 J	81.3
		6/6/2017	671	3.5	84.6
		8/8/2017	833	4.5	79
		10/24/2017	691	6.9	78.4
		4/24/2018	1,950	15	109
		9/21/2018	203	1.7 J	30
		10/22/2018	296	1.8 J	26.9
	MW-33AR	12/21/2015	954	10.6	96.2
		4/5/2016	813	12.5	91.5
		7/7/2016	794	12.5	99.2
		10/13/2016	827	52.5	124
		12/29/2016	812	39.6	132
		1/25/2017	763	41.4	133
		4/11/2017	760	47.1	139
		6/6/2017	692	68.1	151
		8/7/2017	697	105	164
		10/24/2017	678	119	175
		4/24/2018	601	188	163
		9/21/2018	683	32.6	124
		10/22/2018	682	14.4	112

Table 2. Analytical Results - Appendix III Constituents with SSIs
CCR Landfills, Columbia Generation Station
Pardeeville, Wisconsin

Well Group	Well	Collection Date	Boron (µg/L)	Chloride (mg/L)	Sulfate (mg/L)
Compliance	MW-34A	12/21/2015	230	4.9	69.9
		4/5/2016	220	5.1	71.6
		7/7/2016	216	5.6	63.4
		10/13/2016	212	6.8	54.8
		12/29/2016	224	7.1	63.9
		1/25/2017	214	7.2	71.2
		4/11/2017	214	6.2	87.6
		6/6/2017	201	7.8	106
		8/7/2017	205	7.4	105
		10/24/2017	208	7.6	98
		4/24/2018	209	8.2	144
		9/21/2018	241	17.1	141
		10/22/2018	233	19.9	123

Abbreviations:
µg/L = micrograms per liter or parts per billion (ppb)
mg/l = milligrams per liter or parts per million (ppm)
J = Estimated value below the laboratory's limit of quantitation

Notes:
(1) Analytical laboratory reports provided in the 2017 Annual Groundwater Monitoring and Corrective Action Report.

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I:\25216067.00\Deliverables\2019 ASD LF 1-3 1810\Tables\1810_tables\[2 and 3_COL LF ASD.xlsx]Table 2. Analy. Rslts- CCR

Table 3. Groundwater Elevations - State Monitoring Program and CCR Well Network
CCR Landfill Modules 1-3, Columbia Generating Station
Pardeeville, Wisconsin

	Well Number	MW-1AR	MW-5R	MW-33AR	MW-33BR	MW-34A	MW-34B	MW-37A	MW-83	MW-84A	MW-84B	MW-86	MW-91AR	MW-91B	MW-92A	MW-92B
	Top of Casing Elevation (feet amsl)	822.55	805.44	808.29	808.39	805.95	806.05	813.04	807.96	814.28	814.26	824.79	809.03	808.45	808.47	808.41
	Screen Length (ft)															
	Total Depth (ft from top of casing)	44.40	25.97	31.08	57.50	35.43	56.95	31.80	25.42	40.21	52.02	45.43	32.90	52.38	28.94	51.75
	Top of Well Screen Elevation (ft)	778.15	779.47	777.21	750.89	770.52	749.10	781.24	782.54	774.07	762.24	779.36	776.13	756.07	779.53	756.66
Dry Ash Facility	**Measurement Date**															
	April 4-6, 2016	785.82	787.02	785.29	785.07	785.63	785.67	784.76	785.43	786.37	786.26	785.89	786.05	785.95	786.61	786.21
	October 3-5, 2017	785.48	786.66	784.51	784.22	784.67	784.63	784.86	784.29	--	786.49	785.58	786.08	785.83	786.47	786.02
	October 9-10, 2017	--	--	--	--	--	--	--	--	785.56 (2)	--	--	--	--	--	--
	April 23-25, 2018	783.99	785.36	783.09	786.36	781.77	780.79	783.28	783.32	785.88	784.91	782.54	784.71	784.53	785.23	784.81
	October 23-25, 2018	788.25	789.71	788.77	787.96	787.88	787.73	787.62	788.26	788.32	788.19	788.21	788.59	788.31	789.32	788.87
	Bottom of Well Elevation (ft)	778.15	779.47	777.21	750.89	770.52	749.10	781.24	782.54	774.07	762.24	779.36	776.13	756.07	779.53	756.66

	Well Number	M-3	M-4R	MW-39A	MW-39B	MW-48A	MW-48B	MW-57	MW-59	MW-216R	MW-217	MW-220RR
	Top of Casing Elevation (feet amsl)	788.23	806.10	809.62	809.50	828.86	828.84	786.29	815.48	814.21	791.55	792.90
	Screen Length (ft)											
	Total Depth (ft from top of casing)	16.90	25.55	34.80	76.07	51.88	75.80	14.40	38.50	37.85	37.37	18.96
	Top of Well Screen Elevation (ft)	771.33	780.55	774.82	733.43	776.98	753.04	771.89	776.98	776.36	754.18	773.94
Ash Pond Facility	**Measurement Date**											
	April 4-6, 2016	784.21	789.09	785.27	785.27	784.79	784.76	783.21	784.97	785.68	785.02	784.36
	October 3-5, 2017	780.93	787.04	783.35	783.18	784.30	784.19	782.37	784.23	783.89	782.48	782.61
	April 23-25, 2018	782.89	790.43	782.86	782.87	783.14	783.09	783.04	783.02	783.23	783.26	783.45
	October 22-24, 2018	782.95	788.47	787.12	786.88	787.12	786.99	783.48	787.73	787.49	784.90	784.52
	Bottom of Well Elevation (ft)	771.33	780.55	774.82	733.43	776.98	753.04	771.89	776.98	776.36	754.18	773.94

	Well Number	MW-301	MW-302	MW-33AR	MW-34A	MW-84A
	Top of Casing Elevation (feet amsl)	806.89	813.00	808.29	805.95	814.28
	Screen Length (ft)	10	10	10	10	10
	Total Depth (ft from top of casing)	29.40	33.6	31.08	35.43	40.21
	Top of Well Screen Elevation (ft)	787.49	789.40	787.21	780.52	784.07
	Measurement Date					
	April 4-5, 2016	786.78	785.81	785.29	785.63	786.37
	July 7-8, 2016	786.31	786.28	785.19	785.05	785.89
	July 28, 2016	NM	NM	NM	784.86	785.61
CCR Rule Wells	October 11-13, 2016	787.64	787.76	787.36	786.45	787.22
	December 29, 2016	787.37	787.05	785.66	785.72	786.63
	January 25-26, 2017	787.27	786.89	785.88	785.98	786.70
	April 10 & 11, 2017	787.89	787.55	786.39	786.30	787.16
	June 6, 2017	788.25	788.37	787.27	786.66	787.63
	August 7-9, 2017	787.34	787.55	786.11	785.81	786.68
	October 23-24, 2017	785.89	785.94	784.13	784.50	785.32
	April 23-25, 2018	785.29	784.37	783.09	781.77	785.88
	September 21, 2018	NM	788.37	787.90	787.01	NM
	October 22-24, 2018	788.98	789.16	788.77	787.88	788.32
	Bottom of Well Elevation (ft)	771.33	780.55	771.89	776.98	776.36

Notes:
NM = not measured

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Last revision by: NAS Date: 3/6/2019
Checked by: MDB Date: 3/27/2019

(1) Water Levels collected during sample collection.
(2) The depth to water at MW-84A was not measured prior to purging for sampling during the October 3-5, 2017 sampling event. The level was allowed to return to static and was measured on 10/10/2017.

I:\25216067.00\Deliverables\2019 ASD LF 1-3 1810\Tables\1810_tables\[2 and 3_COL LF ASD.xlsx]Table 3. GW Elevations

Table 4. Analytical Results - Lysimeters and Leachate Pond
Wisconsin Power and Light - Columbia Dry Ash Disposal Facility
SCS Engineers Project #25216067

Monitoring Point	Monitoring Period	Monitoring Point Dry/ Broken	Boron, Total (µg/L)	Chloride, Total (mg/L)	Sulfate, Total (mg/L)
LS-1	2015-Apr	DRY	--	--	--
	2015-Oct	BROKEN	--	--	--
	2016-Apr	DRY	--	--	--
	2016-Oct	--	6530	12.3	789
	2017-Apr	--	6510	20.7 J	814
	2017-Oct	--	6200	14.2 J	764
	2018-Apr	--	5920	16 J	856
	2018-Oct	DRY	--	--	
LS-3R	2015-Apr	--	6480	20.6 B	807
	2015-Oct	DRY	--	--	--
	2016-Apr	DRY	--	--	--
	2016-Oct	DRY	--	--	--
	2017-Apr	DRY	--	--	--
	2017-Oct	DRY	--	--	--
	2018-Apr	DRY	--	--	--
	2018-Oct	--	6180	26.2 J	841
LP-1	2015-Apr	--	4060	27.8	734
	2015-Oct	--	4300	37.1	820
	2016-Apr	--	1830	26.8	416
	2016-Oct	--	4610	71.5	835
	2017-Apr	--	2690	66.3	587
	2017-Oct	--	4970	91.7	739
	2018-Apr	--	2060	63.2	634
	2018-Oct	--	2630	151	907

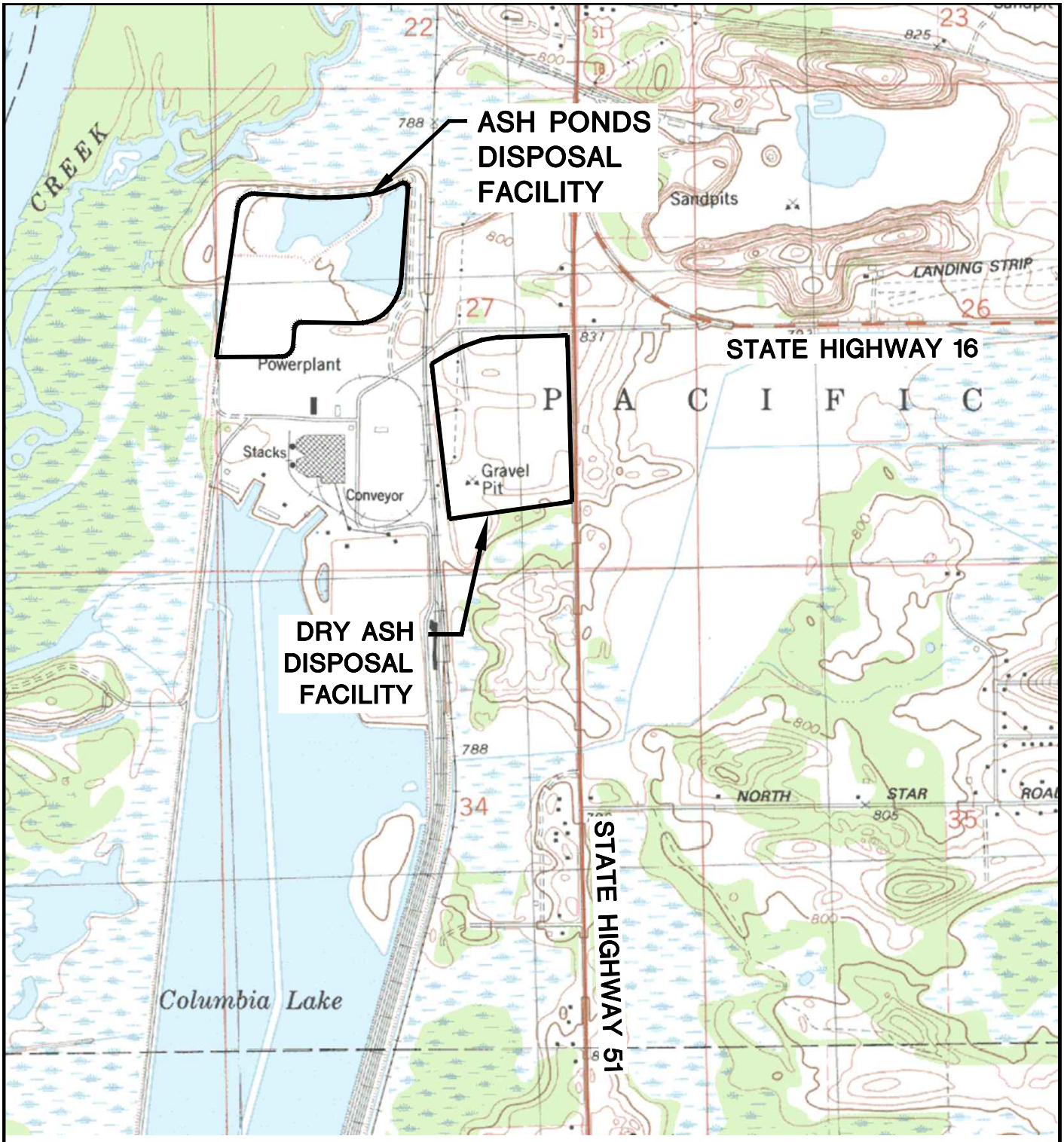
Abbreviations:
µg/L = micrograms per liter
mg/L = milligrams per liter
-- = not analyzed
µmhos/cm = micromhos/centimeter

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

Created by: TLC Date 12/1/2014
Last revision by: NDK Date 3/17/2019
Checked by: MDB Date 3/27/2019

I:\25216067.00\Deliverables\2019 ASD LF 1-3 1810\Tables\1810_tables\[4_Leachate_2015_2016_2018.xlsx]Lys LP1 App

Figures



N

POYNETTE QUADRANGLE
WISCONSIN–COLUMBIA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NW/4 POYNETTE 15' QUADRANGLE
1984
SCALE: 1" = 2,000'

CLIENT	ALLIANT ENERGY 4902 NORTH BILTMORE LN. #1000 MADISON, WI 53718	SITE	COLUMBIA ASH PONDS AND DRY ASH DISPOSAL FACILITIES

SITE LOCATION MAP

PROJECT NO.	25216067.00	DRAWN BY:	KP
DRAWN:	08/10/09	CHECKED BY:	MDB
REVISED:	04/16/18	APPROVED BY:	SC 04/16/18

ENGINEER

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

FIGURE
1

I:\25216067.00\Drawings\Site Loc.dwg, 4/16/2018 11:31:1 AM

PRIMARY ASH POND

SECONDARY ASH POND

CLOSED ASH PONDS LANDFILL (LICENSE NO. 02325)

PRODUCT RECYCLING AREA

POWER GENERATING STATION

WPDES POND

SUBSTATION

COOLING POND

COOLING POND

MODULE 4

MODULE 3

MODULE 2

MODULE 1

LANDFILL SURFACE WATER RUNOFF/ LEACHATE COLLECTION POND

DRY ASH DISPOSAL FACILITY (EXISTING LANDFILL LICENSE #03025)

HIGHWAY 51

MURRAY RD.

LEGEND

- EXISTING MAJOR CONTOUR (10' INTERVAL)
- EXISTING MINOR CONTOUR (2' CONTOUR)
- EXISTING FENCELINE
- EXISTING TRACKS
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EDGE OF WATER
- DESIGN MANAGEMENT ZONE
- APPROVED LIMITS OF WASTE
- CONSTRUCTED LIMITS OF WASTE
- WATER SUPPLY WELL
- STAFF GAUGE
- WATER TABLE WELL
- PIEZOMETER
- SURFACE WATER SAMPLE LOCATION
- LYSIMETER
- ABANDONED WATER TABLE WELL
- ABANDONED PIEZOMETER
- LEACHATE HEADWELL
- MOD 1-3 CCR UNIT
- CCR MONITORING WELL

NOTES:

1. BASE MAP CREATED FROM AERIAL SURVEY BY KBM, FLOWN DECEMBER 1, 2014, AND GROUND SURVEY BY SCS ENGINEERS IN MAY 2016, JUNE 2016, OCTOBER 2016, NOVEMBER 2016, APRIL 2017, NOVEMBER 2017, JULY 2018, AND AUGUST 2018.
2. MONITORING WELL LOCATIONS AND ELEVATIONS SURVEYED BY WISCONSIN POWER AND LIGHT, INC. IN DECEMBER 1994, NOVEMBER 1996, APRIL 2003, AND AUGUST 2012.
3. SUPPLY WELL LOCATIONS ARE APPROXIMATE AND ASSUMED BASED ON JANUARY 2013 DRAWINGS BY TRC.
4. THE LOCATIONS OF THE ASH PONDS FACILITY DESIGN MANAGEMENT ZONE DEMARCATION LINES ARE APPROXIMATE AND BASED ON THE WATER TABLE MAP (OCTOBER 2012) FIGURE BY RMT.
5. THE LOCATION OF THE ACTIVE DRY ASH LANDFILL DESIGN MANAGEMENT ZONE DEMARCATION LINE IS BASED ON A 300 FOOT OFFSET FROM THE DESIGN LIMITS OF ASH EXCEPT WHERE OFFSET WOULD EXTEND LINE BEYOND PROPERTY LINE.

N

200 0 200

SCALE: 1" = 200'

FIGURE 2

SITE PLAN AND WELL LOCATION MAP

COLUMBIA ASH PONDS AND DRY ASH DISPOSAL FACILITIES

3115

CLIENT

ALLIANT ENERGY
4902 NORTH BILTMORE LN. #1000
MADISON, WI 53718

ENGINEER

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

DRAWN BY:	KP		
CHECKED BY:	NK		
APPROVED BY:	TK	04/09/19	
PROJECT NO.	25210067.00		
DRAWN:	01/06/19		
REVISED:	01/09/19		

PRIMARY ASH POND

SECONDARY ASH POND

CLOSED ASH PONDS LANDFILL (LICENSE NO. 02325)

PRODUCT RECYCLING AREA

POWER GENERATING STATION

WPDES POND

SUBSTATION

COOLING POND

COOLING POND

EXISTING LANDFILL (LICENSE #03025)

LANDFILL SURFACE WATER RUNOFF/ LEACHATE COLLECTION POND

MURRAY RD.

HIGHWAY 51

M-3 782.95

M-4R 788.77

MW-305 790.04

MW-304 789.05

MW-308 787.81

SG-2 793.25

MW-57 783.48

MW-307 786.57

SG-3

MW-306 787.66

[786.99] MW-48B MW-48A 787.12

[784.90] MW-21R MW-220R 784.52

MW-303 787.51

MW-216R 787.49

MW-59R 787.83

MW-309 787.99

787.62

MW-310 788.18

HC-3

MW-311 788.64

[768.88] MW-39B MW-39A 787.12

788.77 MW-33AR MW-33B [787.96]

HC-2

SG-4

MW-83 788.26

788.25 MW-1AR M-1R

LH-4

LH-3

LH-2

LP-1

[788.32] MW-91B MW-91AR 788.59

MW-86 788.21

[788.19] MW-84B MW-84A 788.32

MW-302 789.16

LS-1

HC-1

SG-1 787.76

787.88 MW-34A MW-34B [787.73]

MW-16

LS-3R

MW-301 788.98

759.32 MW-92A MW-92B [788.87]

MW-58 789.71

BM19

LEGEND

- 810 — EXISTING MAJOR CONTOUR (10' INTERVAL)
- EXISTING MINOR CONTOUR (2' CONTOUR)
- EXISTING FENCELINE
- EXISTING TRACKS
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EDGE OF WATER
- DESIGN MANAGEMENT ZONE
- APPROVED LIMITS OF WASTE
- CONSTRUCTED LIMITS OF WASTE
- WATER SUPPLY WELL
- STAFF GAUGE
- WATER TABLE WELL
- PIEZOMETER
- SURFACE WATER SAMPLE LOCATION
- LYSIMETER
- ABANDONED WATER TABLE WELL
- ABANDONED PIEZOMETER
- LEACHATE HEADWELL
- 787.62 WATER TABLE ELEVATION MEASURED OCTOBER 2018
- [788.87] POTIENTIOMETRIC SURFACE ELEVATION MEASURED OCOTBER 2018 (NOT CONTOURED)
- WATER TABLE CONTOUR
- APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTES:

1. BASE MAP CREATED FROM AERIAL SURVEY BY KBM, FLOWN DECEMBER 1, 2014, AND GROUND SURVEY BY SCS ENGINEERS IN MAY 2016, JUNE 2016, OCTOBER 2016, NOVEMBER 2016, APRIL 2017, NOVEMBER 2017, JULY 2018, AND AUGUST 2018.
2. MONITORING WELL LOCATIONS AND ELEVATIONS SURVEYED BY WISCONSIN POWER AND LIGHT, INC. IN DECEMBER 1994, NOVEMBER 1996, APRIL 2003, AND AUGUST 2012.
3. SUPPLY WELL LOCATIONS ARE APPROXIMATE AND ASSUMED BASED ON JANUARY 2013 DRAWINGS BY TRC.
4. THE LOCATIONS OF THE ASH PONDS FACILITY DESIGN MANAGEMENT ZONE DEMARCATION LINES ARE APPROXIMATE AND BASED ON THE WATER TABLE MAP (OCTOBER 2012) FIGURE BY RMT.
5. THE LOCATION OF THE ACTIVE DRY ASH LANDFILL DESIGN MANAGEMENT ZONE DEMARCATION LINE IS BASED ON A 300 FOOT OFFSET FROM THE DESIGN LIMITS OF ASH EXCEPT WHERE OFFSET WOULD EXTEND LINE BEYOND PROPERTY LINE.

N

200 0 200

SCALE: 1" = 200'

FIGURE 3

WATER TABLE MAP OCTOBER 2018

COLUMBIA ASH PONDS AND DRY ASH DISPOSAL FACILITIES

SHEET 3 OF 5

CLIENT

ALLIANT ENERGY
4902 NORTH BILTMORE LN. #1000
MADISON, WI 53718

ALLIANT ENERGY

ENGINEER

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

DRAWN BY:	KP		
CHECKED BY:	MDB		
APPROVED BY:	TK	04/09/19	
PROJECT NO.	25216067.00		
DRAWN:	01/03/19		
REVISED:	01/09/19		

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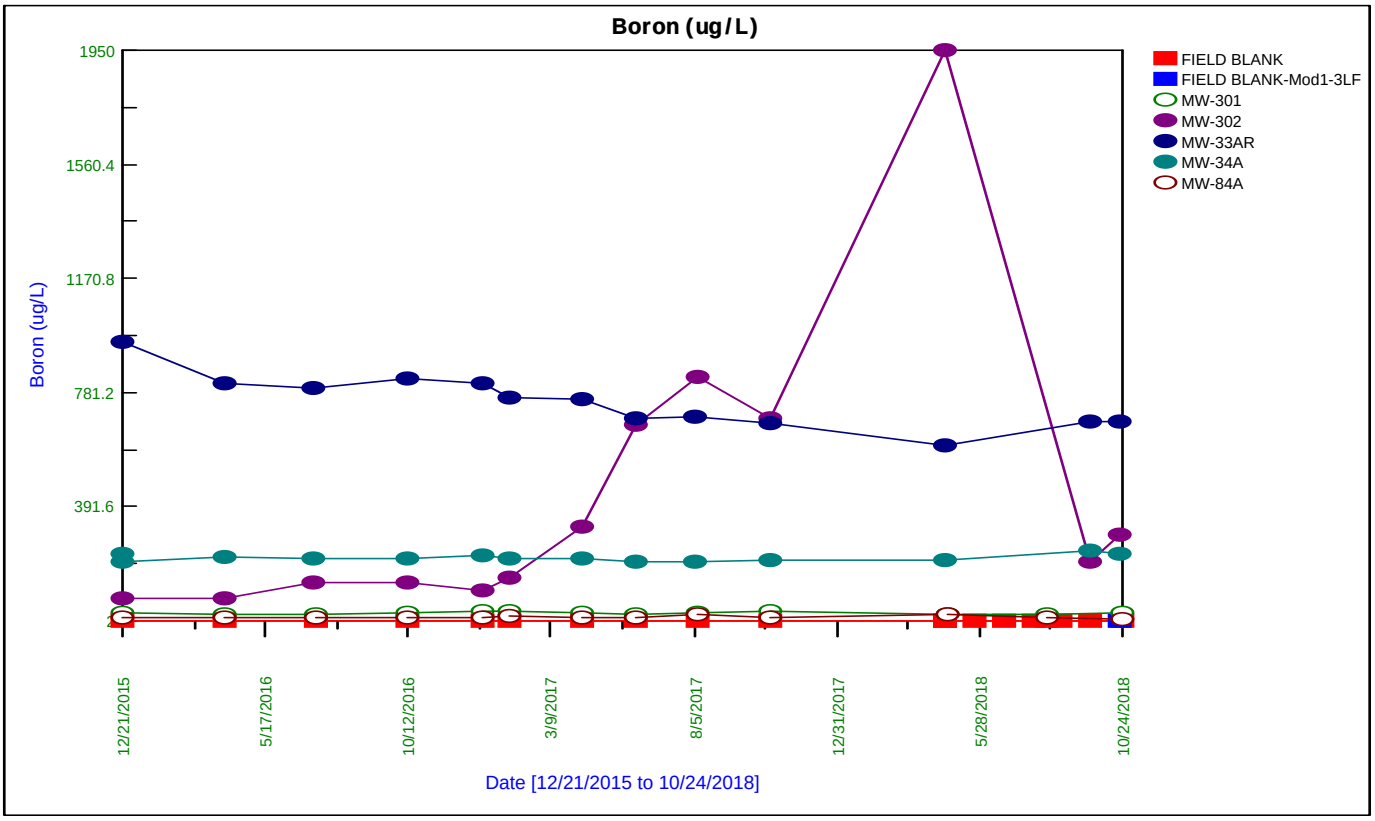
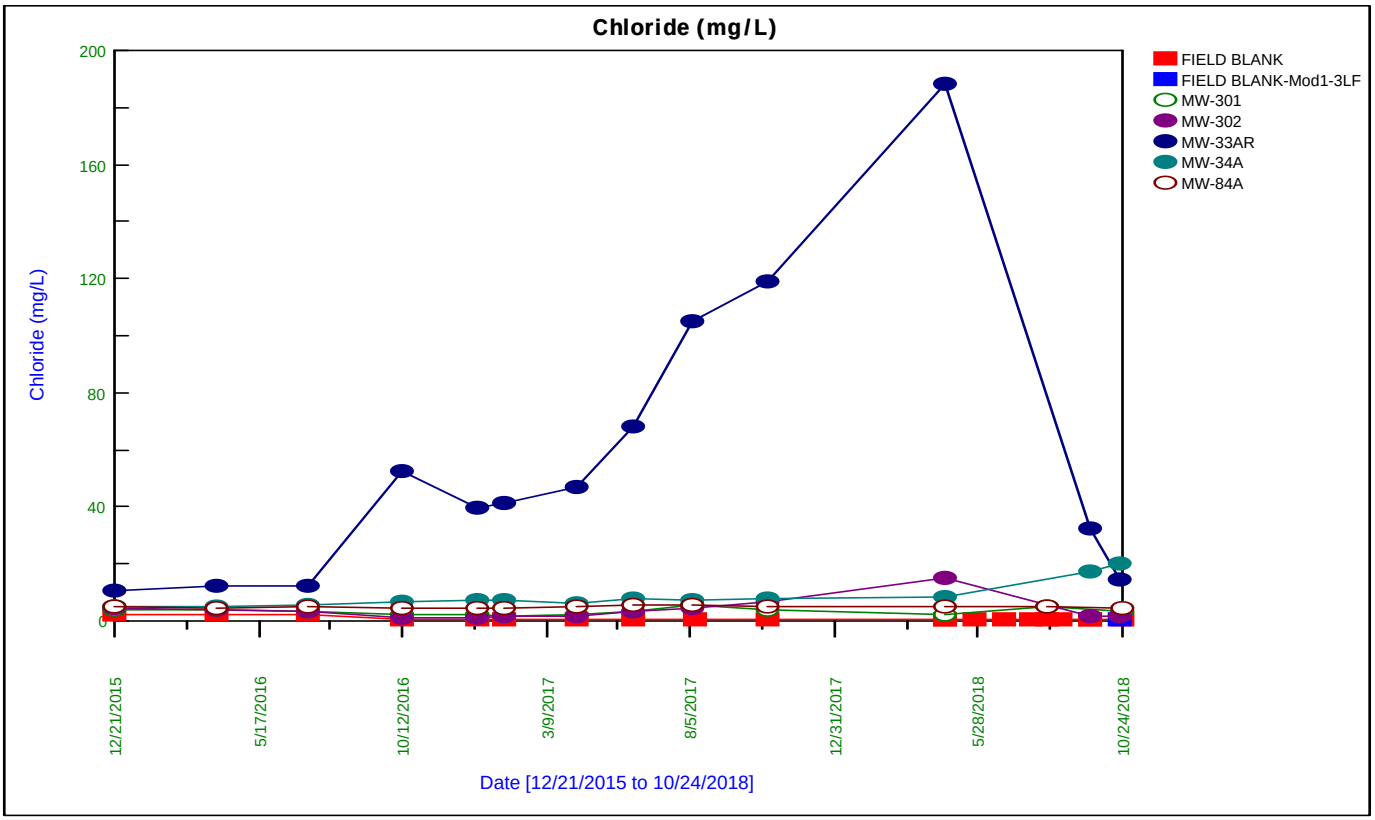
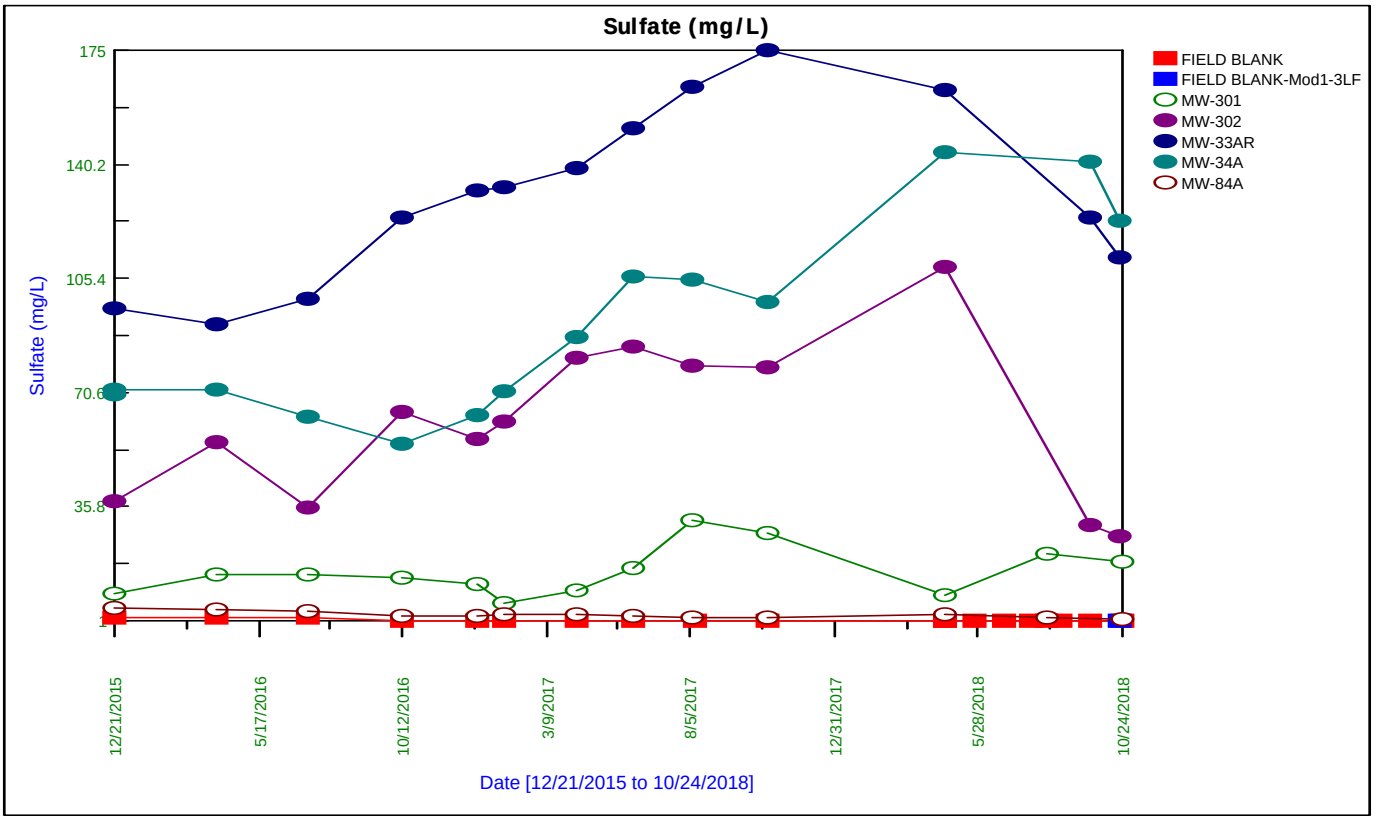
Appendix A

Trend Plots for CCR Wells


Boron (ug/L)
1950
1560.4
1170.8
781.2
391.6
Boron (ug/L)
12/21/2015
5/17/2016
10/12/2016
3/9/2017
8/5/2017
12/31/2017
5/28/2018
10/24/2018
Date [12/21/2015 to 10/24/2018]
FIELD BLANK
FIELD BLANK-Mod1-3LF
MW-301
MW-302
MW-33AR
MW-34A
MW-84A

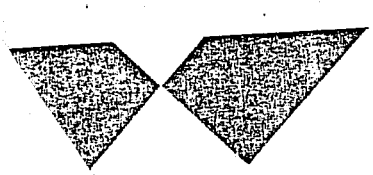

Chloride (mg/L)
200
160
120
80
40
0
Chloride (mg/L)
12/21/2015
5/17/2016
10/12/2016
3/9/2017
8/5/2017
12/31/2017
5/28/2018
10/24/2018
Date [12/21/2015 to 10/24/2018]
FIELD BLANK
FIELD BLANK-Mod1-3LF
MW-301
MW-302
MW-33AR
MW-34A
MW-84A


Sulfate (mg/L)
175
140.2
105.4
70.6
35.8
Sulfate (mg/L)
12/21/2015
5/17/2016
10/12/2016
3/9/2017
8/5/2017
12/31/2017
5/28/2018
10/24/2018
Date [12/21/2015 to 10/24/2018]
FIELD BLANK
FIELD BLANK-Mod1-3LF
MW-301
MW-302
MW-33AR
MW-34A
MW-84A

Appendix B

Feasibility Study Water Quality Information

1370



FEASIBILITY STUDY
PROPOSED FLY ASH AND/OR SCRUBBER SLUDGE
DISPOSAL FACILITY-COLUMBIA SITE
WISCONSIN POWER AND LIGHT COMPANY
TOWN OF PACIFIC, COLUMBIA COUNTY, WISCONSIN

Jan 78

C 7134

conceivable that groundwater flow in the area north of Murray Road may be altered such that contaminants derived from the present ash settling basin might be diverted southerly towards the homes along Murray Road. These questions would have to be addressed in greater detail, consistent with the goals of Wisconsin Power and Light Company.

WATER QUALITY

During the first two weeks of December, 1977, 64 water samples were obtained from surface waters and groundwater monitoring wells at the Columbia Energy Center. The purpose of the sampling was to assess background water quality in the vicinity of the proposed disposal site. The sampling stations included 59 monitoring wells, the cooling lake, ash settling pond, the drainage ditch carrying the ash pond discharge waters and the agricultural drainage ditch along the southern boundary of the site. Due to the large number of sampling stations, the analyses were limited to pH, specific conductance, iron, calcium, magnesium, sulfate and chloride. The analytical data is contained in Appendix F and is discussed below.

pH

Most groundwaters found in the United States have pH values ranging from around 6.0 to 8.5. The pH of a water represents the result of a number of interrelated chemical equilibria. This equilibria can be altered shortly after sampling by gains or losses of carbon dioxide, the oxidation of ferrous iron and numerous other chemical reactions. Thus, pH measurements must be taken shortly after obtaining the sample. For this study, the pH of samples was determined immediately upon return to the laboratory.

Within the proposed site boundaries at the Columbia Energy Center, pH values ranged between 6.3 and 8.1 and averaged 7.5. Typically, the lower pH values were observed in the lowland areas and wetlands, probably as a result of acidic organic soils. The pH of water in the ash disposal settling pond and the cooling lake was 11.4 and 8.3, respectively.

SPECIFIC CONDUCTANCE

Specific conductance, or conductivity, is the ability of a substance to conduct an electric current. The conductance determination is correlative with the dissolved-solids concentration. Conductivity, however, is temperature dependent and thus requires the reference of specific conductance measurements to a standard temperature. The values discussed here are referred to 25°C.

The specific conductance of groundwater in the study area ranged from 220 umhos/cm to a maximum of 2600 umhos/cm. The highest conductivity readings were observed in monitoring wells located along the coal storage area and the drainage ditch carrying the ash pond discharge where values up to 2600 umhos/cm were measured. The conductivity of the ash pond effluent was 1380 umhos/cm. This data appears to confirm earlier speculation of infiltration of effluent from the ash pond discharge channel and from the coal storage area into the groundwater. Conductance within the proposed site boundaries averaged approximately 465 umhos/cm.

Conductivity in the ash disposal settling pond was measured at 1510 umhos/cm. Shallow monitoring wells M-6 and 39A, located adjacent to the pond also exhibited elevated values of 1160 umhos/cm and 1800 umhos/cm, respectively.

High conductivities were also observed along U. S. Highway 51 at monitoring wells 51A and 51B. The chloride data, discussed below, indicates infiltration of road salt has probably occurred at this location.

Specific conductance measurements obtained in the vicinity of the proposed disposal site are shown on Drawing C 7134-15.

IRON

The element iron is an abundant element found in most rocks and soil. It generally occurs as sulfides and oxides in igneous and metamorphic rocks and as iron oxide and hydroxide cementing materials in coarse-grained sedimentary rocks.

Ferrous iron is unstable in the presence of oxygen where it is bound to hydroxide anions as $2Fe(OH)_3$.

$$2Fe^{++} + 4HCO_3^- + H_2O \rightleftharpoons 2Fe(OH)_3 + 4CO_2$$

If subjected to a strong reducing environment, such as a marsh, the reaction is reversed and iron goes back into solution. The amount which dissolves is related to a number of variables including the velocity with which water moves through this environment.

The U. S. Public Health Service recommends an iron concentration of less than 0.3 mg/l in water used for drinking and culinary purposes. Laundry and porcelain tend to be stained when concentrations reach 0.5 to 1.0 mg/l. At this level it can also be tasted.

The presence of iron under the proposed disposal area in the majority of cases was below the detection limit of 0.1 mg/l. In monitoring wells 5 and 18, located in or near the central marsh area, iron increased to 10 mg/l and 5.7 mg/l, respectively. In the southern marsh, monitoring wells exhibited concentrations between 0.5 mg/l and 6.1 mg/l. Although the iron concentration in the cooling lake was below the detection limit, down-gradient wells 44 and 30A located on the cooling lake dike yielded values of 11 mg/l and 26 mg/l iron respectively. Boring logs indicated trace amounts of organic material at the base of the dike which is probably the reason for the high concentrations observed. At the same location, iron in well 30B installed to a depth of 100 feet below the surface was below 0.1 mg/l. Thus, the occurrence of high iron concentrations in this area appears restricted to groundwater in the upper portion of the aquifer where organic material is present and conditions are favorable for the dissolution of iron.

The ash pond discharge in the drainage ditch paralleling the west site boundary showed an iron concentration of 3.7 mg/l. Shallow monitoring wells 33A and 34A adjacent to the ditch indicated less than 0.1 mg/l iron.

North of Murray Road the iron concentration in monitoring wells in the marsh and uplands were typically less than 0.1 mg/l. Although the ash basin had less than 0.1 mg/l iron, several wells along cross-section F-F' showed anomalously high values (#M6-2.3 mg/l; #47-16 mg/l; #51B-21 mg/l).

CALCIUM

Calcium, because of its relative abundance and mobility, is the principle cation in most natural fresh water. Calcium is a constituent of many rock types but is found in greatest quantities in waters leaching deposits of limestone and dolomite. In sandstone and other detrital rock, calcium carbonate is a common cement between grains.

Monitoring wells located within the site boundaries exhibited calcium concentrations between 30 mg/l and 66 mg/l and averaged about 42 mg/l. Similar to iron, the concentrations of calcium in monitoring wells along cross-section F-F' were anomalously high, up to 150 mg/l calcium. Water table wells along the drainage ditch carrying the ash pond discharge averaged 83 mg/l while the ash pond effluent contained 28 mg/l. Generally the amount of calcium in groundwater decreased with depth. Nested monitoring wells typically showed somewhat lower concentrations of calcium in the deeper wells.

MAGNESIUM

As a relatively abundant element on the earth's crust, the principle sources of magnesium in natural waters are considered to be ferromagnesian minerals in igneous rocks and magnesium carbonate in carbonate rocks (limestone and dolomite). Waters in which magnesium is the predominant cation are somewhat unusual. Like calcium, magnesium imparts the property of hardness to water and is, therefore, of concern to industrial users.

Generally, concentrations of magnesium were 1/3 to 1/2 of the calcium levels. Magnesium concentrations within the site boundaries ranged between 10 mg/l and 36 mg/l and averaged 27 mg/l. Similar to calcium and iron, higher magnesium values were observed, in general, north of Murray Road and especially in monitoring wells along cross-section F-F'.

SULFATE

Sulphur is widely distributed in reduced form in both igneous and sedimentary rocks as metallic sulfides and when present in sufficient concentrations, constitutes ore of economic importance. During weathering processes with aerated water, the sulfides are oxidized to sulfate ions and are dissolved into water. Pyrite (FeS_2) crystals often occur in sedimentary rocks and are particularly associated with biogenic deposits such as coal which were deposited under strongly reducing conditions.

The concentrations of sulfate in groundwater in the vicinity of the proposed disposal site ranged from less than 1 mg./l to 1,200 mg./l of sulfate. (Refer to Drawing C 7134-15.) Typically, within the site boundaries concentrations averaged approximately 12 mg./l. Near the coal storage area, however, significant increases were observed. Observation wells 26A, 26B, and 42 exhibited concentrations between 900 and 1100 mg./l. The depth of sulfate enrichment in groundwater, near the coal pile, appears to extend to considerable depths, indicated by relatively high sulfate concentrations in Well 26B sealed 100 feet below ground surface. The oxidation of pyrite minerals in the coal leaching into the groundwater is probably the major source of the high concentrations observed.

Sulfate concentrations in the ash disposal settling pond were 520 mg./l. In the ditch carrying the ash pond discharge, the effluent is treated with sulfuric acid which results in precipitation of barium sulfate and aluminum hydroxide (personal communication, Merlin Horn, 1978). Consequently, the sulfate concentration of the effluent waters is lowered considerably to 13 mg./l. Well 33A, however, located near the point of effluent discharge, exhibited 1200 mg./l sulfates.

CHLORIDE

Chloride is generally present in much lower concentrations in rocks than many of the other major constituents of natural water. Important sources, however, are associated with sedimentary rocks, particularly the evaporites. The chemical behavior of chloride in natural water is relatively inert compared to the other major ions. There are few oxidation-reduction reactions and no significant chemical complexing reactions which chloride enters into. In addition, chloride ions are not significantly adsorbed on mineral surfaces. For these reasons, chloride is commonly used as a tracer in groundwater.

Chloride concentrations in groundwater in the vicinity of the Columbia Energy Center typically range between 0.5 mg./l and 30 mg./l. The highest concentrations in monitoring wells tended to be located adjacent to U. S. Highway 51 where the use of road salt has resulted in the percolation of chloride into the groundwater. Monitoring Wells 51A and 51B located in a low area north of Murray Road along U. S. Highway 51, yielded chloride concentrations in excess of 200 mg./l. Two other wells, 52A and 19, also located along U. S. Highway 51, yielded values of 30 mg./l and 42.5 mg./l chloride, respectively.

Within the proposed site boundaries, the chloride concentration averaged 7.1 mg./l. Excluding the few wells adjacent to U. S. Highway 51 exhibiting elevated concentrations, no other significant trends in the occurrence of chloride were observed.

SUMMARY

In summary, the groundwater in the vicinity of the proposed disposal site exhibited a somewhat alkaline pH. In lowland areas, the pH was typically below 7.0, probably a result of the presence of acidic organic soils.

Specific conductance within the proposed site averaged 465 umhos/cm. Conductivities up to 2600 umhos/cm were observed, however, in the vicinity of the coal storage area, the present ash disposal pond and ash pond effluent channel where infilatration of water from these sources is occurring into the groundwater system.

The groundwater typically exhibted relatively low iron concentrations although, locally, concentrations in excess of drinking water standards were observed in about 20% of the wells. The occurrence of the higher iron concentrations appears to be related to the presence of organic soils.

Groundwater at the proposed site also tended to exhibit high calculated hardness (216 mg./l) based on average observed values for calcium (42 mg./l) and magnesium (27 mg./l). Dissolution of limestone and dolomite rocks in the glacial drift are the probable sources of these elements in the groundwater.

Enrichment of sulfate in groundwater has occurred as a result of leaching of pyrite (FeS_2) minerals from the coal storage area where concentrations up to 1200 mg./l were observed. The depth of this enrichment appears to extend beyond the maximum depth into the aquifer investigated. Sulfate concentrations decreased rapidly away from the coal storage area to an average of 12 mg./l within the proposed site boundaries. Other local sources of sulfate in groundwater appear to be related to the present ash settling pond.

The concentration of chloride within the proposed site averaged 7.1 mg./l. Higher levels were generally observed in wells adjacent to U. S. Highway 51 where the infiltration of road salt has locally raised chloride concentrations.

The above interpretations are based on one round of water quality sampling only and should be considered as preliminary in nature. High sulfate and chloride concentrations observed at greater depths may be a temporary condition resulting from contamination of spoil backfill materials with coal dust or salt, respectively, during installation of the monitoring well. Future sampling of these monitoring wells will help to distinguish short term contamination from actual conditions existing in the aquifer.

APPENDIX F
WATER QUALITY DATA

WELL NO.	pH	SPECIFIC CONDUCTANCE (umhos/cm @ 25°C)	SULFATE (mg/l)	CHLORIDE (mg/l)	CALCIUM (mg/l)	MAGNESIUM (mg/l)	IRON (mg/l)
1A	7.6	550	17.	6.5	52	37	<0.1
1B	8.05	460	16.	10.5	39	31	<0.1
2	7.8	527	14.	2.5	45	32	<0.1
3A	7.5	548	13.	2.5	58	36	<0.1
3B	8.1	506	14.	7.0	50	34	<0.1
4	7.8	580	10.	4.0	59	34	<0.1
5	6.3	560	210.	12.5	13	29	10
16	7.6	408	12.	1.5	42	28	<0.1
17	6.45	350	30.	16.5	16	13	0.6
18	6.45	380	4.	4.5	33	22	5.7
19	7.9	570	10.	42.5	44	24	<0.1
20	8.0	340	10.	5.0	36	24	<0.1
21	6.9	220	20.	4.5	23	10	0.1
24A	7.45	775	18.	6.0	76	52	0.1
24B	7.85	440	15.	6.0	43	31	0.1
25	8.1	300	10.	2.5	29	20	<0.1
26A	7.2	2100	900	17.0	140	48	1.5
26B	7.5	2600	1100	16.5	43	7.0	0.2
27	7.15	400	6.	8.0	23	18	<0.1
28A	7.75	500	3.	0.5	48	31	<0.1
28B	7.6	480	4.	3.5	39	28	<0.1
29A	7.8	330	16.	1.5	33	21	0.5
30A	6.75	920	64.	11.0	38	30	26
30B	7.6	770	210	21.0	37	19	<0.1
33A	8.2	2500	1200	24.0	83	50	<0.1
33B	7.9	390	22.	6.5	31	27	0.2
34A	7.7	680	140.	10.0	58	45	0.1
34B	7.7	1700	660	15.0	48	22	<0.1
35	6.8	740	<1.0	4.0	66	33	2.9
36	6.8	740	<1.0	3.5	53	35	6.1
37A	7.7	460	9.	4.0	48	31	0.8
37B	7.5	630	73.	7.5	71	35	<0.1
39A	7.5	1800	350	22.0	180	100	0.1
39B	7.9	330	560	20.5	31	22	0.1
40A	8.0	630	140	8.5	43	29	<0.1
40B	8.1	330	17.	3.0	31	22	<0.1
41	6.8	590	16.	11.0	58	27	9.3

WELL NO.	pH	SPECIFIC CONDUCTANCE (umhos/cm @ 25°C)	SULFATE (mg/l)	CHLORIDE (mg/l)	CALCIUM (mg/l)	MAGNESIUM (mg/l)	IRON (mg/l)
42	7.4	2400	900	17.5	50	12	0.5
44	6.9	490	<1.	16.5	39	23	11
45	7.6	390	14.	3.0	40	25	<0.1
46A	7.3	1100	21.	15.5	140	82	<0.1
46B	7.8	470	25.	17.5	40	26	<0.1
47	6.6	1200	3.	8.0	140	40	16
48A	7.3	620	15.	8.0	62	37	<0.1
48B	7.1	520	22.	20.0	43	29	0.2
49	7.15	730	6.	3.5	75	41	<0.1
50A	7.6	520	28.	15.5	51	34	<0.1
50B	7.5	410	21.	18.0	31	21	<0.1
51A	6.1	1850	8.	205.	65	40	<0.1
51B	7.2	1250	23.	275.	57	36	21
52A	7.7	450	16.	30.5	36	17	<0.1
52B	7.4	430	40.	17.5	32	20	<0.1
53	7.75	450	27.	10.5	39	28	<0.1
54A	7.8	350	12.	4.0	34	21	0.1
54B	7.55	390	15.	5.5	40	24	0.1
55B	7.9	340	23.	17.5	32	22	0.1
56	7.8	450	22.	9.5	43	28	0.1
57	7.85	380	17.	7.0	38	24	0.1
M-6	7.0	1160	5.	7.0	150	91	2.3
Cooling Lake	8.3	370	31.	18.0	34	21	<0.1
Ash Pond Effluent	7.45	1380	13.	4.0	28	1.2	3.7
Ash Pond Drainage Ditch (A)	11.4	1510	520.	23.5	29	0.2	<0.1
Drainage Ditch (B)	7.8	500	21.	7.0	43	29	<0.1
	9.05	1780	750	14.0	42	5.4	<0.1

APPENDICES TO

SUPPLEMENTARY FEASIBILITY STUDY REPORT
AND PRELIMINARY ENGINEERING CONCEPTS
COLUMBIA SITE
WISCONSIN POWER AND LIGHT COMPANY
TOWN OF PACIFIC, COLUMBIA COUNTY, WISCONSIN

WARZYN
ENGINEERING INC

APPENDIX I

WATER QUALITY DATA - DECEMBER 1978

WARZYN
ENGINEERING INC

1/2/76

C 7134

WATER QUALITY DATA

WELL NO.	pH	SPECIFIC CONDUCTANCE (umhos/cm @ 25°C)	SULFATE (mg/l)	CHLORIDE (mg/l)	CALCIUM (mg/l)	MAGNESIUM (mg/l)	IRON (mg/l)	BORON (mg/l)
1A	7.3	530	30	3.1	54	35	<0.1	-
1B	7.0	470	67	6.1	49	30	<0.1	-
2	7.25	458	91	<.5	48	24	<0.1	-
3A	7.0	560	36	<.5	61	31	<0.1	-
3B	7.15	530	52	35.7	37	33	<0.1	-
4	7.2	750	69	5.8	49	30	<0.1	-
5	6.35	1,650	670	14.1	14	13	1.7	-
16	6.9	390	69	1.0	49	23	<0.1	-
17	5.55	295	57	16.3	14	8.6	0.2	-
18	5.9	430	10	4.2	47	21	1.1	-
19	7.4	765	75	4.2	51	28	<0.1	-
20	7.4	380	26	1.6	39	26	<0.1	-
21	5.7	250	54	10.4	15	8.3	0.2	-
24A	7.2	730	36	1.6	65	42	<0.1	-
24B	7.2	470	10	7.3	42	28	<0.1	-
25	7.0	335	29	7.8	39	21	0.2	-
26A	7.4	2,250	650	12.6	32	8.6	<0.1	-
26B	6.8	2,530	840	20.8	49	18	<0.1	-
27	6.9	410	24	4.2	40	24	0.4	-
28A	7.2	500	61	0.5	45	28	<0.1	-
28B	7.0	465	6	2.1	39	26	0.1	-
29A	7.1	410	24	3.6	31	22	0.1	-
30A	5.8	1,140	15	<0.5	97	56	38	-
30B	6.65	835	160	14.6	37	20	<0.1	-
33A	7.8	1,970	830	16.7	21	8.9	<0.1	-
33B	7.5	380	31	7.3	24	27	<0.1	-
34A	7.25	560	46	4.2	53	33	<0.1	-
34B	8.5	1,575	730	21.9	28	29	0.1	-
35	6.7	545	61	3.6	60	26	1.0	-
36	6.4	515	5.0	2.6	43	24	4.8	-
37A	7.05	438	30	3.7	50	28	<0.1	-
37B	6.7	325	18	7.3	1.0	0.5	<0.1	-
39A	6.35	1,260	33	13.6	70	7.6	0.1	-
39B	6.7	385	25	4.2	30	21	<0.1	<.05
40A	7.35	483	40	<0.5	48	24	<0.1	-
40B	7.25	343	4	4.2	21	14	<0.1	-
41	6.1	640	54	19.8	43	32	<0.1	-

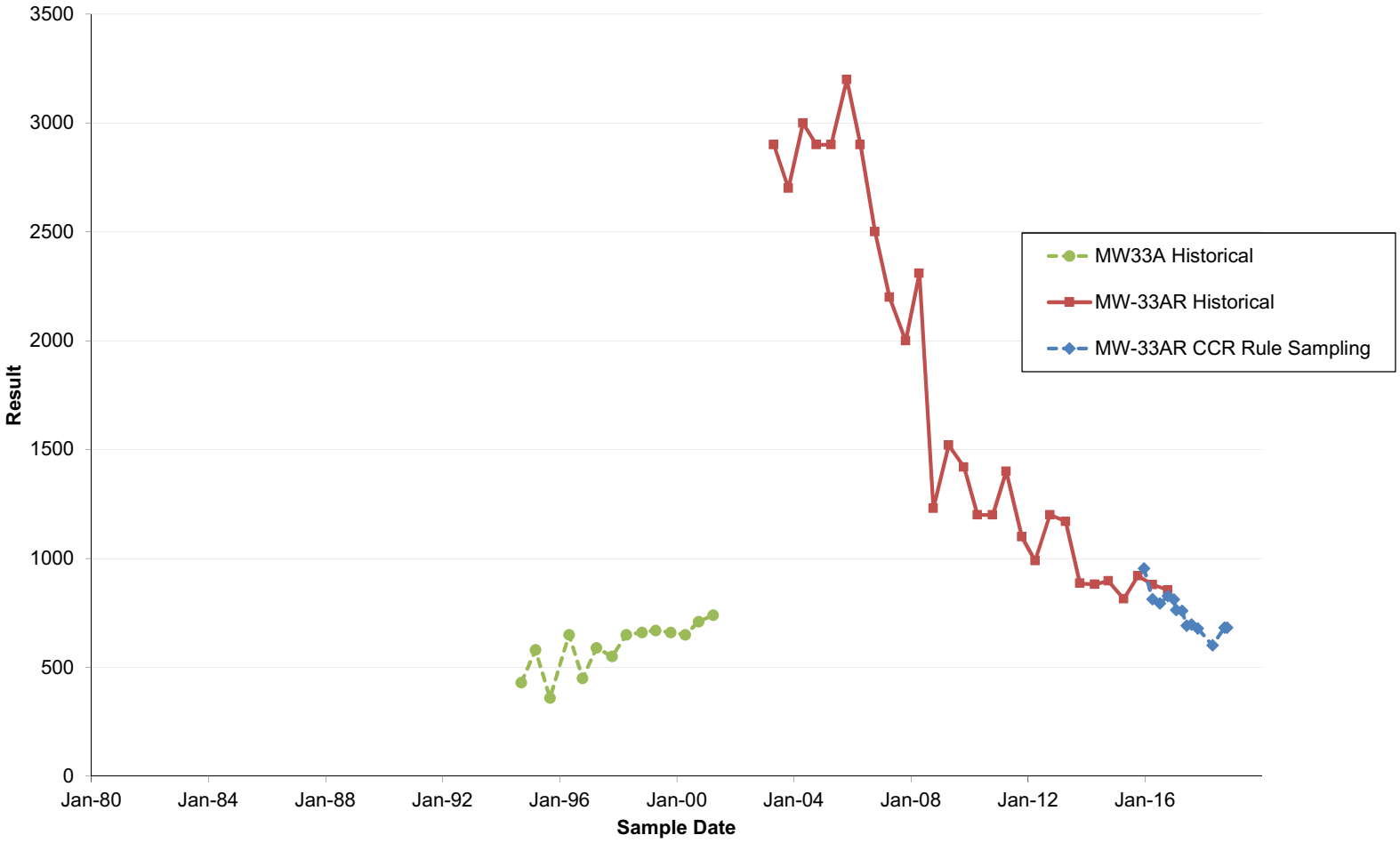
WELL NO.	pH	SPECIFIC CONDUCTANCE (umhos/cm @ 25°C)	SULFATE (mg/l)	CHLORIDE (mg/l)	CALCIUM (mg/l)	MAGNESIUM (mg/l)	IRON (mg/l)	BORON (mg/l)
42	7.15	2,050	910	15.6	23	7.5	0.1	-
44	6.15	710	6	0.5	56	27	3.5	-
45	7.2	420	32	1.0	44	26	<0.1	-
46A	7.0	560	93	<0.5	130	75	<0.1	<0.05
46B	6.5	1,290	170	20.8	46	30	<0.1	<0.05
47	7.3	958	120	<0.5	110	48	<0.1	-
48A	6.15	640	59	<0.5	42	51	<0.1	<0.05
48B	6.8	450	23	5.2	40	27	<0.1	<0.05
49	7.0	880	26	2.1	93	58	0.1	-
50A	7.4	660	25	17.7	60	36	<0.1	-
50B	7.1	405	16	17.7	38	23	<0.1	-
51A	7.0	1,170	57	135	66	31	<0.1	-
51B	7.3	1,410	22	330	46	39	<0.1	-
52A	7.0	370	110	18.5	35	10	<0.1	-
52B	7.0	595	43	52.5			0.1	-
53	Frozen							
54A	7.5	345	10	1.0	36	22	<0.1	<0.05
54B	Frozen							
55B	7.3	505	26	15.6	52	29	<0.1	<0.05
56	Frozen							
57	Frozen							
M-6								
58	6.55	1,265	140	<0.5	110	65	0.1	-
59	6.8	925	40	<0.5	86	60	<0.1	-
60	7.2	1,510	54	4.7	130	85	<0.1	-
61A	6.85	590	39	30.2	58	31	<0.1	-
61B	7.2	505	6	13.5	48	29	<0.1	-
62	6.7	1,517	72	178	120	53	<0.1	-
64	6.9	670	100	26.8	63	36	0.8	-
65	7.2	830	57	17.8	78	50	<0.1	-
66	6.5	680	55	40	66	24	3.6	-

WELL NO.	pH	SPECIFIC CONDUCTANCE (umhos/cm @ 25°C)	SULFATE (mg/l)	CHLORIDE (mg/l)	CALCIUM (mg/l)	MAGNESIUM (mg/l)	IRON (mg/l)	BORON (mg/l)
67	7.0	560	100	1.0	57	32	1.0	-
68A	7.6	440	32	2.1	40	27	<0.1	-
68B	7.2	400	36	1.0	42	25	<0.1	-
70A	7.5	440	20	<0.5	27	37	<0.1	-
70B	7.3	520	25	5.2	51	34	<0.1	-
72A	6.45	860	11	<0.5	100	41	1.8	-
72B	8.4	230	45	<0.5	17	19	<0.1	-
M-4	7.6	864	180	26.1	20	11	<0.1	0.39
MM-4			2	2.6	14	21	0.9	-
Cooling Lake at 1	7.7	355	36	13.6	31	21.2	<0.1	-
Ash Pond at 2	11.4	3,210	1,100	22.9	34	<0.1	<0.1	-
Ash Pond at 3	8.7	725	34	21.9	48	16	<0.1	-
Ash Pond Effluent at 4	6.7	3,090	1,400	25.0	39	0.4	<0.1	-
Drainage Ditch at 5	7.2	730	74	33.9	56	38	<0.1	-
Drainage Ditch at 6	7.35	2,750	640	18.8	34	7.5	<0.1	-
Drainage Ditch at 7	8.05	1,780	740	27.1	31	0.2	<0.1	-

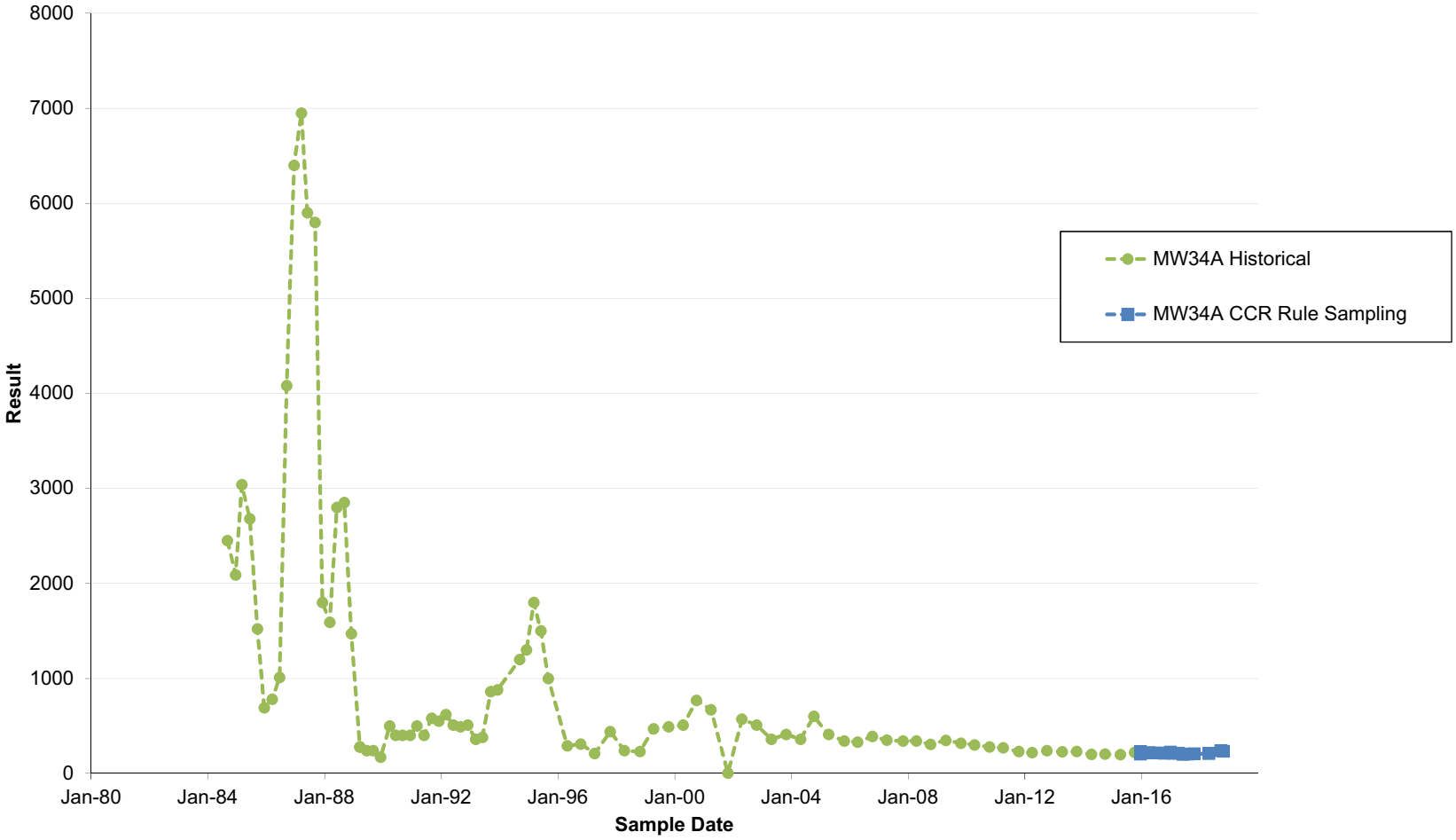
Appendix C

Long-Term Concentration Trend Plots

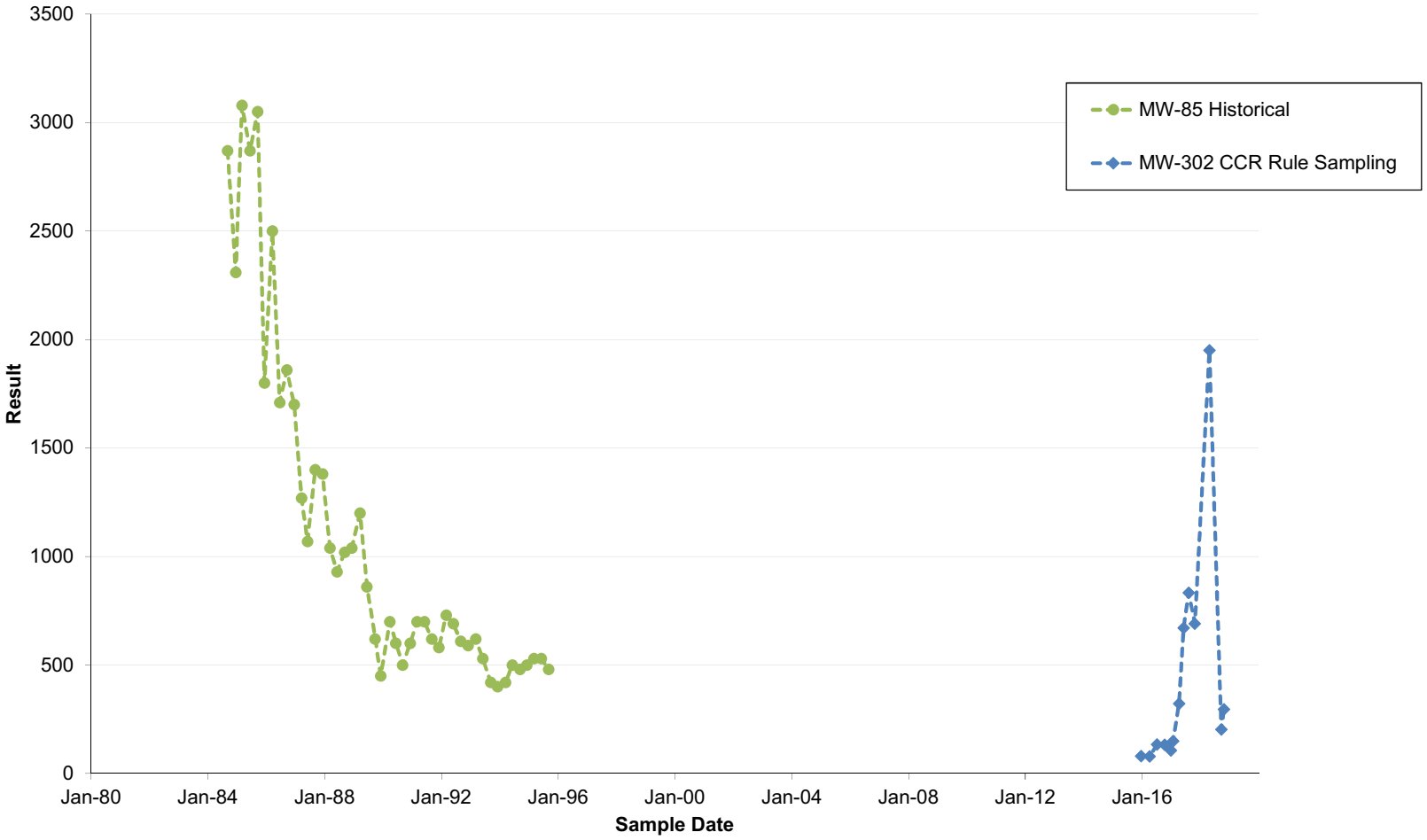
Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-33A and MW-33AR - Boron (µg/l as B)



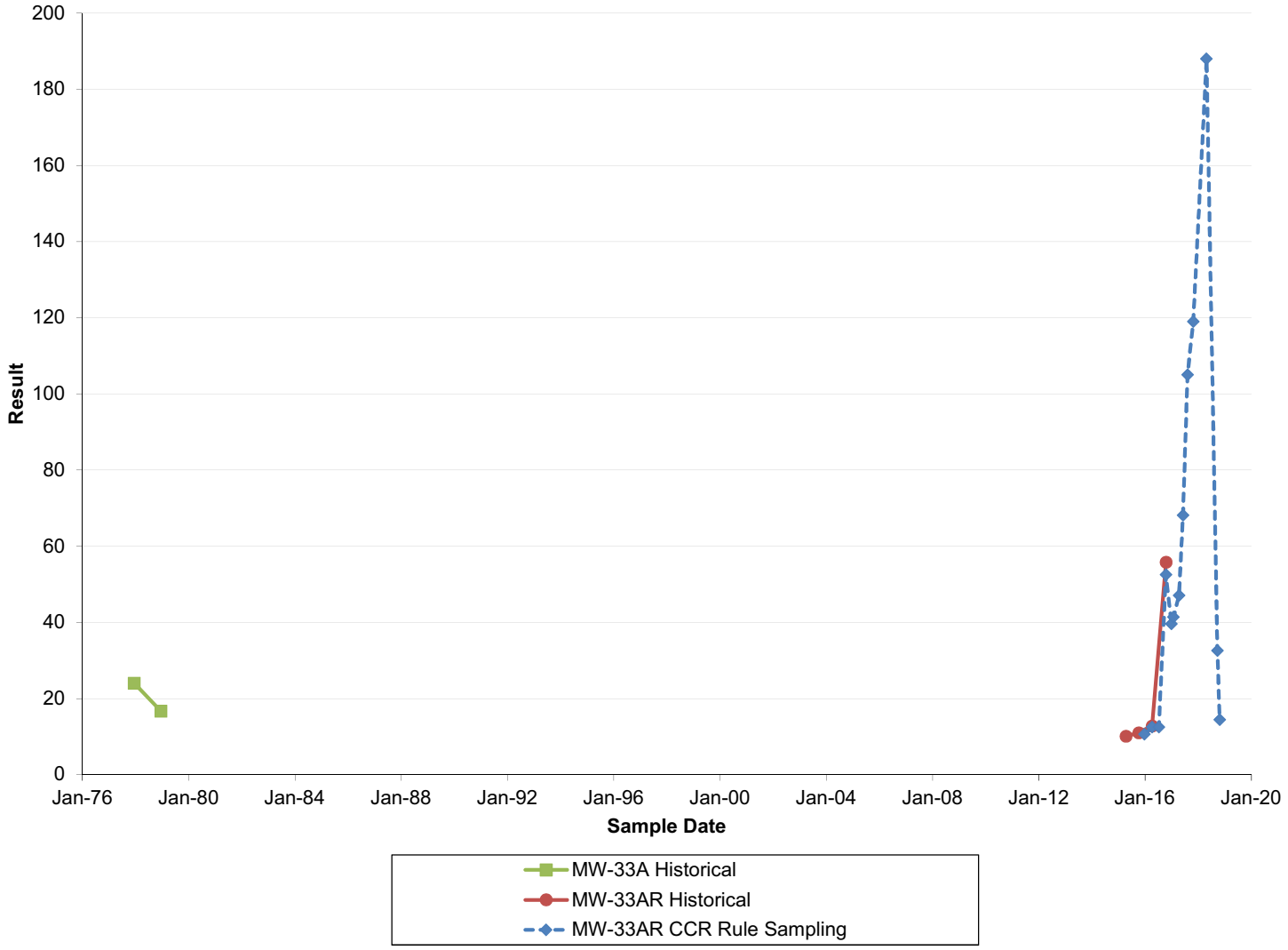
Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW34A - Boron (µg/l as B)



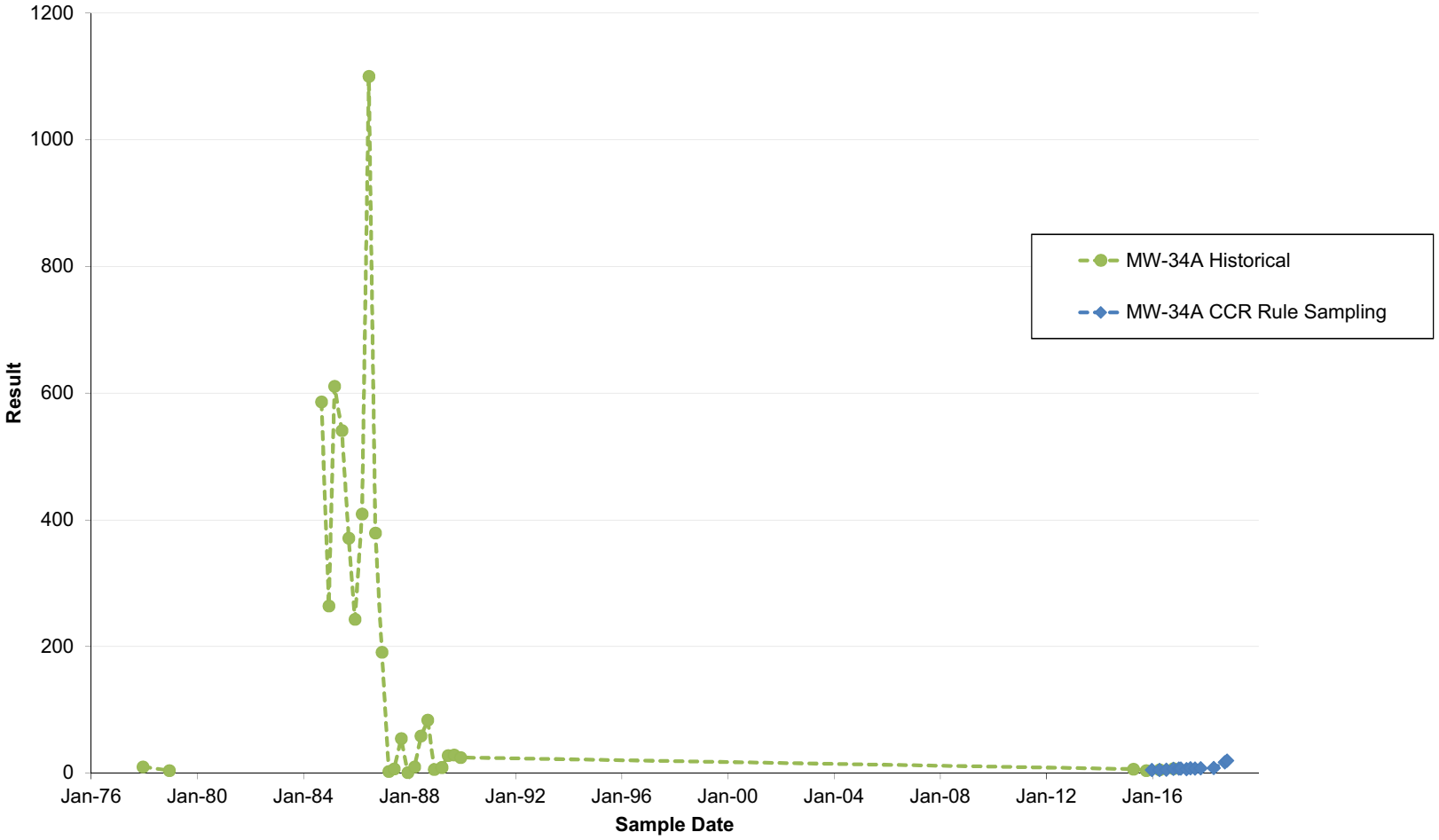
Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-302 and MW-85 - Boron (µg/l as B)



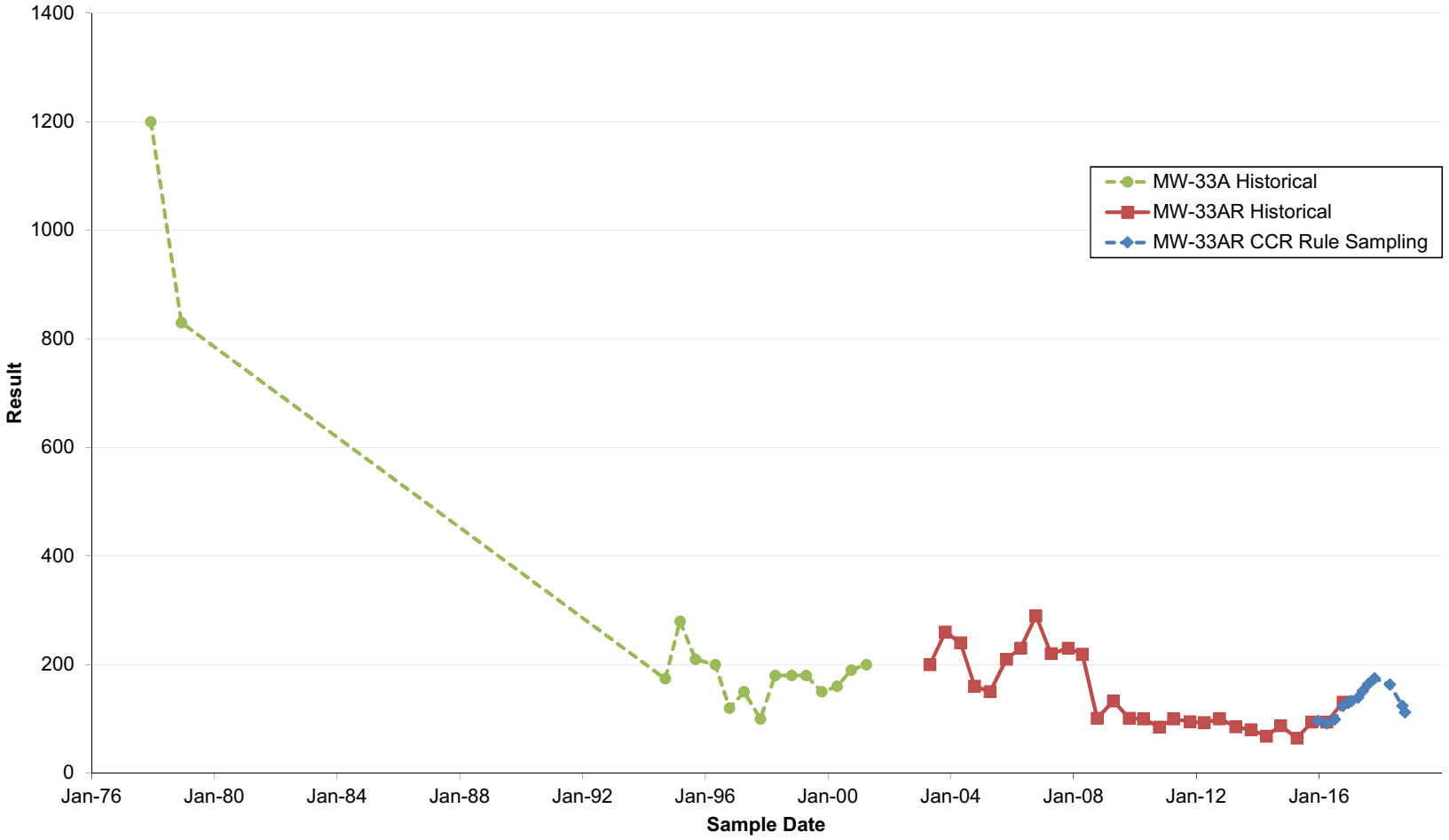
Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-33 and MW-33AR - Chloride (mg/l as Cl)



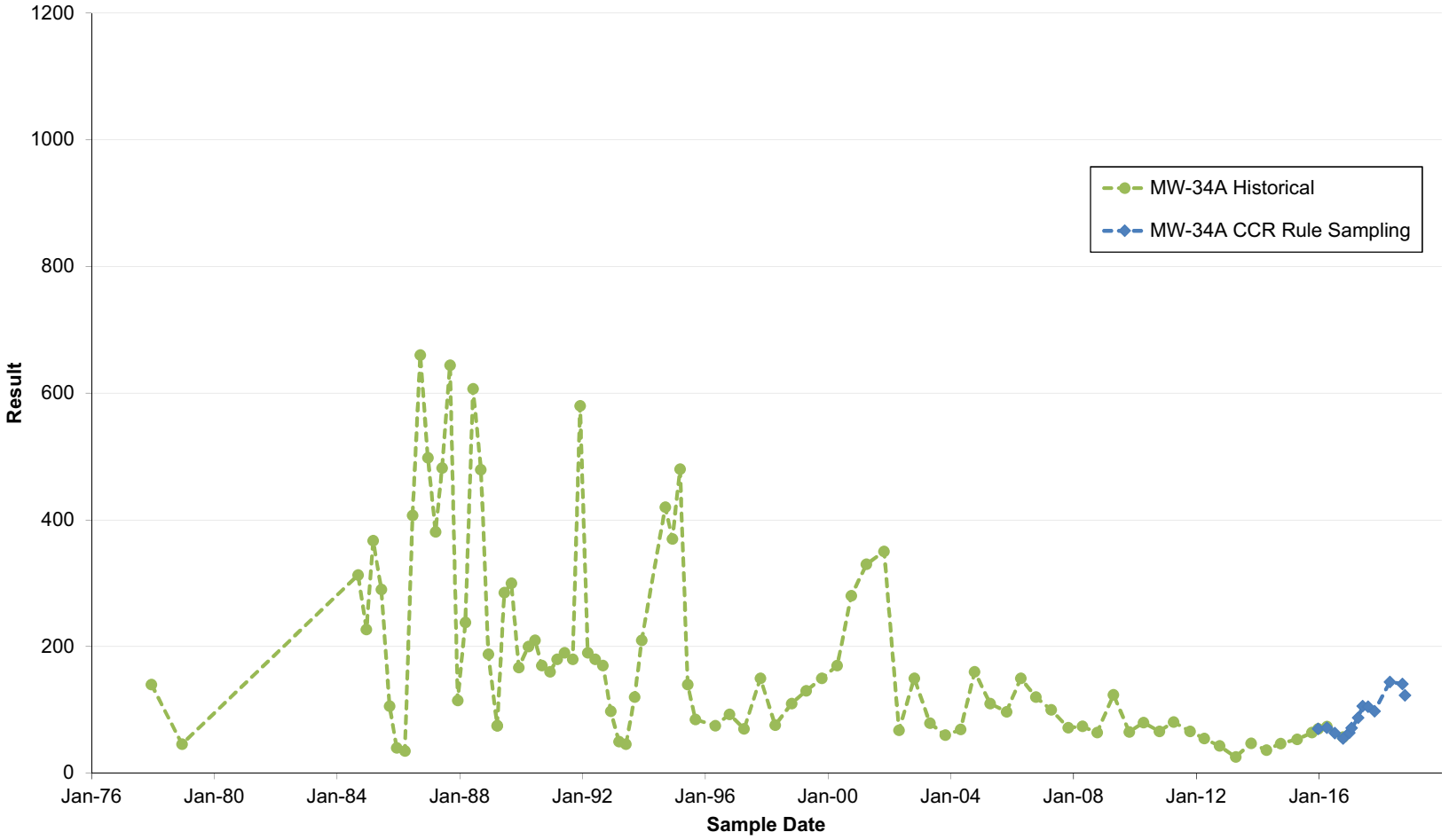
Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW34A - Chloride (mg/l as Cl)



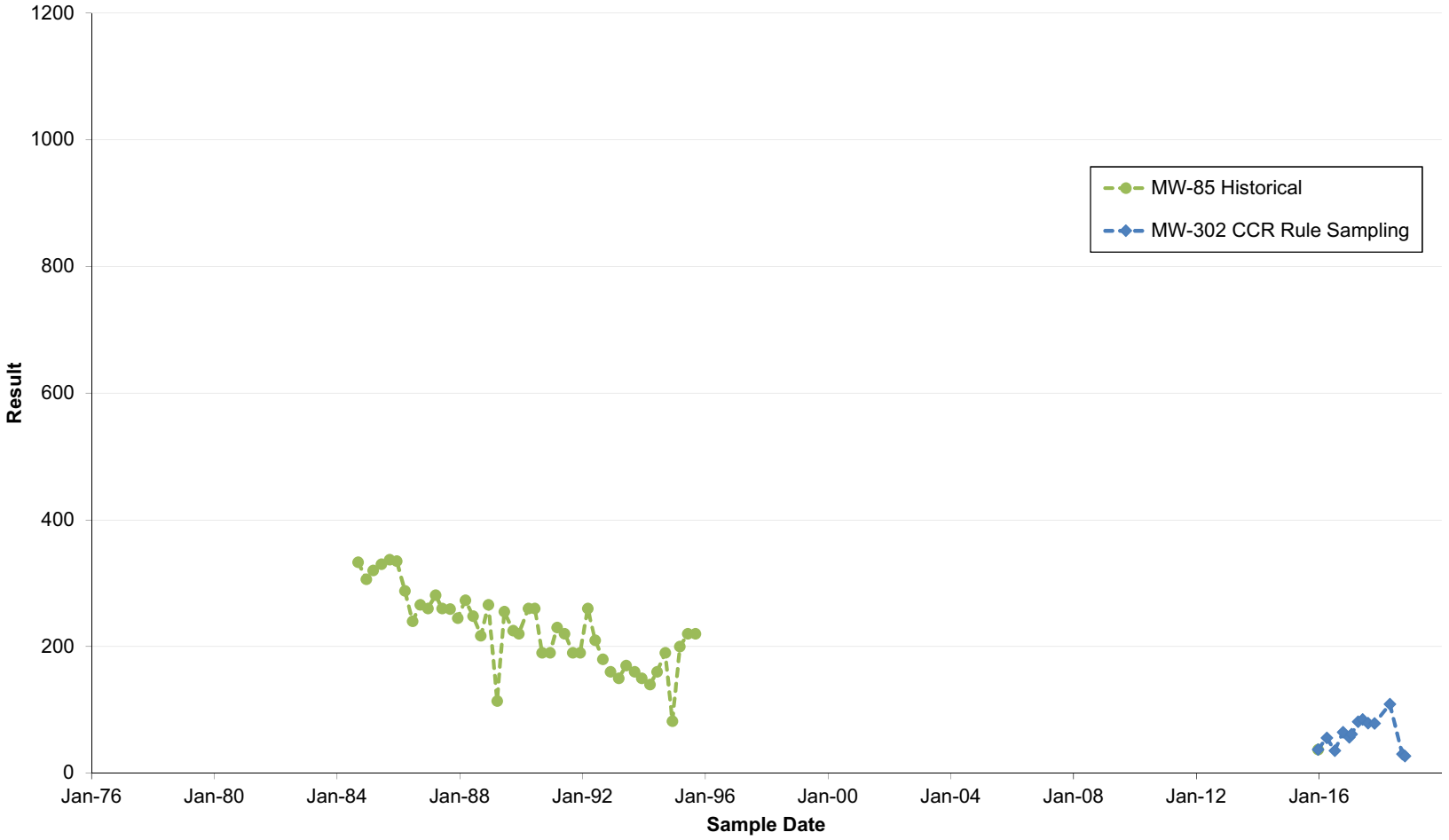
Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-33 and MW-33AR - Sulfate (mg/l as SO4)



Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-34A - Sulfate (mg/l as SO4)



Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-85 and MW-302 - Sulfate (mg/l as SO4)



Appendix D

Historical Groundwater Flow Maps

LEGEND

- PROPOSED PROJECT AREA
- OBSERVATION WELL LOCATION, NUMBER, AND WATER TABLE ELEVATION
- BORING LOCATION AND NUMBER
- WETLANDS
- TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL: 20 FT.)
- PRIVATE RESIDENCES (ASSUMED LOCATIONS OF PRIVATE WATER SUPPLY WELLS)
- COMMERCIAL BUILDINGS (ASSUMED LOCATIONS OF POSSIBLE PUBLIC WATER SUPPLY WELLS)
- SURFACE WATERS (STREAMS OR DRAINAGE DITCHES) ARROWS INDICATE DIRECTION OF FLOW
- OTHER BUILDINGS (GARAGES, BARNS, ETC.)
- HIGH CAPICITY WELLS
- —790— WATER TABLE CONTOURS (CONTOUR INTERVAL: 1 FT.)
- DIRECTION OF GROUNDWATER FLOW

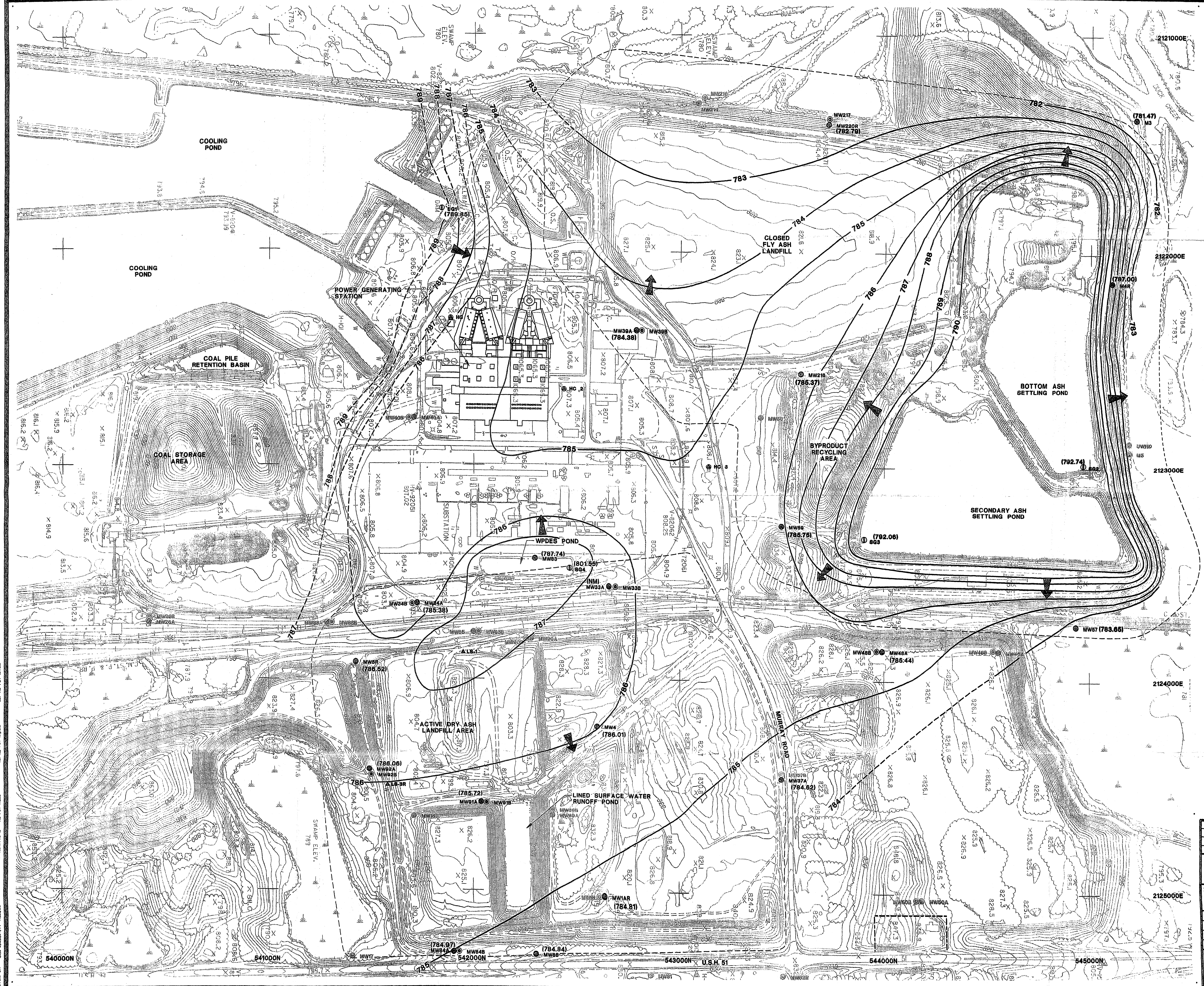
NO.	BY	DATE	REVISION	APP'D

WATER TABLE CONTOUR MAP 2/4/81

PLAN OF OPERATION – ASH DISPOSAL FACILITY
COLUMBIA SITE
WISCONSIN POWER & LIGHT COMPANY
PART OF SECTIONS 27 & 34, T12N, R9E
TOWN OF PACIFIC COLUMBIA CO. WISCONSIN

WARZYN ENGINEERING INC

DRAWN TDH	SCALE 1"=300'	SHEET 39 OF 39	
CHECKED RJK	DATE 2/10/81	DRAWING NO. C7134-94	
APPROVED			
REFERENCE		PRINTED 8/3/88	



LEGEND

- PROPERTY LINE
- EXISTING RAILROAD TRACKS
- EXISTING GROUND CONTOUR
- CONTOUR DEPRESSION
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING FENCE
- EXISTING BUILDING
- EXISTING SPOT ELEVATION
- TREES AND/OR BRUSH
- WETLAND AREA
- EDGE OF WATER
- HC 1 — WATER SUPPLY WELL
- MW91A — WATER TABLE WELL
- MW91B — PIEZOMETER
- ABANDONED WATER TABLE WELL
- ABANDONED PIEZOMETER
- SG1 — STAFF GAUGE
- LS-1 — LYSIMETER
- DESIGN MANAGEMENT ZONE
- PROPERTY LINE
- O.S. — OPEN STORAGE
- O.H. — OVERHEAD STRUCTURE
- E.P.S. — ELECTRICAL POWER STATION
- T — TANK
- W — WALL
- (785.31) — WATER TABLE ELEVATION (FT-MSL) (N.M. = NOT MEASURED)
- 786 — GROUNDWATER CONTOUR LINE (1FT INTERVAL- FT. M.S.L.) (DASHED WHERE INFERRED)
- GROUNDWATER FLOW DIRECTION

NOTES

1. BASE MAP IS PROVIDED BY WISCONSIN POWER & LIGHT CO. AND IS BASED ON PHOTOS TAKEN ON APRIL 6, 1995 BY AERO-METRIC ENGINEERING, SHEBOYGAN, WI.
2. HORIZONTAL DATUM IS BASED ON THE WISCONSIN STATE PLANE COORDINATE SYSTEM, SOUTH ZONE - DATUM: NAD 83(91).
3. VERTICAL DATUM IS REFERENCED TO U.S.G.S. MEAN SEA LEVEL (MSL). TOPOGRAPHIC CONTOUR INTERVAL IS TWO FEET.
4. MONITORING WELL LOCATIONS AND ELEVATIONS SURVEYED BY WISCONSIN POWER & LIGHT CO. IN DECEMBER 1994 & NOVEMBER 1996.
5. THE LOCATION OF THE DESIGN MANAGEMENT ZONE DEMARCATION LINE IS APPROXIMATE.
6. WATER ELEVATION USED TO PREPARE THIS MAP WERE MEASURED ON OCTOBER 24, 2002.
7. THE WATER LEVEL AT MW 33A AND MW 33B COULD NOT BE MEASURED DURING OCTOBER 2002 DUE TO AN OBSTRUCTION IN THE WELL CASING.

NO.	BY	DATE	REVISION	APP'D.
3.				
2.				
1.				

PROJECT: **ALLIANT ENERGY - WP&L COLUMBIA ASH PONDS & DRY ASH DISPOSAL FACILITY**

SHEET TITLE: **WATER TABLE MAP (OCTOBER 2002)**

DRAWN BY: defoej	SCALE: 1"=200'	PROJ. NO. 3024.28
CHECKED BY: JMR		FILE NO. WATERTBL.PLT
APPROVED BY: JCO	DATE PRINTED:	**FIGURE 3**
DATE: JANUARY 2003		

RMT®
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P.O. Box 8923
Madison, WI 53708-8923
Phone: 608-831-4444

B2 Alternative Source Demonstration, April 2019 Detection Monitoring

Alternative Source Demonstration
April 2019 Detection Monitoring

Dry Ash Disposal Facility, Modules 1-3
Columbia Energy Center
Pardeeville, Wisconsin

Prepared for:

SCS ENGINEERS

25219067.00 | October 14, 2019

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

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Section Page

Tables

Figures

Appendices

I:\25219067.00\Deliverables\2019 April ASD COL MOD 1-3 LF\191014_COL_1-3 LF_April ASD_DRAFT.docx

PE CERTIFICATION

I, Sherren Clark, hereby certify that that the information in this alternate source demonstration is accurate and meets the requirements of 40 CFR 257.94(e)(2). This certification is based on my review of the groundwater data and related site information available for the Columbia Energy Center Dry Ash Disposal Facility. I am a duly licensed Professional Engineer under the laws of the State of Wisconsin.

SL Clark 10-11-19

(signature) (date)

Sherren Clark

(printed or typed name)

License number E-29863

My license renewal date is July 31, 2020.

Pages or sheets covered by this seal:
Alternative Source Demonstration, April 2019 Detection Monitoring – Dry Ash Disposal Facility, Modules 1-3 Pardeeville, Wisconsin

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1.0 INTRODUCTION

This Alternative Source Demonstration (ASD) was prepared to support compliance with the groundwater monitoring requirements of the "Coal Combustion Residuals (CCR) Final Rule" published by the U.S. Environmental Protection Agency (USEPA) in the *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule*, dated April 17, 2015 (USEPA, 2015), and subsequent amendments. Specifically, this report was prepared to fulfill the requirements of 40 CFR 257.94(e)(2). The applicable sections of the Rule are provided below in *italics*.

1.1 §257.94(E)(2) ALTERNATIVE SOURCE DEMONSTRATION REQUIREMENTS

The owner and operator may demonstrate that a source other than the CCR Unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The owner or operator must complete the written demonstration within 90 days of detecting a statistically significant increase over background levels.

An ASD is completed when there are exceedances of one or more benchmarks established within the groundwater monitoring program. The ASD is completed to determine if any other sources are likely causes of the identified exceedance(s) of established benchmark(s) at the site. This ASD was performed in response to results indicating a statistically significant increase (SSI) over background levels during detection monitoring under the CCR Rule.

This ASD report is evaluating the SSIs observed in the statistical evaluation of the April 2019 detection monitoring event at the Columbia Energy Center (COL) Dry Ash Disposal Facility, Modules 1-3 CCR Units. The first ASD was prepared for this facility evaluating the SSIs observed in the statistical evaluation of the October 2017 detection monitoring event (SCS Engineers [SCS], 2018). The October 2017 ASD and subsequent semiannual updates have concluded that several lines of evidence demonstrated that SSIs reported for boron, chloride, sulfate, and total dissolved solids (TDS) concentrations in the downgradient monitoring wells were likely due to man-made sources other than the CCR units and/or naturally occurring constituents in the alluvial aquifer.

As discussed in more detail in **Section 4.2** of this ASD, the findings for the April 2019 monitoring event were consistent with those for the previous events.

1.2 SITE INFORMATION AND MAP

The COL site is located at W8375 Murray Road, Pardeeville, Columbia County, Wisconsin (**Figure 1**). The COL site is an active coal-burning generating station which has been burning coal and disposing of CCR on site since the mid-1970s. The layout of the site is shown on **Figure 2**. The COL property includes two areas of CCR storage and disposal. These are the Dry Ash Disposal Facility (ADF) and the Ash Ponds Facility. This ASD will evaluate the conditions at the site for Modules 1-3 of the ADF only. The ADF is operated under the Wisconsin Department of Natural Resources (WDNR) License No. 3025.

The groundwater monitoring system for the COL ADF Modules 1-3 (MOD 1-3) is a multi-unit system, monitoring three existing CCR Units:

- COL Dry ADF – Module 1 (existing CCR Landfill)
- COL Dry ADF – Module 2 (existing CCR Landfill)
- COL Dry ADF – Module 3 (existing CCR Landfill)

A map showing the CCR Units and all background (or upgradient) and downgradient monitoring wells with identification numbers for the CCR groundwater monitoring program and the state monitoring program is provided as **Figure 2**. Separate monitoring systems have been established for Module 4 of the COL ADF, for the primary ash pond and for the secondary ash pond.

1.3 STATISTICALLY SIGNIFICANT INCREASES IDENTIFIED

SSIs were identified for boron, chloride, sulfate, and TDS at one or more wells based on the April 2019 detection monitoring event.

A summary of the April 2019 constituent concentrations and the established benchmark concentrations is provided in **Table 1**. The constituent concentrations with SSIs above the background concentration are highlighted in the table. Concentration trends for the parameters with SSIs are shown in **Appendix A**.

1.4 OVERVIEW OF ALTERNATIVE SOURCE DEMONSTRATION

This ASD report includes:

- Background information (**Section 2.0**)
- Evaluation of potential that SSIs are due to methodology or analysis (**Section 3.0**)
- Evaluation of potential that SSIs are due to natural sources or man-made sources other than the CCR Units (**Section 4.0**)
- ASD conclusions (**Section 5.0**)
- Monitoring recommendations (**Section 6.0**)

The CCR Rule constituent results from background and compliance sampling for parameters with SSIs are provided in **Table 2**. The laboratory report for the April 2019 detection monitoring event will be included in the 2019 Annual Groundwater Monitoring and Corrective Action Report submitted in January 2020. Complete laboratory reports for the background monitoring events and the previous detection monitoring events were included in previous annual groundwater monitoring and corrective action reports.

2.0 BACKGROUND

To provide context for the ASD evaluation, the following background information is provided in this section of the report, prior to the ASD evaluation sections:

- Geologic and hydrogeologic setting
- CCR Rule monitoring system
- Other monitoring wells

A more detailed discussion of the background information for the site is provided in the ASD for the October 2017 event (SCS, 2018).

2.1 REGIONAL GEOLOGY AND HYDROGEOLOGY

2.1.1 Regional Information

For the purposes of groundwater monitoring, the surficial sand and gravel aquifer is considered the uppermost aquifer, as defined under 40 CFR 257.53. Immediately underlying the surficial sand and gravel aquifer is the Cambrian-Ordovician sandstone aquifer.

Additional details on the regional geology and hydrogeology were provided in the October 2017 ASD (SCS, 2018).

2.1.2 Site Information

Soils at the site are primarily sand to a depth of approximately 50 to 100 feet and overlie sandstone bedrock. Soils encountered during the site feasibility study for the COL ADF were described as generally sandy with interbedded silty clay lenses up to 20 feet thick (Warzyn, 1978). During drilling of CCR wells MW-301 and MW-302, the unconsolidated materials were identified as consisting primarily of silty sand. Boring logs for previously installed monitoring wells MW-33AR, MW-34A, MW-84A, and M-4R show silty sand and sand as the primary unconsolidated materials at these locations. All CCR monitoring wells are screened within the unconsolidated sand unit.

Shallow groundwater at the site generally flows to the northwest across the existing landfill area, then generally flows west toward the Wisconsin River. A groundwater flow map for April 2019 is shown on Figure 3. The groundwater elevation data for the CCR monitoring wells are provided in Table 3.

2.2 CCR RULE MONITORING SYSTEM

The groundwater monitoring system established in accordance with the CCR Rule consists of two upgradient (background) monitoring wells and three downgradient monitoring wells. The background wells include MW-301 and MW-84A. The downgradient wells include MW-302, MW-33AR, and MW-34A. The CCR Rule wells are installed within the sand and gravel aquifer. Well depths range from approximately 29 to 40 feet, measured from the top of the well casing.

2.3 OTHER MONITORING WELLS

Additional groundwater monitoring wells currently exist at COL as part of the monitoring systems developed for the state monitoring program and for the other CCR units.

Monitoring wells for the state monitoring program are installed in the unconsolidated sand and gravel unit, which is the uppermost aquifer as defined under 40 CFR 257.53. This shallow monitoring system includes water table wells and mid-depth piezometers. Well depths range from approximately 14 to 76 feet, measured from the top of the well casing.

3.0 METHODOLOGY AND ANALYSIS REVIEW

To evaluate the potential that an SSI is due to a source other than the regulated CCR Unit, SCS used a two-step evaluation process. First, the sample collection, field and laboratory analysis, and

statistical evaluation were reviewed to identify any potential error or analysis that led to exceedance of the benchmark. Second, potential alternative sources, including natural variation and man-made sources other than the CCR unit, were evaluated. This section of the report provides the findings of the methodology and analysis review. Section 4.0 of the report addresses the potential alternative sources.

3.1 SAMPLING AND FIELD ANALYSIS

Field notes and sampling results were reviewed to determine if any sampling error may have caused or contributed to the observed SSIs. Potential field sampling errors or issues could include mislabeling of samples, improper sample handling, missed holding times, cross contamination during sampling, or other field error. Field blank sample results were also reviewed for any indication of potential contamination from sampling equipment or containers. Based on the review of the field notes and results, SCS did not identify any indication that the SSI concentrations were due to a sampling error.

SCS did not identify any issues with the field analysis based on review of the data and field notes. Because boron, chloride, sulfate, and TDS are laboratory parameters, there is little potential for a field analysis error to contribute to an SSI.

3.2 LABORATORY ANALYSIS REVIEW

The laboratory reports for the April 2019 detection monitoring event were reviewed to determine if any laboratory analysis error or issue may have caused or contributed to an observed SSI for boron, chloride, sulfate, or TDS. The laboratory report review included reviewing the laboratory quality control flags and narrative, verifying that correct methods were used and desired detection limits were achieved, and checking the field and laboratory blank sample results.

Based on the review of the laboratory reports, SCS did not identify any indication that the SSIs were due to a laboratory analysis error. There were no laboratory quality control flags or issues identified in the laboratory report that affect the usability of the data for detection monitoring.

Time series plots of the SSI constituent analytical data were also reviewed for any anomalous results that might indicate a possible sampling or laboratory error (e.g., dilution error or incorrect sample labeling). The time series plots are provided in Appendix A. The concentrations observed are similar to historical concentrations with the exception of MW-33AR which has recent concentration increases of chloride, sulfate, and TDS. The boron concentration at MW-33AR is consistent with previously observed concentrations at this monitoring well (Appendix A).

3.3 STATISTICAL EVALUATION REVIEW

The review of the statistical results and methods include a quality control check of the following:

- Input analytical data vs. laboratory analytical reports
- Statistical method and process for each SSI

Based on the review of the statistical evaluation, SCS did not identify any errors or issues in the statistical evaluation that caused or contributed to the determination of interwell SSIs for the April 2019 detection monitoring event.

3.4 SUMMARY OF METHODOLOGY AND ANALYSIS REVIEW FINDINGS

In summary, there were no changes to the SSI determinations for the April 2019 monitoring event based on the methodology and analysis review, and no errors or issues causing or contributing to the reported SSIs were identified.

4.0 ALTERNATIVE SOURCES

This section of the report discusses the potential alternative sources for the boron, chloride, sulfate, and TDS SSIs at the downgradient monitoring wells; identifies the most likely alternative source(s); and presents the lines of evidence indicating that an alternative source is the most likely cause of the observed SSIs.

4.1 POTENTIAL CAUSES OF SSI

4.1.1 Natural Variation

The statistical analysis was completed using an interwell approach, comparing the April 2019 detection monitoring results to the upper prediction limits (UPLs) calculated based on sampling of the background wells (MW-84A and MW-301). If concentrations of a constituent that is naturally present in the aquifer vary spatially, then the potential exists that the downgradient concentrations may be higher than upgradient concentrations due to natural variation.

Although natural variation is present in the shallow aquifer, it does not appear likely that natural variation is the primary source causing the boron, chloride, sulfate, and TDS SSIs.

4.1.2 Man-Made Alternative Sources

Man-made alternative sources that could potentially contribute to the boron, chloride, sulfate, and TDS SSIs could include the closed ash pond landfill, the active ash ponds, the former ash pond effluent ditch, the coal storage area, road salt use, railroad operations, or other plant operations.

Based on the groundwater flow directions and on previous investigations at the site, the former ash pond effluent ditch appears to be the most likely cause of the boron and/or sulfate SSIs for wells MW-33AR, MW-34A, and MW-302. The ash pond effluent ditch also likely contributed to the chloride SSIs at MW-33AR and MW34A.

The higher chloride and TDS concentrations at MW-33AR are likely related to a non-CCR alternative source.

4.2 LINES OF EVIDENCE

The lines of evidence indicating that the SSIs for boron, chloride, sulfate, and TDS in compliance wells MW-33AR, MW-34A, and MW-302, relative to the background wells, are due to an alternative source include:

1. Elevated concentrations of boron, chloride, sulfate, and TDS were present in the area west of the landfill, where the three compliance wells are located, before the landfill was constructed.

2. Monitoring performed under the state program documents that the concentrations of boron, chloride, and sulfate were elevated before CCR disposal in the landfill began, and have decreased since the landfill has been in operation.

3. Groundwater flow directions have changed through time due to changes in water management at the plant, so that groundwater impacted by the effluent ditch formerly flowed to the east, under the landfill, and is now flowing west and/or north.

4. The increase in chloride and TDS results for well B-33AR in the last 2 years has not correlated with an increase in boron, as would be expected for a CCR leachate source; therefore, an alternative source is more likely.

4.2.1 Pre-Landfill Water Quality

Elevated concentrations of boron, chloride, sulfate, and TDS were present in the area west of the landfill, where the three compliance wells are located, before the landfill was constructed. Groundwater monitoring performed in 1977 and 1978 as part of the feasibility study for the landfill permitting showed that wells located along the west side of the future landfill footprint, where the current compliance wells are located, had elevated results for sulfate, chloride, and specific conductance. TDS was not monitored, but is generally correlated with specific conductance.

The 1978 Feasibility Study (Warzyn, 1978) for the dry ADF discusses the influence of the ash pond effluent ditch on groundwater west of the proposed site. The former ash pond effluent ditch, shown on **Figure 2**, carried effluent from the ash ponds located north of the plant, and flowed south between the west side of the current landfill and the substation. Groundwater monitoring in December 1977 indicated that sulfate was present at 1,200 milligrams per liter (mg/L) in MW-33A, which was located near the point where the ash pond effluent discharged from a culvert into the effluent ditch. The sulfate concentration at this well decreased to 830 mg/L in the December 1978 sampling (Warzyn, 1979). Current concentrations of sulfate in this area are much lower, but remain above background. The October 2018 sulfate result for MW-33AR (installed to replace MW-33A) was 112 mg/L and at MW-34A were 123 mg/L.

Selected text and tables from the 1978 Feasibility Study and the 1979 Supplementary Feasibility Study Report are included in **Appendix B**.

4.2.2 Long-Term Concentration Trends

Monitoring performed under the state program documents that the concentrations of boron and sulfate were elevated before CCR disposal in the landfill began, and have decreased since the landfill has been in operation. Routine groundwater monitoring for the COL ADF began after the Plan of Operation was approved and prior to initial CCR disposal. The earliest data available from the WDNR Groundwater Environmental Monitoring System (GEMS) database is from September 1984. Initial placement of CCR in test plots in Module 1 of the ADF was approved in October 1984 and CCR disposal began sometime after that. Therefore, the initial groundwater monitoring results in the GEMS database represent pre-disposal conditions for the landfill.

The historic monitoring data show that concentrations of boron and sulfate were significantly higher in the area west of the landfill where the compliance wells are located. Graphs of historical concentrations are provided in **Appendix C**. Results for compliance well MW-33AR are plotted with results from well MW-33A. MW-33AR was a replacement well for MW-33A at a slightly different location and depth. The well screen was installed approximately 10 feet higher in MW-33AR than in

MW-33A, intersecting the water table, which may explain the increase in concentration that occurred with the well replacement. Results for compliance well MW-302 are plotted with results from monitoring well MW-85, which was located near the current MW-302 location (see **Figure 2**) and was monitored from September 1984 through September 1995.

The recent boron concentrations are consistent with generally decreasing or stable historical concentrations at MW-33AR and MW-34A (**Appendix A** and **Appendix C**).

4.2.3 Groundwater Flow Direction Changes

Groundwater flow directions have changed through time due to changes in water management at the plant, so that groundwater impacted by the effluent ditch formerly flowed to the east, under the landfill, and is now flowing west. The 1978 Feasibility Study report states that the southern 2/3 of the proposed fill area (including the area of the active CCR landfill phases) exhibits a southeast and southerly groundwater flow direction, toward an agricultural drainage ditch southeast and south of the landfill area. The 1981 Plan of Operation indicates that flow in the landfill area is to the east-southeast. A water table map prepared by RMT, based on October 2002 water level measurements, shows flow under the landfill generally to the east and northeast from a groundwater high near the effluent ditch and Wisconsin Pollutant Discharge Elimination System (WPDES) pond between the landfill and the substation. The 1981 and 2002 water table maps are provided in **Appendix D**.

Under current conditions, groundwater flow below the active landfill area is generally to the west and northwest. The flow changes with time reflect the termination of discharge to the ash pond effluent ditch in the mid-2000s. When discharge via this ditch was active, the ditch was a source of recharge to the groundwater and created a high groundwater area with flow moving away from the ditch to the east. After discharge to the ditch was terminated, water levels in this area decreased significantly and the groundwater flow direction changed.

With the changes in groundwater flow, historically impacted groundwater moved in alternating directions. While the effluent ditch was active, impacted groundwater likely moved eastward past the current compliance wells, as indicated by the long-term concentration data. Although the compliance wells are downgradient from the landfill under current flow conditions, the observed groundwater impacts may be residual from the past when the wells were downgradient from the effluent ditch.

4.2.4 Chloride and Boron Leachate Concentrations

The chloride and TDS results for well MW-33AR increased significantly without a corresponding increase in boron, indicating the source of the increasing chloride and TDS is not likely the CCR landfill. Sampling of the landfill leachate pond and the lysimeters indicates that boron and chloride concentrations are generally both elevated in leachate (**Table 4**). Furthermore, the chloride concentration in the April 2019 sample from MW-33AR was significantly higher than the chloride concentrations measured in the leachate, indicating the leachate is not the source (**Tables 2** and **4**). An alternative man-made source, such as road salt, is a more likely source of chloride than the CCR Units. The TDS increase correlated closely with the chloride increase and likely has the same alternative source.

5.0 ALTERNATIVE SOURCE DEMONSTRATION CONCLUSIONS

The lines of evidence discussed above regarding the SSIs reported for boron, chloride, sulfate, and TDS concentrations in downgradient monitoring wells MW-33AR, MW-34A, and/or MW-302 demonstrate that the SSIs are likely primarily due to sources other than the CCR Units. Boron, sulfate, and chloride concentrations were elevated prior to disposal of CCR in the landfill and are associated with historical discharges from the ash ponds via the effluent ditch located west of the landfill. Elevated chloride and TDS concentrations detected at well MW-33AR appear likely to be related to an alternative non-CCR source, such as salt.

6.0 SITE GROUNDWATER MONITORING RECOMMENDATIONS

In accordance with section 257.94(e)(2) of the CCR Rule, the COL MOD 1-3 CCR Units may continue with detection monitoring based on this ASD. The ASD report will be included in the 2019 Annual Report due January 31, 2020.

7.0 REFERENCES

SCS, 2018, Alternative Source Demonstration, October 2017 Detection Monitoring, Columbia Energy Center Dry Ash Disposal Facility, April 2018.

USEPA, 2015, Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule. April 2015.

Warzyn Engineering, Inc., 1978, Feasibility Study, Proposed Fly Ash and/or Scrubber Sludge Disposal Facility – Columbia Site, Wisconsin Power and Light Company, Town of Pacific, Columbia County, WI, January 1978.

Warzyn Engineering, Inc., 1979, and Preliminary Engineering Concepts, Columbia Site, Wisconsin Power and Light Company, Town of Pacific, Columbia County, WI, January 1978.

Tables

Table 1. Groundwater Analytical Results - Detection Monitoring
Columbia Dry ADF, Modules 1-3 / SCS Engineers Project #25219067.00

Parameter Name	Interwell Upper Prediction Limit (UPL)	Background Wells								Compliance Wells															
		MW-84A				MW-301				MW-33AR					MW-34A					MW-302					
		Oct-17	Apr-18	Oct-18	Apr-19	Oct-17	Apr-18	Oct-18	Apr-19	Oct-17	Apr-18		Oct-18	Apr-19	Oct-17	Apr-18		Oct-18	Apr-19	Oct-17	Apr-18		Oct-18	Apr-19
		10/24/2017	4/25/2018	10/22/2018	4/3/2019	10/23/2017	4/25/2018	10/22/2018	4/3/2019	10/24/2017	4/24/2018	Resample 9/21/2018	10/22/2018	4/2/2019	10/24/2017	4/24/2018	Resample 9/21/2018	10/22/2018	4/4/2019	10/24/2017	4/24/2018	Resample 9/21/2018	10/22/2018	4/2/2019
Boron, ug/L	37.4	13.8	25.0	10.1 J	13.6	34.3	24.3	27.8	26.9	678	601	683	682	568	208	209	241	233	204	691	1,950	203	296	254
Calcium, ug/L	138,400	77,500	76,600	74000	80,100	87,200	112,000	101,000	126,000 P6	98,200	99,800	NA	66,900	131,000	69,600	69,600	NA	70,100	67,500	94,400	110,000	NA	56,900	62,400
Chloride, mg/L	6.52	5.1	4.8	4.2	3.6 B	4.0	2.3	3.2	2.9 J,B	119	188	32.6	14.4	229	7.6	8.2	17.1	19.9	18.7	6.9	15.0	1.7 J	1.8 J	1.5 J
Fluoride, mg/L	DQ	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.50 D3	<0.10	<0.10	NA	<0.10	<0.10	<0.10	<0.10	NA	<0.10	<0.10	<0.10	<0.10	NA	<0.10	<0.10
Field pH, Std. Units	7.93	7.68	7.45	7.24	7.03	7.37	6.76	6.79	6.62	7.81	7.74	8.16	7.69	7.72	7.67	7.80	8.12	7.64	7.73	8.23	7.21	7.74	7.22	7.32
Sulfate, mg/L	37.1	2.2 J	2.8 J	1.6 J	1.4 J	27.5	8.6	19.2	5.3 J	175	163	124	112	201	98	144	141	123	70.4	78.4	109	30.0	26.9	25.2
Total Dissolved Solids, mg/L	514	314	328	330	318	362	464	424	462	606	692	466	388	784	340	412	460	392	310	446	598	280	288	290

Highlighted cell indicates the compliance well result is an SSI. UPLs are based on a 1-of-2 retesting approach; therefore, for the April 2018 semiannual event an SSI is indicated only if both the original result and the September 2018 retest are above the UPL and the LOQ.

Abbreviations:
UPL = Upper Prediction Limit
NA = Not Analyzed
LOQ = Limit of Quantification
LOD = Limit of Detection
SSI = Statistically Significant Increase
DQ = Double Qualification
B = Analyte was detected in the associated Method Blank.
J = Estimated concentration at or above the LOD and below the LOQ.
D3 = Sample was diluted due to the presence of high levels of non-target analytes or other matrix interference.
P6 = Matrix Spike Recovery was outside laboratory control limits due to a parent sample concentrations notably higher than the spike level.

Notes:
1. Interwell UPL is based on the parametric prediction limit with 1-of-2 retesting methodology for all parameters except fluoride. and total dissolved solids. Parametric UPL for sulfate calculated using natural logarithm transformed data.
2. Interwell UPL for fluoride is based on the double quantification rule, because fluoride was not detected above the LOQ in the background samples.
3. Interwell UPL for total dissolved solids is nonparametric limit.
4. Interwell UPLs calculated from background well results for December 2015 through October 2017.

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Checked by: AJR Date: 9/24/2019

I:\25219067.00\Deliverables\2019 April ASD COL MOD 1-3 LF\Tables\[1_CCR GW Screening Summary_COL LF Mod 1_3 updated.xlsx]Table

Table 2. Analytical Results - Appendix III Constituents with SSIs
Columbia Dry ADF, Modules 1-3

Well Group	Well	Collection Date	Boron (µg/L)	Chloride (mg/L)	Sulfate (mg/L)	Total Dissolved Solids (mg/L)
Background	MW-301	12/22/2015	26.5	3.7 J	9.3	478
		4/5/2016	25.2	4	15.3	486
		7/8/2016	23.6	3.5 J	15	464
		10/13/2016	30.6	2.2	13.9	490
		12/29/2016	32.8	2 J	12.3 J	444
		1/25/2017	32.6	1.5 J	6.5	514
		4/11/2017	28.8	2	10.3	502
		6/6/2017	21.3	3.5	17.1	458
		8/8/2017	30.6	5.5	31.6	462
		10/23/2017	34.3	4	27.5	362
		4/25/2018	24.3	2.3	8.6	464
		10/22/2018	27.8	3.2	19.2	424
		4/3/2019	26.9	2.9 J, B	5.3 J	462
	MW-84A	12/22/2015	11.9	4.9	4.9	316
		4/5/2016	14	4.7	4.3	322
		7/8/2016	14.7	5.1	3.7 J	316
		10/13/2016	11.1	4.3	2.6 J	324
		12/29/2016	14.7	4.7	2.7 J	316
		1/25/2017	16.1	4.6	3	328
		4/11/2017	12.9	4.9	2.8 J	342
		6/6/2017	14.8	5.5	2.7 J	344
		8/8/2017	22.9	5.5	2 J	342
		10/24/2017	13.8	5.1	2.2 J	314
		4/25/2018	25	4.8	2.8 J	328
		10/22/2018	10.1 J	4.2	1.6 J	330
		4/3/2019	13.6	3.6 B	1.4 J	318
Compliance	MW-302	12/22/2015	80	4.2	37.4	312
		4/5/2016	78.8	4.1	55.6	312
		7/7/2016	134	3.1 J	35.4	344
		10/13/2016	132	1.1 J	64.7	360
		12/29/2016	106	1.2 J	56.4	330
		1/25/2017	149	1.6 J	61.6	384
		4/11/2017	322	1.6 J	81.3	436
		6/6/2017	671	3.5	84.6	466
		8/8/2017	833	4.5	79	470
		10/24/2017	691	6.9	78.4	446
		4/24/2018	1,950	15	109	598
		9/21/2018	203	1.7 J	30	280
		10/22/2018	296	1.8 J	26.9	288
		4/2/2019	254	1.5 J	25.2	290

Table 2. Analytical Results - Appendix III Constituents with SSIs
Columbia Dry ADF, Modules 1-3

Well Group	Well	Collection Date	Boron (µg/L)	Chloride (mg/L)	Sulfate (mg/L)	Total Dissolved Solids (mg/L)
Compliance	MW-33AR	12/21/2015	954	10.6	96.2	356
		4/5/2016	813	12.5	91.5	354
		7/7/2016	794	12.5	99.2	364
		10/13/2016	827	52.5	124	456
		12/29/2016	812	39.6	132	440
		1/25/2017	763	41.4	133	426
		4/11/2017	760	47.1	139	446
		6/6/2017	692	68.1	151	492
		8/7/2017	697	105	164	598
		10/24/2017	678	119	175	606
		4/24/2018	601	188	163	692
		9/21/2018	683	32.6	124	466
		10/22/2018	682	14.4	112	388
		4/2/2019	568	229	201	784
	MW-34A	12/21/2015	230	4.9	69.9	324
		4/5/2016	220	5.1	71.6	298
		7/7/2016	216	5.6	63.4	304
		10/13/2016	212	6.8	54.8	288
		12/29/2016	224	7.1	63.9	242
		1/25/2017	214	7.2	71.2	310
		4/11/2017	214	6.2	87.6	330
		6/6/2017	201	7.8	106	366
		8/7/2017	205	7.4	105	358
		10/24/2017	208	7.6	98	340
		4/24/2018	209	8.2	144	412
		9/21/2018	241	17.1	141	460
		10/22/2018	233	19.9	123	392
		4/4/2019	204	18.7	70.4	310

Abbreviations:
µg/L = micrograms per liter or parts per billion (ppb)
mg/l = milligrams per liter or parts per million (ppm)
J = Estimated value below the laboratory's limit of quantitation
B = Analyte was detected in the associated Method Blank.

Notes:
(1) Analytical laboratory reports provided in the 2017 Annual Groundwater Monitoring and Corrective Action Report.

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I:\25219067.00\Deliverables\2019 April ASD COL MOD 1-3 LF\Tables\[2 and 3_COL LF ASD.xlsx]Table 2. Analy. Rslts- CCR

Table 3. Groundwater Elevations - State Monitoring Program and CCR Well Network
Columbia Generating Station

	Well Number	MW-1AR	MW-5R	MW-33AR	MW-33BR	MW-34A	MW-34B	MW-37A	MW-83	MW-84A	MW-84B	MW-86	MW-91AR	MW-91B	MW-92A	MW-92B
Dry Ash Facility	Top of Casing Elevation (feet amsl)	822.55	805.44	808.29	808.39	805.95	806.05	813.04	807.96	814.28	814.26	824.79	809.03	808.45	808.47	808.41
	Screen Length (ft)															
	Total Depth (ft from top of casing)	44.40	25.97	31.08	57.50	35.43	56.95	31.80	25.42	40.21	52.02	45.43	32.90	52.38	28.94	51.75
	Top of Well Screen Elevation (ft)	778.15	779.47	777.21	750.89	770.52	749.10	781.24	782.54	774.07	762.24	779.36	776.13	756.07	779.53	756.66
	Measurement Date															
	April 4-6, 2016	785.82	787.02	785.29	785.07	785.63	785.67	784.76	785.43	786.37	786.26	785.89	786.05	785.95	786.61	786.21
	October 3-5, 2017	785.48	786.66	784.51	784.22	784.67	784.63	784.86	784.29	--	786.49	785.58	786.08	785.83	786.47	786.02
	October 9-10, 2017	--	--	--	--	--	--	--	--	785.56 (2)	--	--	--	--	--	--
	April 23-25, 2018	783.99	785.36	783.09	786.36	781.77	780.79	783.28	783.32	785.88	784.91	782.54	784.71	784.53	785.23	784.81
	October 23-25, 2018	788.25	789.71	788.77	787.96	787.88	787.73	787.62	788.26	788.32	788.19	788.21	788.59	788.31	789.32	788.87
	April 1-4, 2019	787.05	788.64	786.63	786.54	786.82	786.92	786.47	786.78	787.35	787.34	787.16	787.45	787.18	788.04	787.63
	Bottom of Well Elevation (ft)	778.15	779.47	777.21	750.89	770.52	749.10	781.24	782.54	774.07	762.24	779.36	776.13	756.07	779.53	756.66

	Well Number	M-3	M-4R	MW-39A	MW-39B	MW-48A	MW-48B	MW-57	MW-59	MW-216R	MW-217	MW-220RR
Ash Pond Facility	Top of Casing Elevation (feet amsl)	788.23	806.10	809.62	809.50	828.86	828.84	786.29	815.48	814.21	791.55	792.90
	Screen Length (ft)											
	Total Depth (ft from top of casing)	16.90	25.55	34.80	76.07	51.88	75.80	14.40	38.50	37.85	37.37	18.96
	Top of Well Screen Elevation (ft)	771.33	780.55	774.82	733.43	776.98	753.04	771.89	776.98	776.36	754.18	773.94
	Measurement Date											
	April 4-6, 2016	784.21	789.09	785.27	785.27	784.79	784.76	783.21	784.97	785.68	785.02	784.36
	October 3-5, 2017	780.93	787.04	783.35	783.18	784.30	784.19	782.37	784.23	783.89	782.48	782.61
	April 23-25, 2018	782.89	790.43	782.86	782.87	783.14	783.09	783.04	783.02	783.23	783.26	783.45
	October 22-24, 2018	782.95	788.47	787.12	786.88	787.12	786.99	783.48	787.73	787.49	784.90	784.52
	April 1-4, 2019	785.68	789.44	786.28	786.31	786.56	786.45	785.27	787.39	786.53	786.33	785.46
	Bottom of Well Elevation (ft)	771.33	780.55	774.82	733.43	776.98	753.04	771.89	776.98	776.36	754.18	773.94

		Background Wells		Mod 1- 3 LF			Primary Pond				Secondary Pond			Mod 4 Landfill		
	Well Number	MW-301	MW-84A	MW-302	MW-33AR	MW-34A	MW-303	MW-304	MW-305	M-4R	MW-306	MW-307	MW-308	MW-309	MW-310	MW-311
CCR Rule Wells	Top of Casing Elevation (feet amsl)	806.89	814.28	813.00	808.29	805.95	811.52	805.42	806.32	806.1	807.63	806.89	806.9	813.27	813.62	809.74
	Screen Length (ft)	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Total Depth (ft from top of casing)	29.40	40.21	33.6	31.08	35.43	35.8	25.7	25.6	39.58	27	26.5	28	37.67	38.41	36.19
	Top of Well Screen Elevation (ft)	787.49	784.07	789.40	787.21	780.52	785.72	789.72	790.72	776.52	790.63	790.39	788.90	785.60	785.21	783.55
	Measurement Date															
	April 4-5, 2016	786.78	786.37	785.81	785.29	785.63	785.48	788.08	789.61	789.09	--	--	--	--	--	--
	July 7-8, 2016	786.31	785.89	786.28	785.19	785.05	784.60	787.36	789.26	787.43	--	--	--	--	--	--
	July 28, 2016	NM	785.61	NM	NM	784.86	784.35	NM	NM	NM	--	--	--	--	--	--
	October 11-13, 2016	787.64	787.22	787.76	787.36	786.45	786.18	788.18	789.78	787.88	--	--	--	--	--	--
	December 29, 2016	787.37	786.63	787.05	785.66	785.72	NM	NM	NM	NM	--	--	--	--	--	--
	January 25-26, 2017	787.27	786.70	786.89	785.88	785.98	785.28	789.34	789.36	789.64	785.50	785.36	785.73	--	--	--
	April 10 & 11, 2017	787.89	787.16	787.55	786.39	786.30	786.00	788.22	789.57	787.95	786.22	785.64	786.51	--	--	--
	June 6, 2017	788.25	787.63	788.37	787.27	786.66	786.49	788.58	789.79	787.83	786.85	786.07	786.46	--	--	--
	August 7-9, 2017	787.34	786.68	787.55	786.11	785.81	785.42	789.52	789.30	788.54	785.69	785.19	785.37	--	--	--
	October 23-24, 2017	785.89	785.32	785.94	784.13	784.50	783.92	788.97	788.14	788.00	783.97	784.79	784.17	--	--	--
	February 21, 2018	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	783.19	783.05	783.02
	March 23, 2018	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	783.10	783.10	783.00
	April 23-25, 2018	785.29	785.88	784.37	783.09	781.77	783.27	789.69	787.67	790.43	783.24	783.65	782.65	783.07	782.97	781.83
	May 24, 2018	NM	NM	NM	NM	NM	NM	NM	NM	NM	785.79	785.09	NM	785.45	785.97	786.11
	June 23, 2018	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	786.03	786.64	786.47
	July 23, 2018	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	786.27	786.35	786.55
	August 7, 2018	787.06	786.55	NM	NM	NM	785.20	788.25	788.56	787.63	NM	NM	NM	NM	NM	NM
	August 22, 2018	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	785.54	785.40	785.46
	September 21, 2018	NM	NM	788.37	787.90	787.01	786.50	NM	NM	NM	NM	NM	NM	787.08	787.24	787.66
	October 22-24, 2018	788.98	788.32	789.16	788.77	787.88	787.51	789.05	790.04	788.47	787.66	786.57	787.81	787.99	788.18	788.64
	April 1-4, 2019	787.04	787.35	787.56	786.63	786.82	786.52	789.72	790.07	789.44	786.72	786.71	787.53	786.30	786.38	786.38
	Bottom of Well Elevation (ft)	771.33	776.36	780.55	771.89	776.98	774.82	733.43	776.98	753.04	780.63	780.39	778.90	775.60	775.21	773.55

Notes:
NM = not measured

Created by: MDB Date: 5/6/2013
Last revision by: NDK Date: 8/1/2019
Checked by: AJR Date: 8/21/2019

(1) Water Levels collected during sample collection.
(2) The depth to water at MW-84A was not measured prior to purging for sampling during the October 3-5, 2017 sampling event. The level was allowed to return to static and was measured on 10/10/2017.

I:\25219067.00\Deliverables\2019 April ASD COL MOD 1-3 LF\Tables\[2 and 3_COL LF ASD.xlsx]Table 3. GW Elevations

Table 4. Analytical Results - Lysimeters and Leachate Pond
Columbia Dry Ash Disposal Facility
SCS Engineers Project #25219067.00

Monitoring Point	Monitoring Period	Monitoring Point Dry/ Broken	Boron, Total (µg/L)	Chloride, Total (mg/L)	Sulfate, Total (mg/L)
LS-1	2015-Apr	DRY	--	--	--
	2015-Oct	BROKEN	--	--	--
	2016-Apr	DRY	--	--	--
	2016-Oct	--	6530	12.3	789
	2017-Apr	--	6510	20.7 J	814
	2017-Oct	--	6200	14.2 J	764
	2018-Apr	--	5920	16 J	856
	2018-Oct	DRY	--	--	
	2019-Apr	--	5,640	22 J	911
LS-3R	2015-Apr	--	6480	20.6 B	807
	2015-Oct	DRY	--	--	--
	2016-Apr	DRY	--	--	--
	2016-Oct	DRY	--	--	--
	2017-Apr	DRY	--	--	--
	2017-Oct	DRY	--	--	--
	2018-Apr	DRY	--	--	--
	2018-Oct	--	6180	26.2 J	841
	2019-Apr	DRY	--	--	--
LP-1	2015-Apr	--	4060	27.8	734
	2015-Oct	--	4300	37.1	820
	2016-Apr	--	1830	26.8	416
	2016-Oct	--	4610	71.5	835
	2017-Apr	--	2690	66.3	587
	2017-Oct	--	4970	91.7	739
	2018-Apr	--	2060	63.2	634
	2018-Oct	--	2630	151	907
	2019-Apr	--	570	35.1	249

Table 4. Analytical Results - Lysimeters and Leachate Pond
Columbia Dry Ash Disposal Facility
SCS Engineers Project #25219067.00

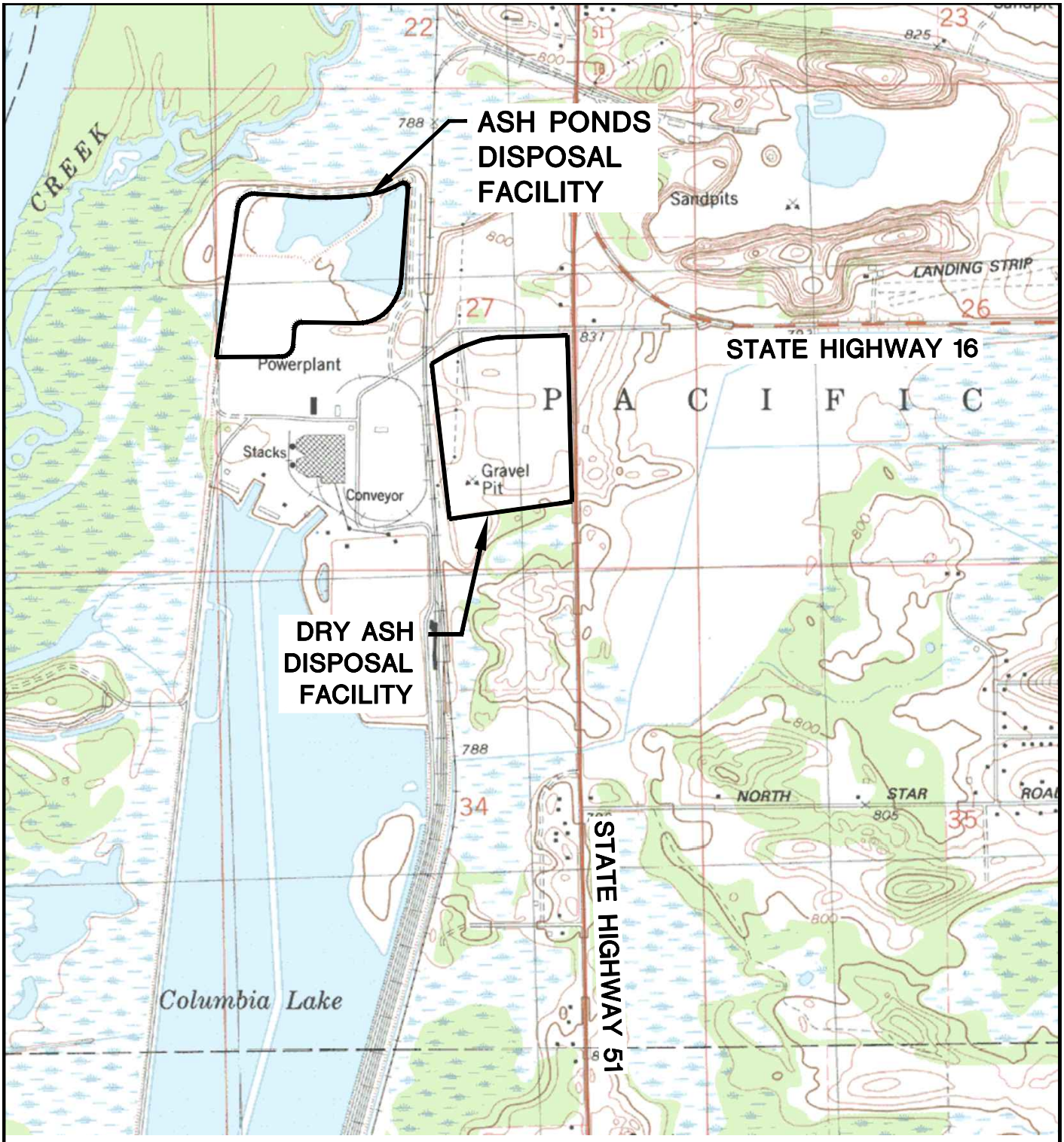
Abbreviations:
µg/L = micrograms per liter
mg/L = milligrams per liter
-- = not analyzed
µmhos/cm = micromhos/centimeter

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

Created by:	TLC	Date:	12/1/2014
Last revision by:	NDK	Date:	8/20/2019
Checked by:	AJR	Date:	8/21/2019

I:\25219067.00\Deliverables\2019 April ASD COL MOD 1-3 LF\Tables\[4_Leachate_2015-2019.xlsx]Lys LP1 App III

Figures



N

POYNETTE QUADRANGLE
WISCONSIN–COLUMBIA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NW/4 POYNETTE 15' QUADRANGLE
1984
SCALE: 1" = 2,000'

CLIENT	ALLIANT ENERGY 4902 NORTH BILTMORE LN. #1000 MADISON, WI 53718	SITE	COLUMBIA ASH PONDS AND DRY ASH DISPOSAL FACILITIES

SITE LOCATION MAP

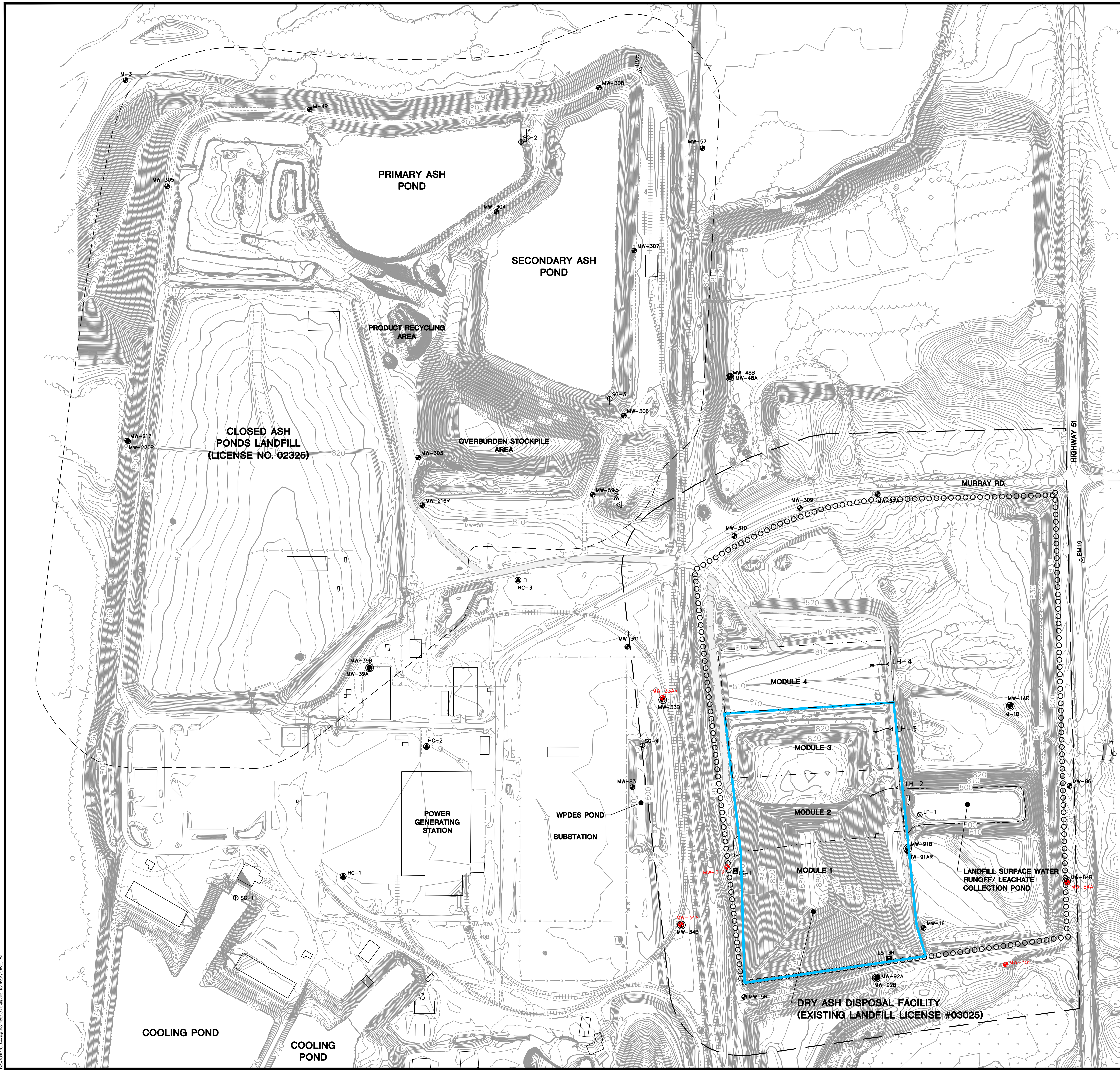
PROJECT NO.	25216067.00	DRAWN BY:	KP
DRAWN:	08/10/09	CHECKED BY:	MDB
REVISED:	04/16/18	APPROVED BY:	SC 04/16/18

ENGINEER

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

FIGURE
1

I:\25216067.00\Drawings\Site Loc.dwg, 4/16/2018 11:31:1 AM



LEGEND

—810—	EXISTING MAJOR CONTOUR (10' INTERVAL)
	EXISTING MINOR CONTOUR (2' CONTOUR)
	EXISTING FENCELINE
	EXISTING TRACKS
	EXISTING PAVED ROAD
	EXISTING UNPAVED ROAD
	EDGE OF WATER
	DESIGN MANAGEMENT ZONE
	APPROVED LIMITS OF WASTE
	CONSTRUCTED LIMITS OF WASTE
	WATER SUPPLY WELL
	STAFF GAUGE
	WATER TABLE WELL
	PIEZOMETER
	SURFACE WATER SAMPLE LOCATION
	LYSIMETER
	ABANDONED WATER TABLE WELL
	ABANDONED PIEZOMETER
	LEACHATE HEADWELL
	MOD 1-3 CCR UNIT
	CCR MONITORING WELL

NOTES:

1. BASE MAP CREATED FROM AERIAL SURVEY BY KBM, FLOWN DECEMBER 1, 2014, AND GROUND SURVEY BY SCS ENGINEERS IN MAY 2016, JUNE 2016, OCTOBER 2016, NOVEMBER 2016, APRIL 2017, NOVEMBER 2017, JULY 2018, AND AUGUST 2018.
2. MONITORING WELL LOCATIONS AND ELEVATIONS SURVEYED BY WISCONSIN POWER AND LIGHT, INC. IN DECEMBER 1994, NOVEMBER 1996, APRIL 2003, AND AUGUST 2012.
3. SUPPLY WELL LOCATIONS ARE APPROXIMATE AND ASSUMED BASED ON JANUARY 2013 DRAWINGS BY TRC.
4. THE LOCATIONS OF THE ASH PONDS FACILITY DESIGN MANAGEMENT ZONE DEMARCATION LINES ARE APPROXIMATE AND BASED ON THE WATER TABLE MAP (OCTOBER 2012) FIGURE BY RMT.
5. THE LOCATION OF THE ACTIVE DRY ASH LANDFILL DESIGN MANAGEMENT ZONE DEMARCATION LINE IS BASED ON A 300 FOOT OFFSET FROM THE DESIGN LIMITS OF ASH EXCEPT WHERE OFFSET WOULD EXTEND LINE BEYOND PROPERTY LINE.

N

200 0 200

SCALE: 1" = 200'

FIGURE 2

SITE PLAN AND WELL LOCATION MAP

SITE: COLUMBIA ASH PONDS AND DRY ASH DISPOSAL FACILITIES

CLIENT: ALLIANT ENERGY, 4902 NORTH BILTMORE LN. #1000, MADISON, WI 53718

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

PROJECT NO.	25216067.00	DRAWN BY:	KP/JMO
DRAWN:	01/06/19	CHECKED BY:	NK
REVISED:	10/10/19	APPROVED BY:	SC 10/10/19

PRIMARY ASH POND

SECONDARY ASH POND

PRODUCT RECYCLING AREA

CLOSED ASH PONDS LANDFILL (LICENSE NO. 02325)

OVERBURDEN STOCKPILE AREA

MURRAY RD.

HIGHWAY 51

MODULE 4

MODULE 3

MODULE 2

MODULE 1

DRY ASH DISPOSAL FACILITY (LICENSE #03025)

LANDFILL SURFACE WATER RUNOFF/ LEACHATE COLLECTION POND

POWER GENERATING STATION

SUBSTATION

WPDES POND

COOLING POND

COOLING POND

M-3 785.68

M-4B 789.44

MW-308 787.53

MW-57 785.27

SG-2 (794.60)

MW-305 790.07

MW-304 785.72

MW-307 786.71

SG-3

MW-306 786.72

[786.45] MW-48B MW-48A 786.56

[786.33] MW-217 MW-220R 785.46

MW-303 787.52

MW-50 787.39

MW-216R 786.53

MW-58

HC-3

MW-311 786.38

[766.31] MW-39B MW-39A 786.28

786.63 MW-33AR MW-33B [786.54]

HC-2

SG-4

MW-85 786.78

HC-1

SG-1 (787.76)

MW-84A

MW-34A MW-34B [786.92]

MW-37A 786.47

MW-309 786.30

MW-310 786.38

LH-4

LH-3

LH-2

787.05 MW-1AR M-1B

MW-86 787.16

LP-1

[767.18] MW-91B MW-91AR 787.45

MW-302 787.56

LS-1

[787.34] MW-84B MW-84A 787.35

MW-16

LS-3R

MW-301 787.04

788.04 MW-92A MW-92B [787.63]

MW-5R 788.64

BM5

BM6

BM19

LEGEND

- 810 — EXISTING MAJOR CONTOUR (10' INTERVAL)
- EXISTING MINOR CONTOUR (2' CONTOUR)
- EXISTING FENCELINE
- EXISTING TRACKS
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EDGE OF WATER
- DESIGN MANAGEMENT ZONE
- APPROVED LANDFILL LIMITS
- CONSTRUCTED LANDFILL LIMITS/MODULE LIMITS
- WATER SUPPLY WELL
- STAFF GAUGE
- WATER TABLE WELL
- PIEZOMETER
- SURFACE WATER SAMPLE LOCATION
- LYSIMETER
- ABANDONED WATER TABLE WELL
- ABANDONED PIEZOMETER
- LEACHATE HEADWELL
- 787.62 — WATER TABLE ELEVATION MEASURED APRIL 2019
- [788.87] — POTIENTIOMETRIC SURFACE ELEVATION MEASURED APRIL 2019 (NOT CONTOURED)
- (794.60) — SURFACE WATER ELEVATION MEASURED APRIL 2019 (NOT CONTOURED)
- WATER TABLE CONTOUR
- APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTES:

1. BASE MAP CREATED FROM AERIAL SURVEY BY KBM, FLOWN DECEMBER 1, 2014, AND GROUND SURVEY BY SCS ENGINEERS IN MAY 2016, JUNE 2016, OCTOBER 2016, NOVEMBER 2016, APRIL 2017, NOVEMBER 2017, JULY 2018, AND AUGUST 2018.
2. MONITORING WELL LOCATIONS AND ELEVATIONS SURVEYED BY WISCONSIN POWER AND LIGHT, INC. IN DECEMBER 1994, NOVEMBER 1996, APRIL 2003, JANUARY 6, 2016 AND BY SCS ENGINEERS IN FEBRUARY 2018.
3. SUPPLY WELL LOCATIONS ARE APPROXIMATE AND ASSUMED BASED ON JANUARY 2013 DRAWINGS BY TRC.
4. THE LOCATIONS OF THE ASH PONDS FACILITY DESIGN MANAGEMENT ZONE DEMARCATION LINES ARE APPROXIMATE AND BASED ON THE WATER TABLE MAP (OCTOBER 2012) FIGURE BY RMT.
5. THE LOCATION OF THE ACTIVE DRY ASH LANDFILL DESIGN MANAGEMENT ZONE DEMARCATION LINE IS BASED ON A 300 FOOT OFFSET FROM THE DESIGN LIMITS OF ASH EXCEPT WHERE OFFSET WOULD EXTEND LINE BEYOND PROPERTY LINE.

N

200 0 200

SCALE: 1" = 200'

FIGURE 3

WATER TABLE MAP APRIL 2019

COLUMBIA ASH PONDS AND DRY ASH DISPOSAL FACILITIES

SHT

CLIENT

ALLIANT ENERGY
4902 NORTH BILTMORE LN. #1000
MADISON, WI 53718

ENGINEER

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

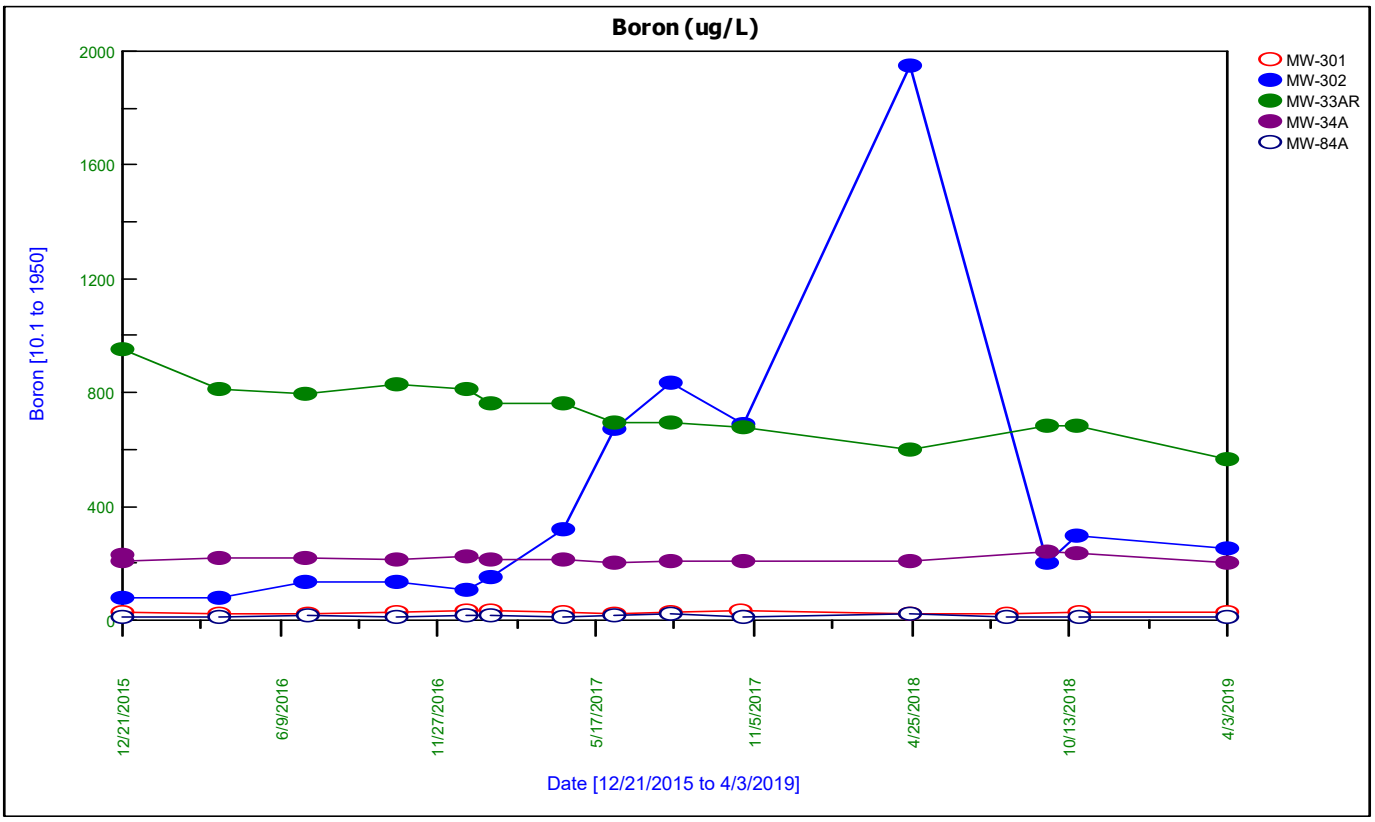
DRAWN BY:	KP/JMO	
CHECKED BY:	NDK	
APPROVED BY:	SC	10/10/19

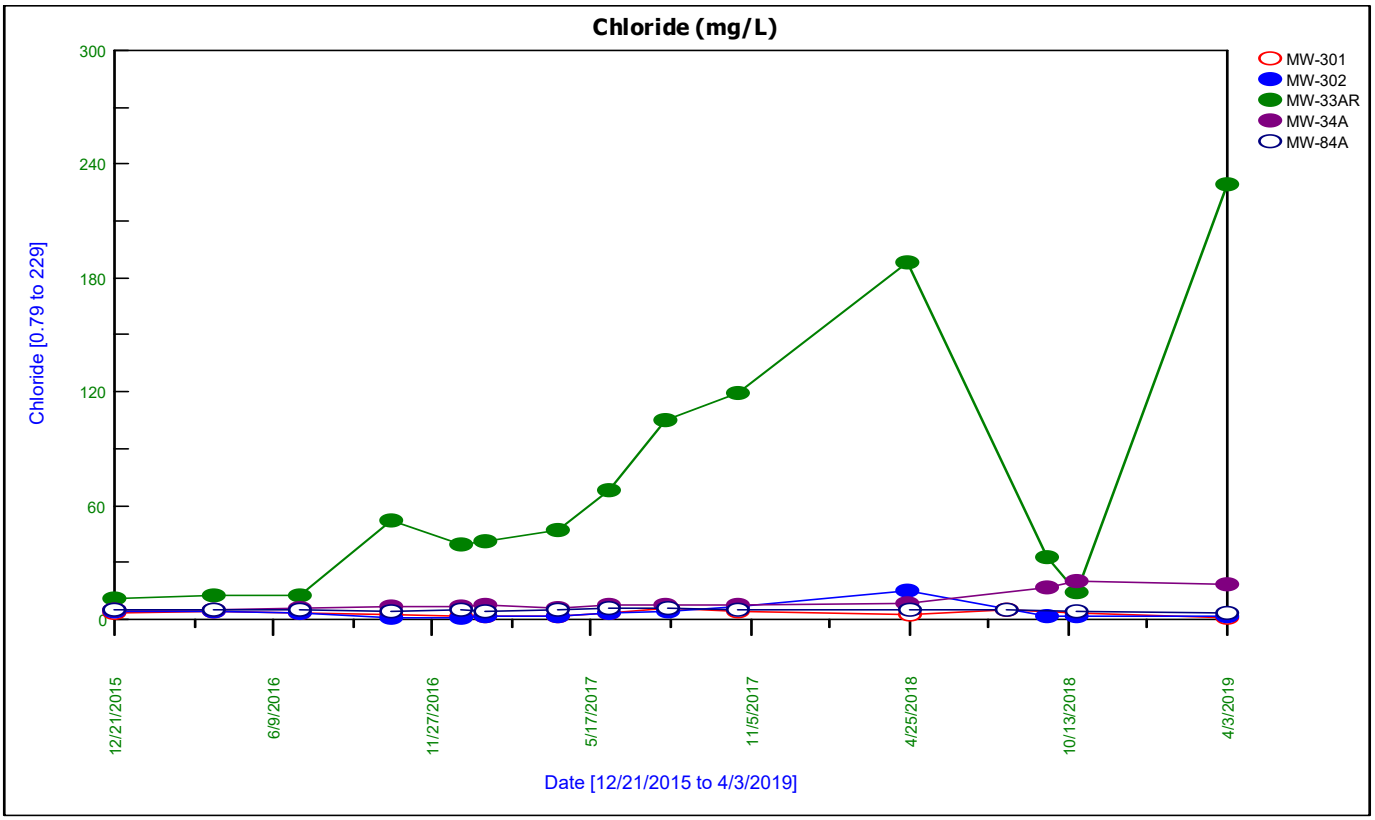
PROJECT NO.	25219067.00
DRAWN:	08/23/19
REVISED:	10/10/19

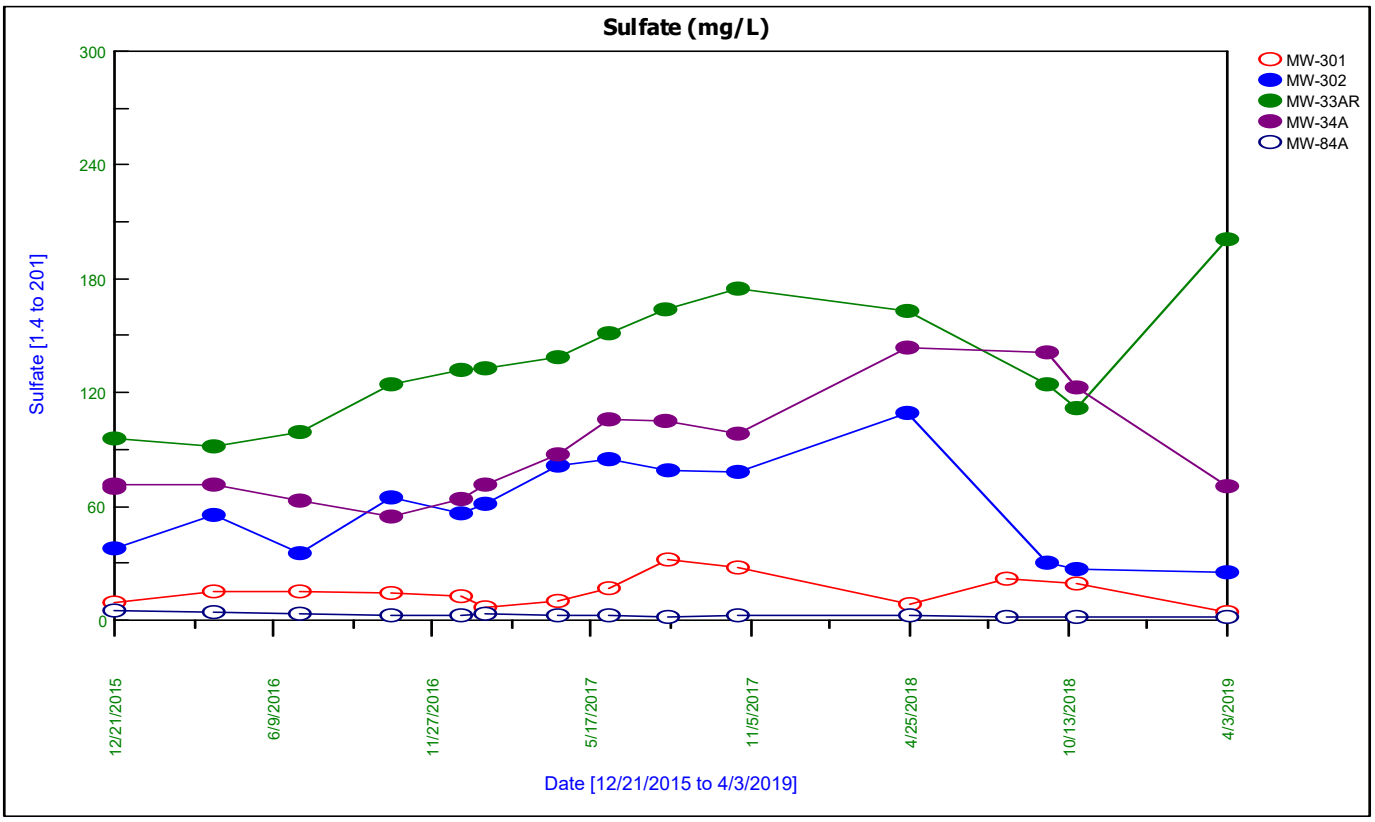
G:\25219067.00\Drawings\F_3_April 2019.dwg, 10/10/2019 9:37:07 AM

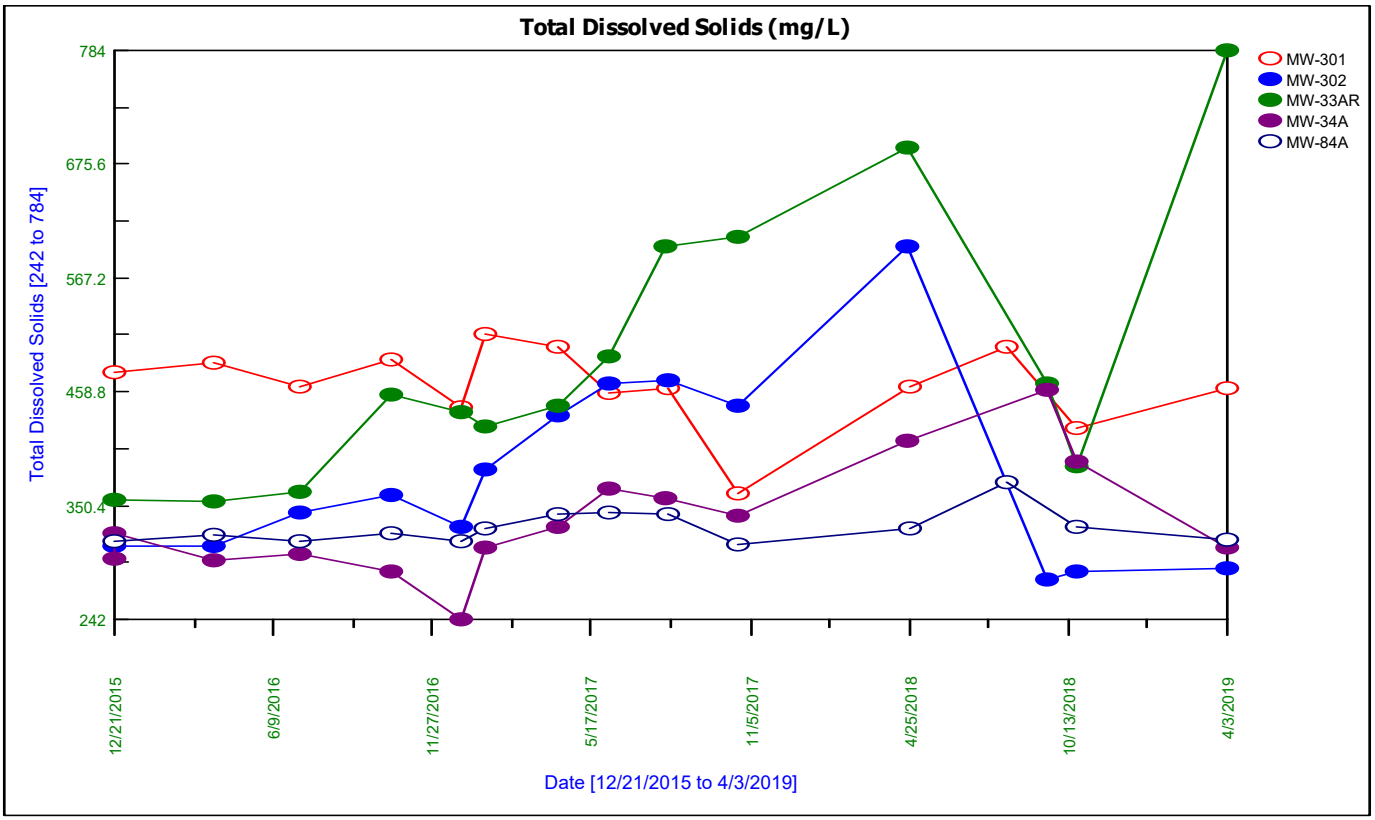
Appendix A

Trend Plots for CCR Wells


Boron (ug/L)
Boron [10.1 to 1950]
2000
1600
1200
800
400
0
MW-301
MW-302
MW-33AR
MW-34A
MW-84A
12/21/2015
6/9/2016
11/27/2016
5/17/2017
11/5/2017
4/25/2018
10/13/2018
4/3/2019
Date [12/21/2015 to 4/3/2019]


Chloride (mg/L)
Chloride [0.79 to 229]
300
240
180
120
60
0
MW-301
MW-302
MW-33AR
MW-34A
MW-84A
12/21/2015
6/9/2016
11/27/2016
5/17/2017
11/5/2017
4/25/2018
10/13/2018
4/3/2019
Date [12/21/2015 to 4/3/2019]

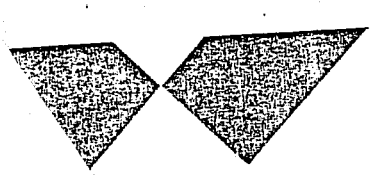

Sulfate (mg/L)
300
240
180
120
60
0
Sulfate [1.4 to 201]
MW-301
MW-302
MW-33AR
MW-34A
MW-84A
12/21/2015
6/9/2016
11/27/2016
5/17/2017
11/5/2017
4/25/2018
10/13/2018
4/3/2019
Date [12/21/2015 to 4/3/2019]


Total Dissolved Solids (mg/L)
784
675.6
567.2
458.8
350.4
242
Total Dissolved Solids [242 to 784]
MW-301
MW-302
MW-33AR
MW-34A
MW-84A
12/21/2015
6/9/2016
11/27/2016
5/17/2017
11/5/2017
4/25/2018
10/13/2018
4/3/2019
Date [12/21/2015 to 4/3/2019]

Appendix B

Feasibility Study Water Quality Information

1370



FEASIBILITY STUDY
PROPOSED FLY ASH AND/OR SCRUBBER SLUDGE
DISPOSAL FACILITY-COLUMBIA SITE
WISCONSIN POWER AND LIGHT COMPANY
TOWN OF PACIFIC, COLUMBIA COUNTY, WISCONSIN

Jan 78

C 7134

conceivable that groundwater flow in the area north of Murray Road may be altered such that contaminants derived from the present ash settling basin might be diverted southerly towards the homes along Murray Road. These questions would have to be addressed in greater detail, consistent with the goals of Wisconsin Power and Light Company.

WATER QUALITY

During the first two weeks of December, 1977, 64 water samples were obtained from surface waters and groundwater monitoring wells at the Columbia Energy Center. The purpose of the sampling was to assess background water quality in the vicinity of the proposed disposal site. The sampling stations included 59 monitoring wells, the cooling lake, ash settling pond, the drainage ditch carrying the ash pond discharge waters and the agricultural drainage ditch along the southern boundary of the site. Due to the large number of sampling stations, the analyses were limited to pH, specific conductance, iron, calcium, magnesium, sulfate and chloride. The analytical data is contained in Appendix F and is discussed below.

pH

Most groundwaters found in the United States have pH values ranging from around 6.0 to 8.5. The pH of a water represents the result of a number of interrelated chemical equilibria. This equilibria can be altered shortly after sampling by gains or losses of carbon dioxide, the oxidation of ferrous iron and numerous other chemical reactions. Thus, pH measurements must be taken shortly after obtaining the sample. For this study, the pH of samples was determined immediately upon return to the laboratory.

Within the proposed site boundaries at the Columbia Energy Center, pH values ranged between 6.3 and 8.1 and averaged 7.5. Typically, the lower pH values were observed in the lowland areas and wetlands, probably as a result of acidic organic soils. The pH of water in the ash disposal settling pond and the cooling lake was 11.4 and 8.3, respectively.

SPECIFIC CONDUCTANCE

Specific conductance, or conductivity, is the ability of a substance to conduct an electric current. The conductance determination is correlative with the dissolved-solids concentration. Conductivity, however, is temperature dependent and thus requires the reference of specific conductance measurements to a standard temperature. The values discussed here are referred to 25°C.

The specific conductance of groundwater in the study area ranged from 220 umhos/cm to a maximum of 2600 umhos/cm. The highest conductivity readings were observed in monitoring wells located along the coal storage area and the drainage ditch carrying the ash pond discharge where values up to 2600 umhos/cm were measured. The conductivity of the ash pond effluent was 1380 umhos/cm. This data appears to confirm earlier speculation of infiltration of effluent from the ash pond discharge channel and from the coal storage area into the groundwater. Conductance within the proposed site boundaries averaged approximately 465 umhos/cm.

Conductivity in the ash disposal settling pond was measured at 1510 umhos/cm. Shallow monitoring wells M-6 and 39A, located adjacent to the pond also exhibited elevated values of 1160 umhos/cm and 1800 umhos/cm, respectively.

High conductivities were also observed along U. S. Highway 51 at monitoring wells 51A and 51B. The chloride data, discussed below, indicates infiltration of road salt has probably occurred at this location.

Specific conductance measurements obtained in the vicinity of the proposed disposal site are shown on Drawing C 7134-15.

IRON

The element iron is an abundant element found in most rocks and soil. It generally occurs as sulfides and oxides in igneous and metamorphic rocks and as iron oxide and hydroxide cementing materials in coarse-grained sedimentary rocks.

Ferrous iron is unstable in the presence of oxygen where it is bound to hydroxide anions as $2Fe(OH)_3$.

$$2Fe^{++} + 4HCO_3^- + H_2O \rightleftharpoons 2Fe(OH)_3 + 4CO_2$$

If subjected to a strong reducing environment, such as a marsh, the reaction is reversed and iron goes back into solution. The amount which dissolves is related to a number of variables including the velocity with which water moves through this environment.

The U. S. Public Health Service recommends an iron concentration of less than 0.3 mg/l in water used for drinking and culinary purposes. Laundry and porcelain tend to be stained when concentrations reach 0.5 to 1.0 mg/l. At this level it can also be tasted.

The presence of iron under the proposed disposal area in the majority of cases was below the detection limit of 0.1 mg/l. In monitoring wells 5 and 18, located in or near the central marsh area, iron increased to 10 mg/l and 5.7 mg/l, respectively. In the southern marsh, monitoring wells exhibited concentrations between 0.5 mg/l and 6.1 mg/l. Although the iron concentration in the cooling lake was below the detection limit, down-gradient wells 44 and 30A located on the cooling lake dike yielded values of 11 mg/l and 26 mg/l iron respectively. Boring logs indicated trace amounts of organic material at the base of the dike which is probably the reason for the high concentrations observed. At the same location, iron in well 30B installed to a depth of 100 feet below the surface was below 0.1 mg/l. Thus, the occurrence of high iron concentrations in this area appears restricted to groundwater in the upper portion of the aquifer where organic material is present and conditions are favorable for the dissolution of iron.

The ash pond discharge in the drainage ditch paralleling the west site boundary showed an iron concentration of 3.7 mg/l. Shallow monitoring wells 33A and 34A adjacent to the ditch indicated less than 0.1 mg/l iron.

North of Murray Road the iron concentration in monitoring wells in the marsh and uplands were typically less than 0.1 mg/l. Although the ash basin had less than 0.1 mg/l iron, several wells along cross-section F-F' showed anomalously high values (#M6-2.3 mg/l; #47-16 mg/l; #51B-21 mg/l).

CALCIUM

Calcium, because of its relative abundance and mobility, is the principle cation in most natural fresh water. Calcium is a constituent of many rock types but is found in greatest quantities in waters leaching deposits of limestone and dolomite. In sandstone and other detrital rock, calcium carbonate is a common cement between grains.

Monitoring wells located within the site boundaries exhibited calcium concentrations between 30 mg/l and 66 mg/l and averaged about 42 mg/l. Similar to iron, the concentrations of calcium in monitoring wells along cross-section F-F' were anomalously high, up to 150 mg/l calcium. Water table wells along the drainage ditch carrying the ash pond discharge averaged 83 mg/l while the ash pond effluent contained 28 mg/l. Generally the amount of calcium in groundwater decreased with depth. Nested monitoring wells typically showed somewhat lower concentrations of calcium in the deeper wells.

MAGNESIUM

As a relatively abundant element on the earth's crust, the principle sources of magnesium in natural waters are considered to be ferromagnesian minerals in igneous rocks and magnesium carbonate in carbonate rocks (limestone and dolomite). Waters in which magnesium is the predominant cation are somewhat unusual. Like calcium, magnesium imparts the property of hardness to water and is, therefore, of concern to industrial users.

Generally, concentrations of magnesium were 1/3 to 1/2 of the calcium levels. Magnesium concentrations within the site boundaries ranged between 10 mg/l and 36 mg/l and averaged 27 mg/l. Similar to calcium and iron, higher magnesium values were observed, in general, north of Murray Road and especially in monitoring wells along cross-section F-F'.

SULFATE

Sulphur is widely distributed in reduced form in both igneous and sedimentary rocks as metallic sulfides and when present in sufficient concentrations, constitutes ore of economic importance. During weathering processes with aerated water, the sulfides are oxidized to sulfate ions and are dissolved into water. Pyrite (FeS_2) crystals often occur in sedimentary rocks and are particularly associated with biogenic deposits such as coal which were deposited under strongly reducing conditions.

The concentrations of sulfate in groundwater in the vicinity of the proposed disposal site ranged from less than 1 mg./l to 1,200 mg./l of sulfate. (Refer to Drawing C 7134-15.) Typically, within the site boundaries concentrations averaged approximately 12 mg./l. Near the coal storage area, however, significant increases were observed. Observation wells 26A, 26B, and 42 exhibited concentrations between 900 and 1100 mg./l. The depth of sulfate enrichment in groundwater, near the coal pile, appears to extend to considerable depths, indicated by relatively high sulfate concentrations in Well 26B sealed 100 feet below ground surface. The oxidation of pyrite minerals in the coal leaching into the groundwater is probably the major source of the high concentrations observed.

Sulfate concentrations in the ash disposal settling pond were 520 mg./l. In the ditch carrying the ash pond discharge, the effluent is treated with sulfuric acid which results in precipitation of barium sulfate and aluminum hydroxide (personal communication, Merlin Horn, 1978). Consequently, the sulfate concentration of the effluent waters is lowered considerably to 13 mg./l. Well 33A, however, located near the point of effluent discharge, exhibited 1200 mg./l sulfates.

CHLORIDE

Chloride is generally present in much lower concentrations in rocks than many of the other major constituents of natural water. Important sources, however, are associated with sedimentary rocks, particularly the evaporites. The chemical behavior of chloride in natural water is relatively inert compared to the other major ions. There are few oxidation-reduction reactions and no significant chemical complexing reactions which chloride enters into. In addition, chloride ions are not significantly adsorbed on mineral surfaces. For these reasons, chloride is commonly used as a tracer in groundwater.

Chloride concentrations in groundwater in the vicinity of the Columbia Energy Center typically range between 0.5 mg./l and 30 mg./l. The highest concentrations in monitoring wells tended to be located adjacent to U. S. Highway 51 where the use of road salt has resulted in the percolation of chloride into the groundwater. Monitoring Wells 51A and 51B located in a low area north of Murray Road along U. S. Highway 51, yielded chloride concentrations in excess of 200 mg./l. Two other wells, 52A and 19, also located along U. S. Highway 51, yielded values of 30 mg./l and 42.5 mg./l chloride, respectively.

Within the proposed site boundaries, the chloride concentration averaged 7.1 mg./l. Excluding the few wells adjacent to U. S. Highway 51 exhibiting elevated concentrations, no other significant trends in the occurrence of chloride were observed.

SUMMARY

In summary, the groundwater in the vicinity of the proposed disposal site exhibited a somewhat alkaline pH. In lowland areas, the pH was typically below 7.0, probably a result of the presence of acidic organic soils.

Specific conductance within the proposed site averaged 465 umhos/cm. Conductivities up to 2600 umhos/cm were observed, however, in the vicinity of the coal storage area, the present ash disposal pond and ash pond effluent channel where infilatration of water from these sources is occurring into the groundwater system.

The groundwater typically exhibted relatively low iron concentrations although, locally, concentrations in excess of drinking water standards were observed in about 20% of the wells. The occurrence of the higher iron concentrations appears to be related to the presence of organic soils.

Groundwater at the proposed site also tended to exhibit high calculated hardness (216 mg./l) based on average observed values for calcium (42 mg./l) and magnesium (27 mg./l). Dissolution of limestone and dolomite rocks in the glacial drift are the probable sources of these elements in the groundwater.

Enrichment of sulfate in groundwater has occurred as a result of leaching of pyrite (FeS_2) minerals from the coal storage area where concentrations up to 1200 mg./l were observed. The depth of this enrichment appears to extend beyond the maximum depth into the aquifer investigated. Sulfate concentrations decreased rapidly away from the coal storage area to an average of 12 mg./l within the proposed site boundaries. Other local sources of sulfate in groundwater appear to be related to the present ash settling pond.

The concentration of chloride within the proposed site averaged 7.1 mg./l. Higher levels were generally observed in wells adjacent to U. S. Highway 51 where the infiltration of road salt has locally raised chloride concentrations.

The above interpretations are based on one round of water quality sampling only and should be considered as preliminary in nature. High sulfate and chloride concentrations observed at greater depths may be a temporary condition resulting from contamination of spoil backfill materials with coal dust or salt, respectively, during installation of the monitoring well. Future sampling of these monitoring wells will help to distinguish short term contamination from actual conditions existing in the aquifer.

APPENDIX F
WATER QUALITY DATA

WELL NO.	pH	SPECIFIC CONDUCTANCE (umhos/cm @ 25°C)	SULFATE (mg/l)	CHLORIDE (mg/l)	CALCIUM (mg/l)	MAGNESIUM (mg/l)	IRON (mg/l)
1A	7.6	550	17.	6.5	52	37	<0.1
1B	8.05	460	16.	10.5	39	31	<0.1
2	7.8	527	14.	2.5	45	32	<0.1
3A	7.5	548	13.	2.5	58	36	<0.1
3B	8.1	506	14.	7.0	50	34	<0.1
4	7.8	580	10.	4.0	59	34	<0.1
5	6.3	560	210.	12.5	13	29	10
16	7.6	408	12.	1.5	42	28	<0.1
17	6.45	350	30.	16.5	16	13	0.6
18	6.45	380	4.	4.5	33	22	5.7
19	7.9	570	10.	42.5	44	24	<0.1
20	8.0	340	10.	5.0	36	24	<0.1
21	6.9	220	20.	4.5	23	10	0.1
24A	7.45	775	18.	6.0	76	52	0.1
24B	7.85	440	15.	6.0	43	31	0.1
25	8.1	300	10.	2.5	29	20	<0.1
26A	7.2	2100	900	17.0	140	48	1.5
26B	7.5	2600	1100	16.5	43	7.0	0.2
27	7.15	400	6.	8.0	23	18	<0.1
28A	7.75	500	3.	0.5	48	31	<0.1
28B	7.6	480	4.	3.5	39	28	<0.1
29A	7.8	330	16.	1.5	33	21	0.5
30A	6.75	920	64.	11.0	38	30	26
30B	7.6	770	210	21.0	37	19	<0.1
33A	8.2	2500	1200	24.0	83	50	<0.1
33B	7.9	390	22.	6.5	31	27	0.2
34A	7.7	680	140.	10.0	58	45	0.1
34B	7.7	1700	660	15.0	48	22	<0.1
35	6.8	740	<1.0	4.0	66	33	2.9
36	6.8	740	<1.0	3.5	53	35	6.1
37A	7.7	460	9.	4.0	48	31	0.8
37B	7.5	630	73.	7.5	71	35	<0.1
39A	7.5	1800	350	22.0	180	100	0.1
39B	7.9	330	560	20.5	31	22	0.1
40A	8.0	630	140	8.5	43	29	<0.1
40B	8.1	330	17.	3.0	31	22	<0.1
41	6.8	590	16.	11.0	58	27	9.3

WELL NO.	pH	SPECIFIC CONDUCTANCE (umhos/cm @ 25°C)	SULFATE (mg/l)	CHLORIDE (mg/l)	CALCIUM (mg/l)	MAGNESIUM (mg/l)	IRON (mg/l)
42	7.4	2400	900	17.5	50	12	0.5
44	6.9	490	<1.	16.5	39	23	11
45	7.6	390	14.	3.0	40	25	<0.1
46A	7.3	1100	21.	15.5	140	82	<0.1
46B	7.8	470	25.	17.5	40	26	<0.1
47	6.6	1200	3.	8.0	140	40	16
48A	7.3	620	15.	8.0	62	37	<0.1
48B	7.1	520	22.	20.0	43	29	0.2
49	7.15	730	6.	3.5	75	41	<0.1
50A	7.6	520	28.	15.5	51	34	<0.1
50B	7.5	410	21.	18.0	31	21	<0.1
51A	6.1	1850	8.	205.	65	40	<0.1
51B	7.2	1250	23.	275.	57	36	21
52A	7.7	450	16.	30.5	36	17	<0.1
52B	7.4	430	40.	17.5	32	20	<0.1
53	7.75	450	27.	10.5	39	28	<0.1
54A	7.8	350	12.	4.0	34	21	0.1
54B	7.55	390	15.	5.5	40	24	0.1
55B	7.9	340	23.	17.5	32	22	0.1
56	7.8	450	22.	9.5	43	28	0.1
57	7.85	380	17.	7.0	38	24	0.1
M-6	7.0	1160	5.	7.0	150	91	2.3
Cooling Lake	8.3	370	31.	18.0	34	21	<0.1
Ash Pond Effluent	7.45	1380	13.	4.0	28	1.2	3.7
Ash Pond Drainage Ditch (A)	11.4	1510	520.	23.5	29	0.2	<0.1
Drainage Ditch (B)	7.8	500	21.	7.0	43	29	<0.1
	9.05	1780	750	14.0	42	5.4	<0.1

APPENDICES TO

SUPPLEMENTARY FEASIBILITY STUDY REPORT
AND PRELIMINARY ENGINEERING CONCEPTS
COLUMBIA SITE
WISCONSIN POWER AND LIGHT COMPANY
TOWN OF PACIFIC, COLUMBIA COUNTY, WISCONSIN

WARZYN
ENGINEERING INC

APPENDIX I

WATER QUALITY DATA - DECEMBER 1978

WARZYN
ENGINEERING INC

1/2/76

C 7134

WATER QUALITY DATA

WELL NO.	pH	SPECIFIC CONDUCTANCE (umhos/cm @ 25°C)	SULFATE (mg/l)	CHLORIDE (mg/l)	CALCIUM (mg/l)	MAGNESIUM (mg/l)	IRON (mg/l)	BORON (mg/l)
1A	7.3	530	30	3.1	54	35	<0.1	-
1B	7.0	470	67	6.1	49	30	<0.1	-
2	7.25	458	91	<.5	48	24	<0.1	-
3A	7.0	560	36	<.5	61	31	<0.1	-
3B	7.15	530	52	35.7	37	33	<0.1	-
4	7.2	750	69	5.8	49	30	<0.1	-
5	6.35	1,650	670	14.1	14	13	1.7	-
16	6.9	390	69	1.0	49	23	<0.1	-
17	5.55	295	57	16.3	14	8.6	0.2	-
18	5.9	430	10	4.2	47	21	1.1	-
19	7.4	765	75	4.2	51	28	<0.1	-
20	7.4	380	26	1.6	39	26	<0.1	-
21	5.7	250	54	10.4	15	8.3	0.2	-
24A	7.2	730	36	1.6	65	42	<0.1	-
24B	7.2	470	10	7.3	42	28	<0.1	-
25	7.0	335	29	7.8	39	21	0.2	-
26A	7.4	2,250	650	12.6	32	8.6	<0.1	-
26B	6.8	2,530	840	20.8	49	18	<0.1	-
27	6.9	410	24	4.2	40	24	0.4	-
28A	7.2	500	61	0.5	45	28	<0.1	-
28B	7.0	465	6	2.1	39	26	0.1	-
29A	7.1	410	24	3.6	31	22	0.1	-
30A	5.8	1,140	15	<0.5	97	56	38	-
30B	6.65	835	160	14.6	37	20	<0.1	-
33A	7.8	1,970	830	16.7	21	8.9	<0.1	-
33B	7.5	380	31	7.3	24	27	<0.1	-
34A	7.25	560	46	4.2	53	33	<0.1	-
34B	8.5	1,575	730	21.9	28	29	0.1	-
35	6.7	545	61	3.6	60	26	1.0	-
36	6.4	515	5.0	2.6	43	24	4.8	-
37A	7.05	438	30	3.7	50	28	<0.1	-
37B	6.7	325	18	7.3	1.0	0.5	<0.1	-
39A	6.35	1,260	33	13.6	70	7.6	0.1	-
39B	6.7	385	25	4.2	30	21	<0.1	<.05
40A	7.35	483	40	<0.5	48	24	<0.1	-
40B	7.25	343	4	4.2	21	14	<0.1	-
41	6.1	640	54	19.8	43	32	<0.1	-

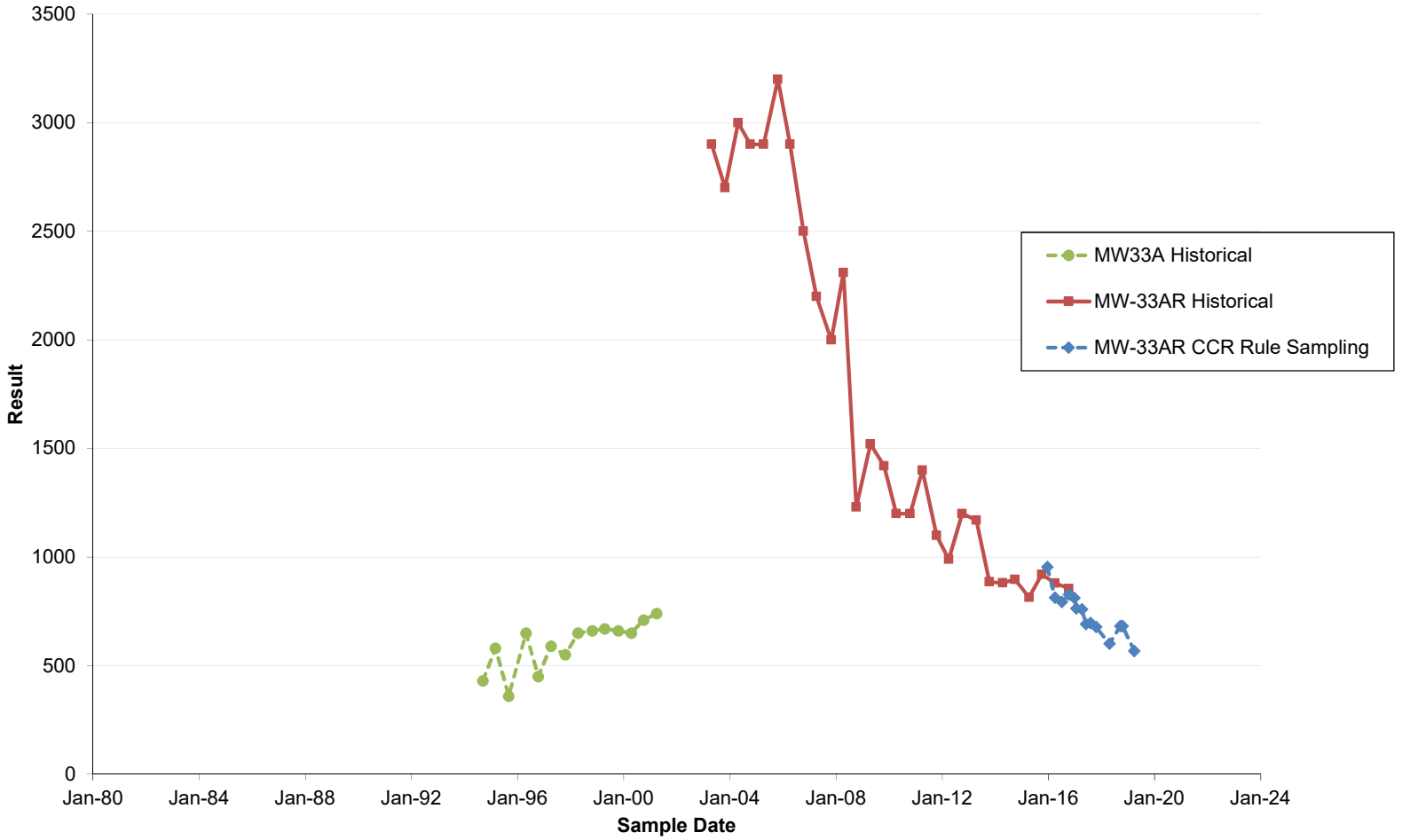
WELL NO.	pH	SPECIFIC CONDUCTANCE (umhos/cm @ 25°C)	SULFATE (mg/l)	CHLORIDE (mg/l)	CALCIUM (mg/l)	MAGNESIUM (mg/l)	IRON (mg/l)	BORON (mg/l)
42	7.15	2,050	910	15.6	23	7.5	0.1	-
44	6.15	710	6	0.5	56	27	3.5	-
45	7.2	420	32	1.0	44	26	<0.1	-
46A	7.0	560	93	<0.5	130	75	<0.1	<0.05
46B	6.5	1,290	170	20.8	46	30	<0.1	<0.05
47	7.3	958	120	<0.5	110	48	<0.1	-
48A	6.15	640	59	<0.5	42	51	<0.1	<0.05
48B	6.8	450	23	5.2	40	27	<0.1	<0.05
49	7.0	880	26	2.1	93	58	0.1	-
50A	7.4	660	25	17.7	60	36	<0.1	-
50B	7.1	405	16	17.7	38	23	<0.1	-
51A	7.0	1,170	57	135	66	31	<0.1	-
51B	7.3	1,410	22	330	46	39	<0.1	-
52A	7.0	370	110	18.5	35	10	<0.1	-
52B	7.0	595	43	52.5			0.1	-
53	Frozen							
54A	7.5	345	10	1.0	36	22	<0.1	<0.05
54B	Frozen							
55B	7.3	505	26	15.6	52	29	<0.1	<0.05
56	Frozen							
57	Frozen							
M-6								
58	6.55	1,265	140	<0.5	110	65	0.1	-
59	6.8	925	40	<0.5	86	60	<0.1	-
60	7.2	1,510	54	4.7	130	85	<0.1	-
61A	6.85	590	39	30.2	58	31	<0.1	-
61B	7.2	505	6	13.5	48	29	<0.1	-
62	6.7	1,517	72	178	120	53	<0.1	-
64	6.9	670	100	26.8	63	36	0.8	-
65	7.2	830	57	17.8	78	50	<0.1	-
66	6.5	680	55	40	66	24	3.6	-

WELL NO.	pH	SPECIFIC CONDUCTANCE (umhos/cm @ 25°C)	SULFATE (mg/l)	CHLORIDE (mg/l)	CALCIUM (mg/l)	MAGNESIUM (mg/l)	IRON (mg/l)	BORON (mg/l)
67	7.0	560	100	1.0	57	32	1.0	-
68A	7.6	440	32	2.1	40	27	<0.1	-
68B	7.2	400	36	1.0	42	25	<0.1	-
70A	7.5	440	20	<0.5	27	37	<0.1	-
70B	7.3	520	25	5.2	51	34	<0.1	-
72A	6.45	860	11	<0.5	100	41	1.8	-
72B	8.4	230	45	<0.5	17	19	<0.1	-
M-4	7.6	864	180	26.1	20	11	<0.1	0.39
MM-4			2	2.6	14	21	0.9	-
Cooling Lake at 1	7.7	355	36	13.6	31	21.2	<0.1	-
Ash Pond at 2	11.4	3,210	1,100	22.9	34	<0.1	<0.1	-
Ash Pond at 3	8.7	725	34	21.9	48	16	<0.1	-
Ash Pond Effluent at 4	6.7	3,090	1,400	25.0	39	0.4	<0.1	-
Drainage Ditch at 5	7.2	730	74	33.9	56	38	<0.1	-
Drainage Ditch at 6	7.35	2,750	640	18.8	34	7.5	<0.1	-
Drainage Ditch at 7	8.05	1,780	740	27.1	31	0.2	<0.1	-

Appendix C

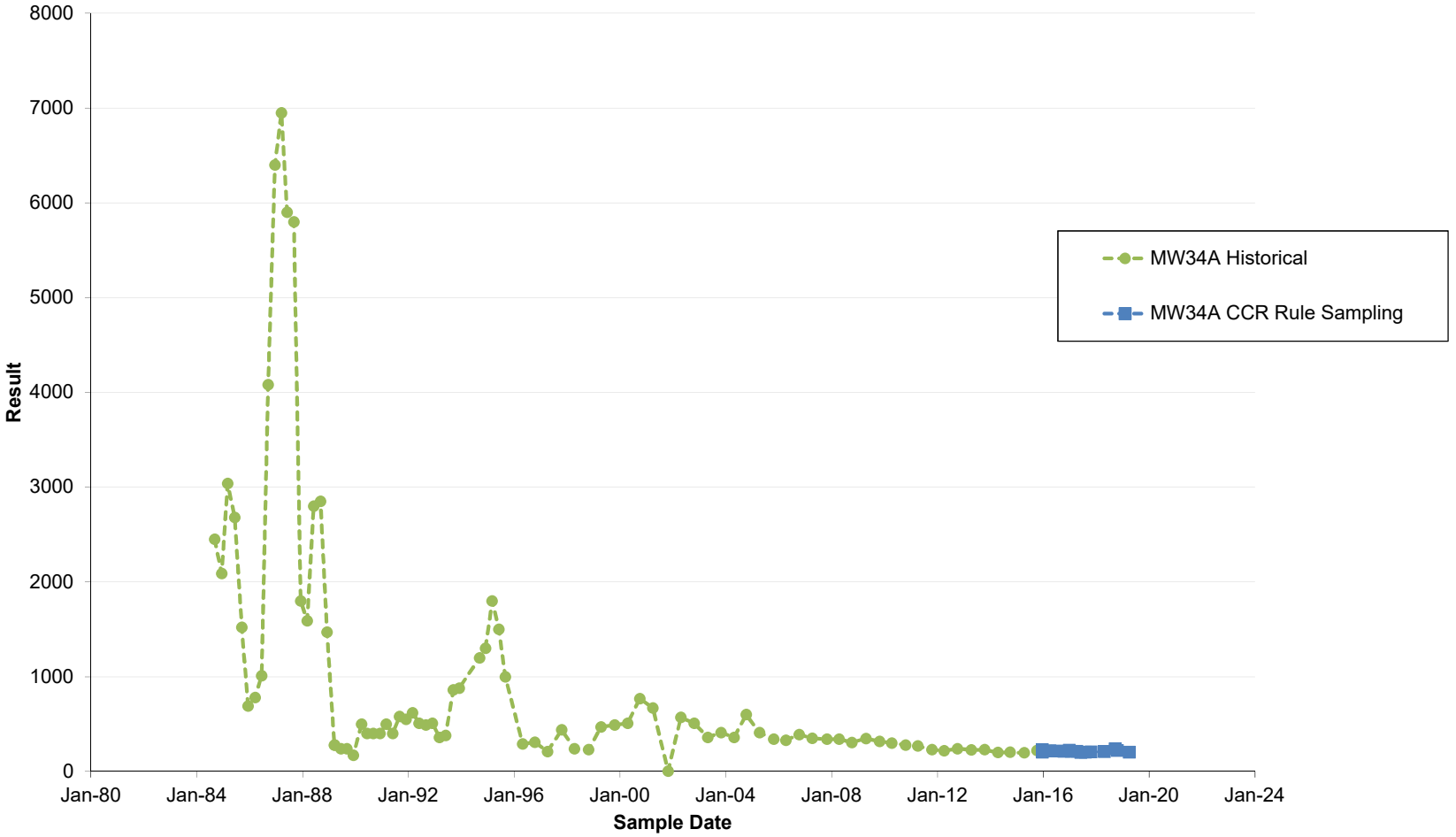
Long-Term Concentration Trend Plots

Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-33A and MW-33AR - Boron (µg/l as B)



I:\25219067.00\Deliverables\2019 April ASD COL MOD 1-3 LF\Graphs\[Bo_COL Dry.xlsx]MW-33AR

Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW34A - Boron (µg/l as B)



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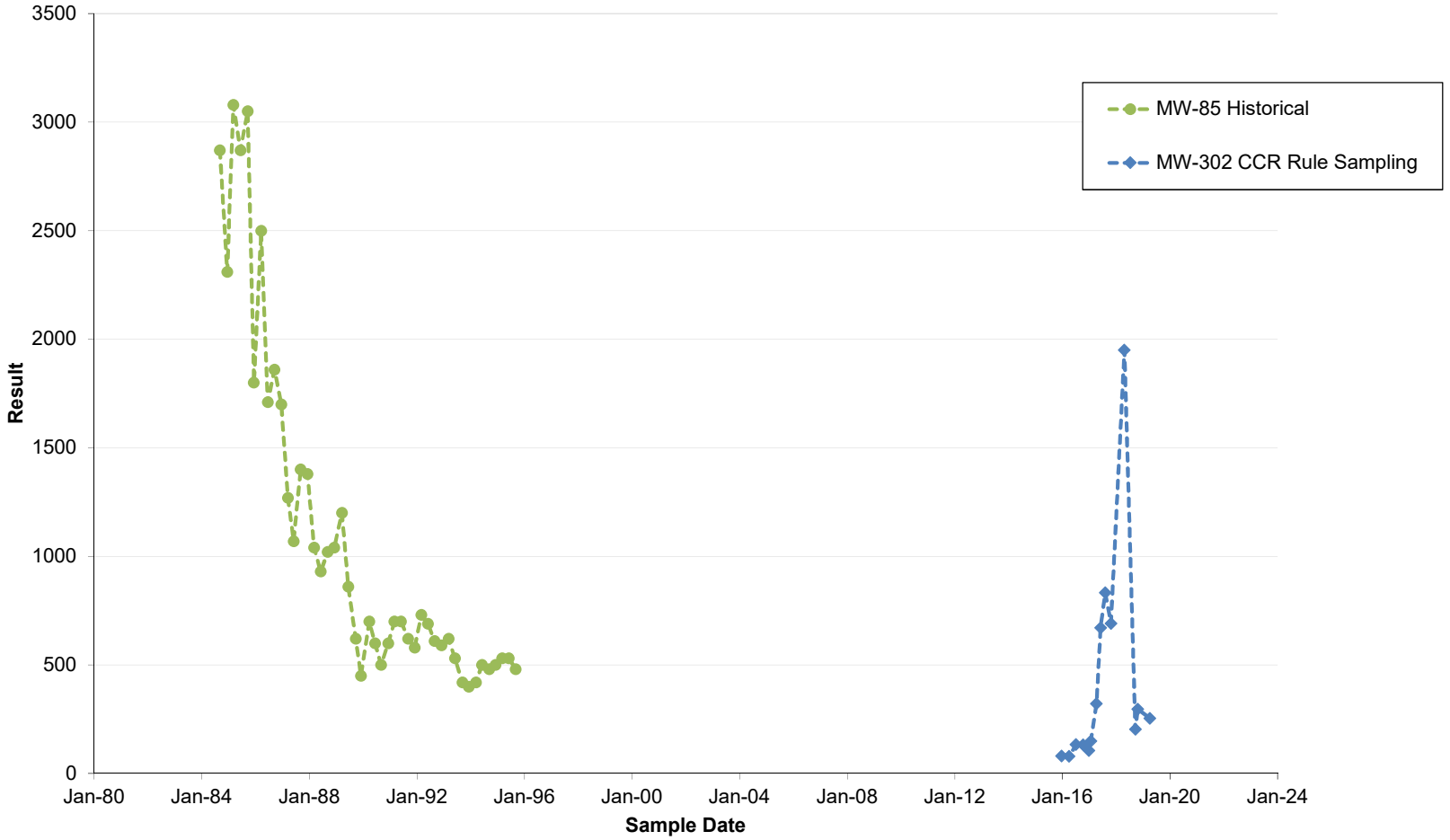
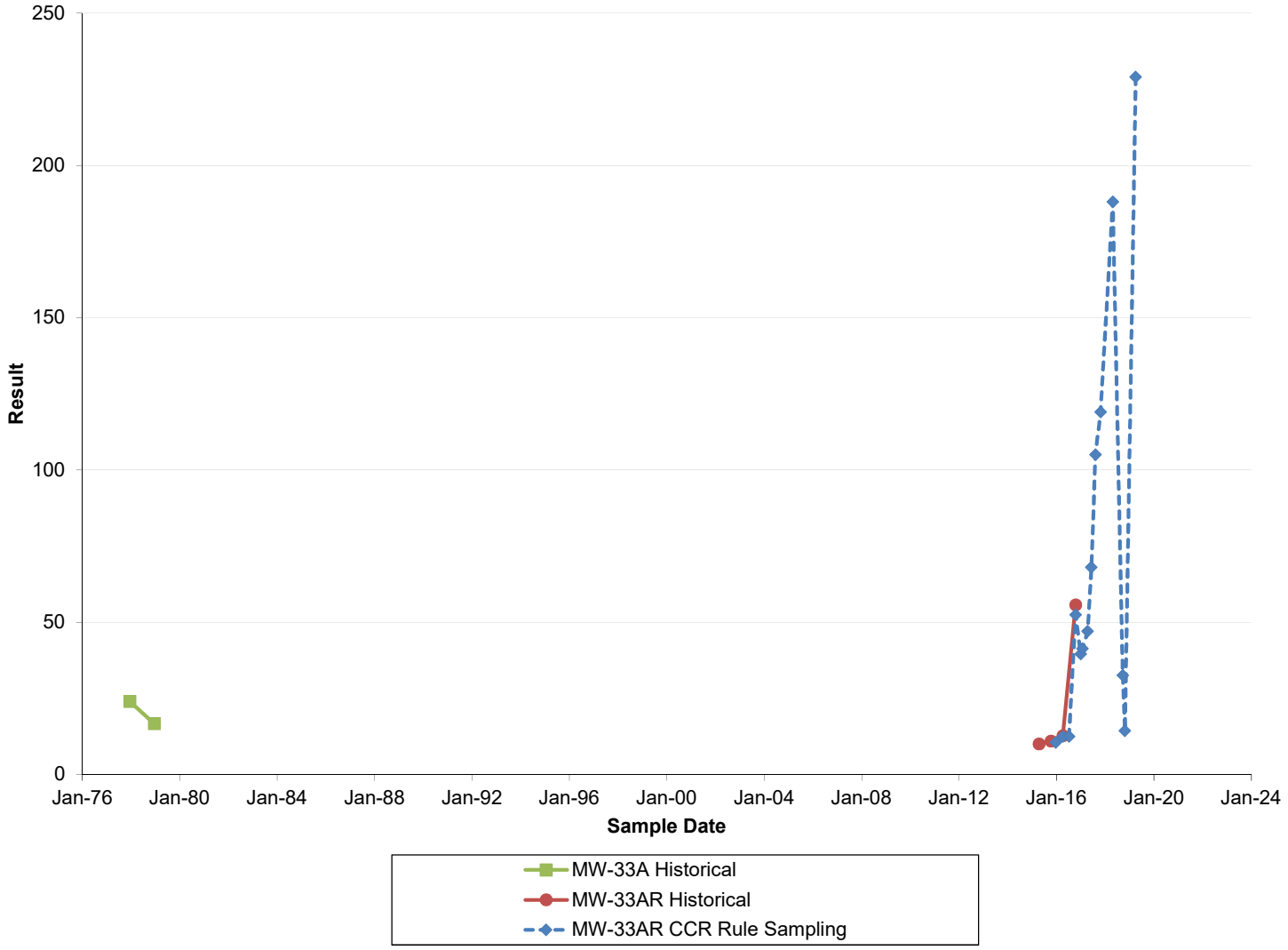
Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-302 and MW-85 - Boron (µg/l as B)



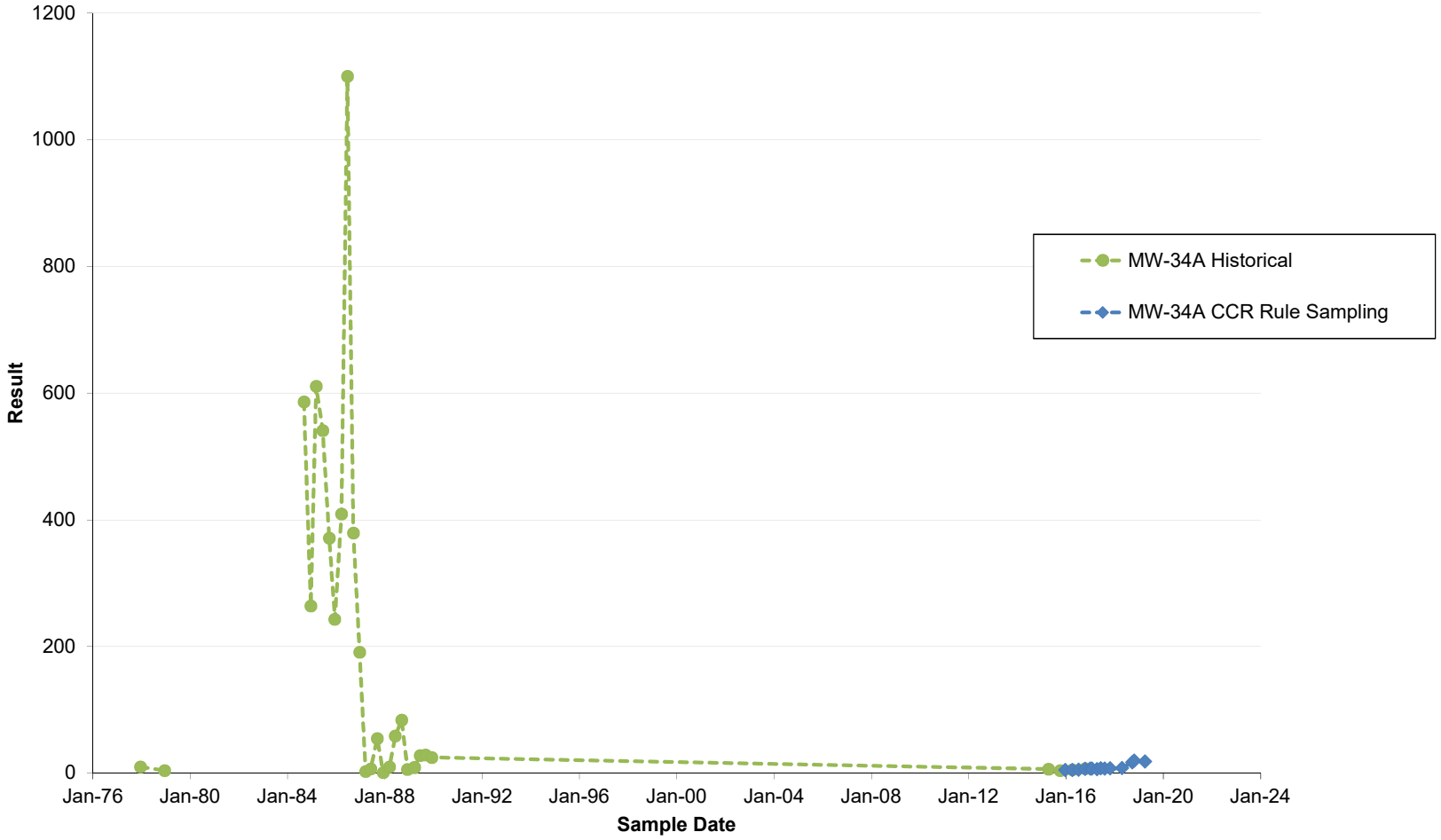
I:\25219067.00\Deliverables\2019 April ASD COL MOD 1-3 LF\Graphs\[Bo_COL Dry.xlsx]MW-85

Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-33 and MW-33AR - Chloride (mg/l as Cl)



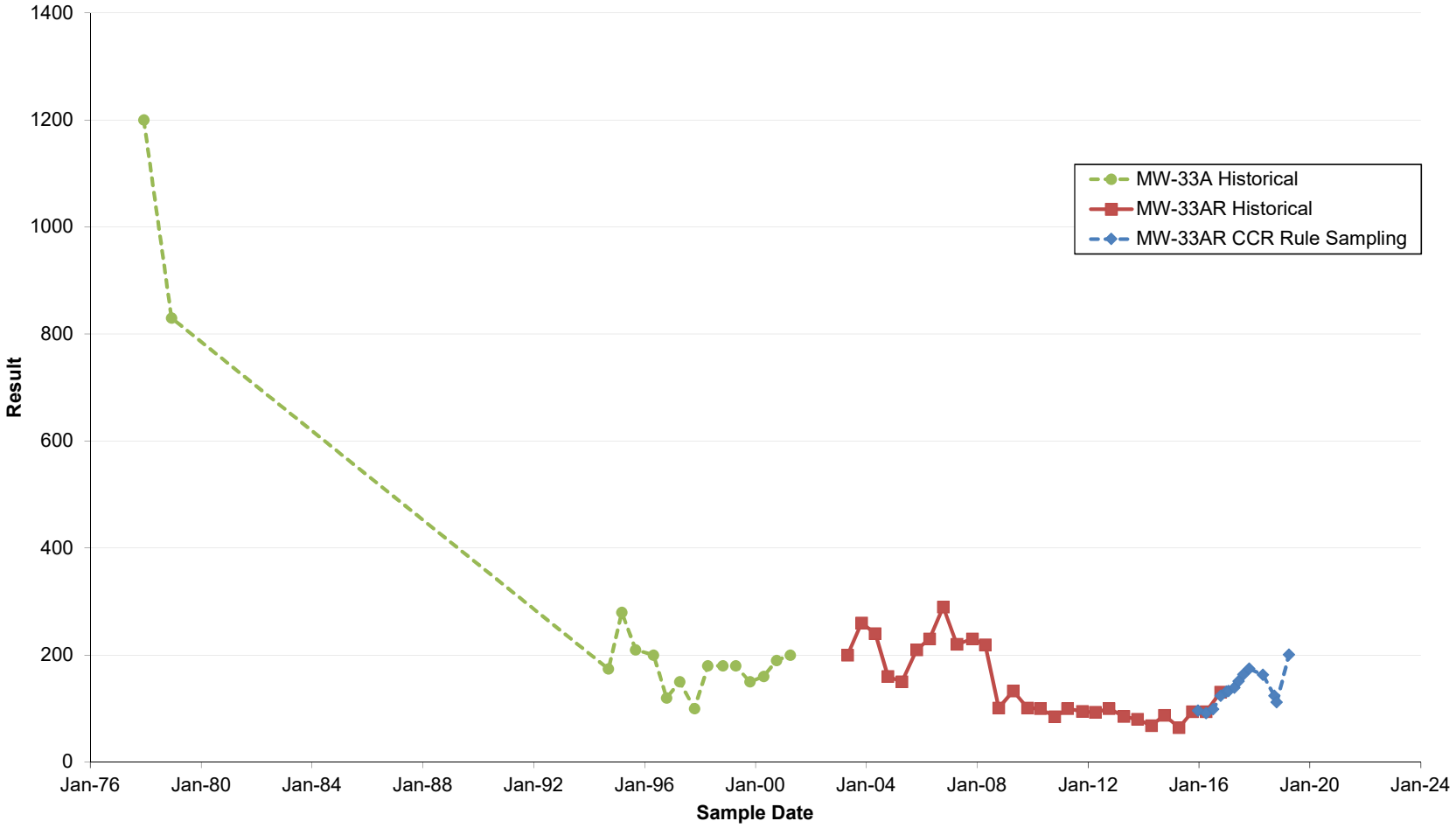
I:\25219067.00\Deliverables\2019 April ASD COL MOD 1-3 LF\Graphs\[Cl_COL Dry.xlsx]MW-33AR

Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW34A - Chloride (mg/l as Cl)

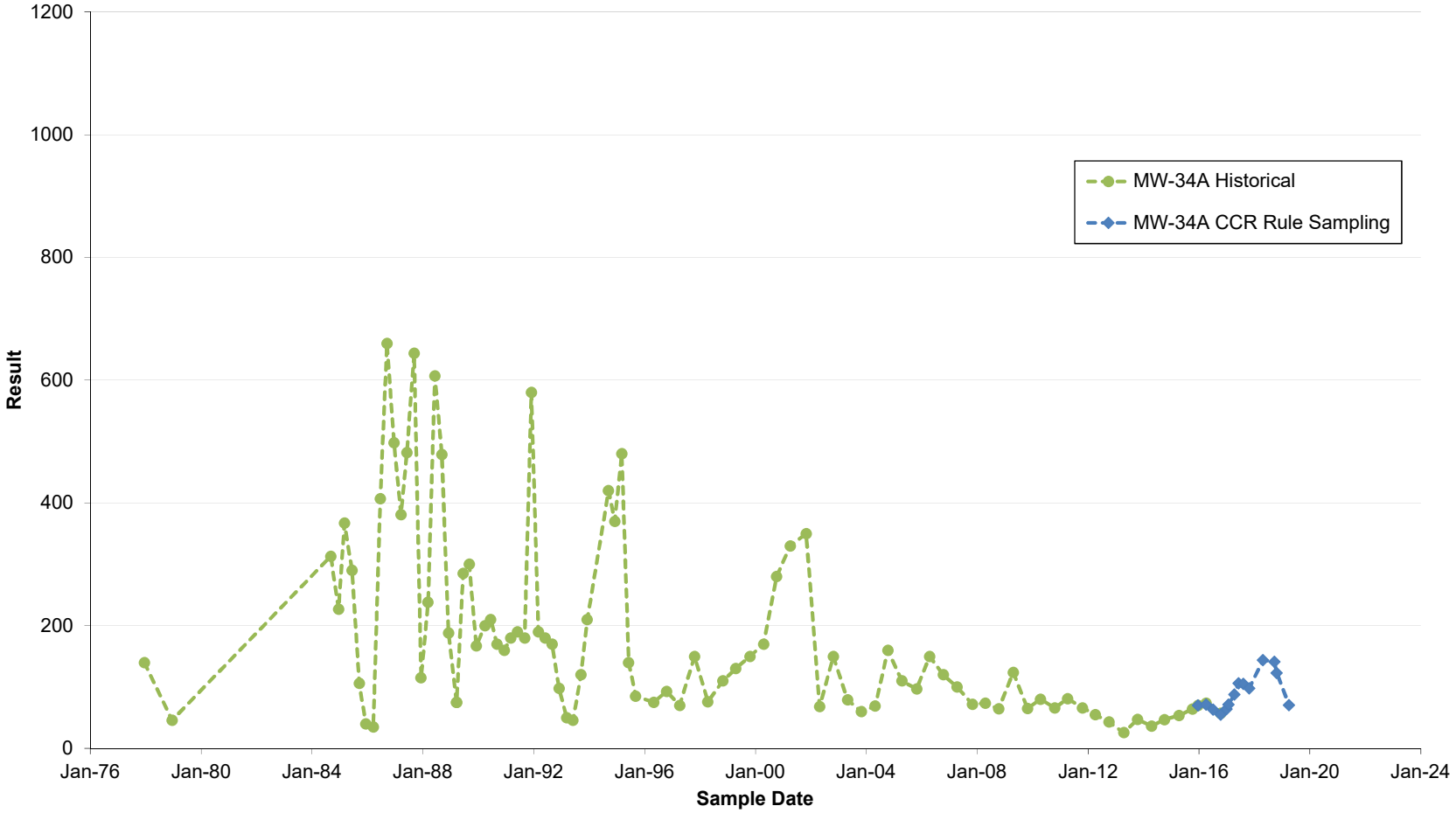


I:\25219067.00\Deliverables\2019 April ASD COL MOD 1-3 LF\Graphs\[Cl_COL Dry.xlsx]MW-34A

Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-33 and MW-33AR - Sulfate (mg/l as SO4)

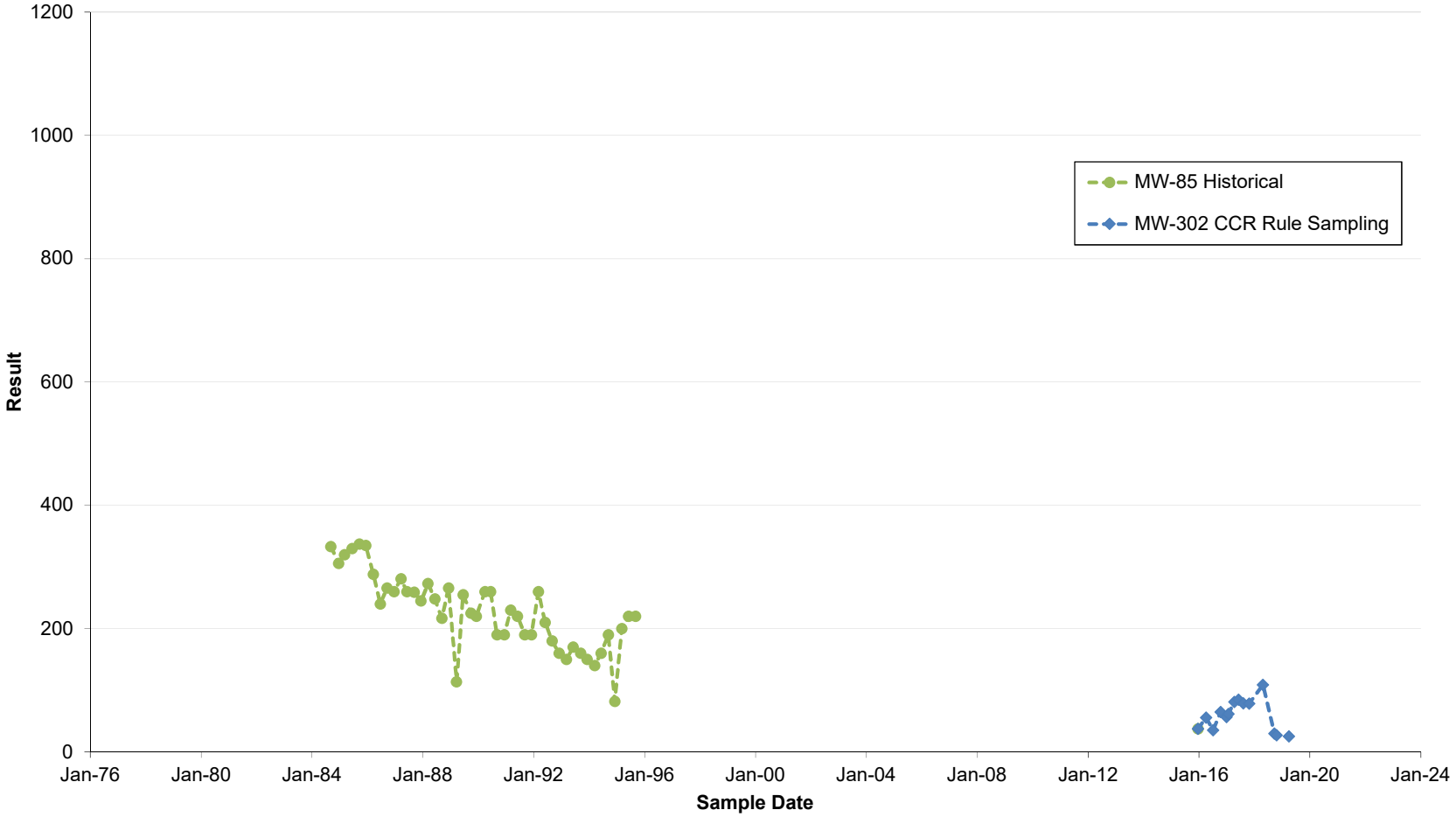


Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-34A - Sulfate (mg/l as SO4)



I:\25219067.00\Deliverables\2019 April ASD COL MOD 1-3 LF\Graphs\[SO4_COL Dry.xlsx]MW-34A CCR

Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-85 and MW-302 - Sulfate (mg/l as SO4)



I:\25219067.00\Deliverables\2019 April ASD COL MOD 1-3 LF\Graphs\[SO4_COL Dry.xlsx]MW-85 MW302 CCR

Appendix D

Historical Groundwater Flow Maps

LEGEND

- PROPOSED PROJECT AREA
- OBSERVATION WELL LOCATION, NUMBER, AND WATER TABLE ELEVATION
- BORING LOCATION AND NUMBER
- WETLANDS
- TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL: 20 FT.)
- PRIVATE RESIDENCES (ASSUMED LOCATIONS OF PRIVATE WATER SUPPLY WELLS)
- COMMERCIAL BUILDINGS (ASSUMED LOCATIONS OF POSSIBLE PUBLIC WATER SUPPLY WELLS)
- SURFACE WATERS (STREAMS OR DRAINAGE DITCHES) ARROWS INDICATE DIRECTION OF FLOW
- OTHER BUILDINGS (GARAGES, BARNS, ETC.)
- HIGH CAPICITY WELLS
- —790— WATER TABLE CONTOURS (CONTOUR INTERVAL: 1 FT.)
- DIRECTION OF GROUNDWATER FLOW

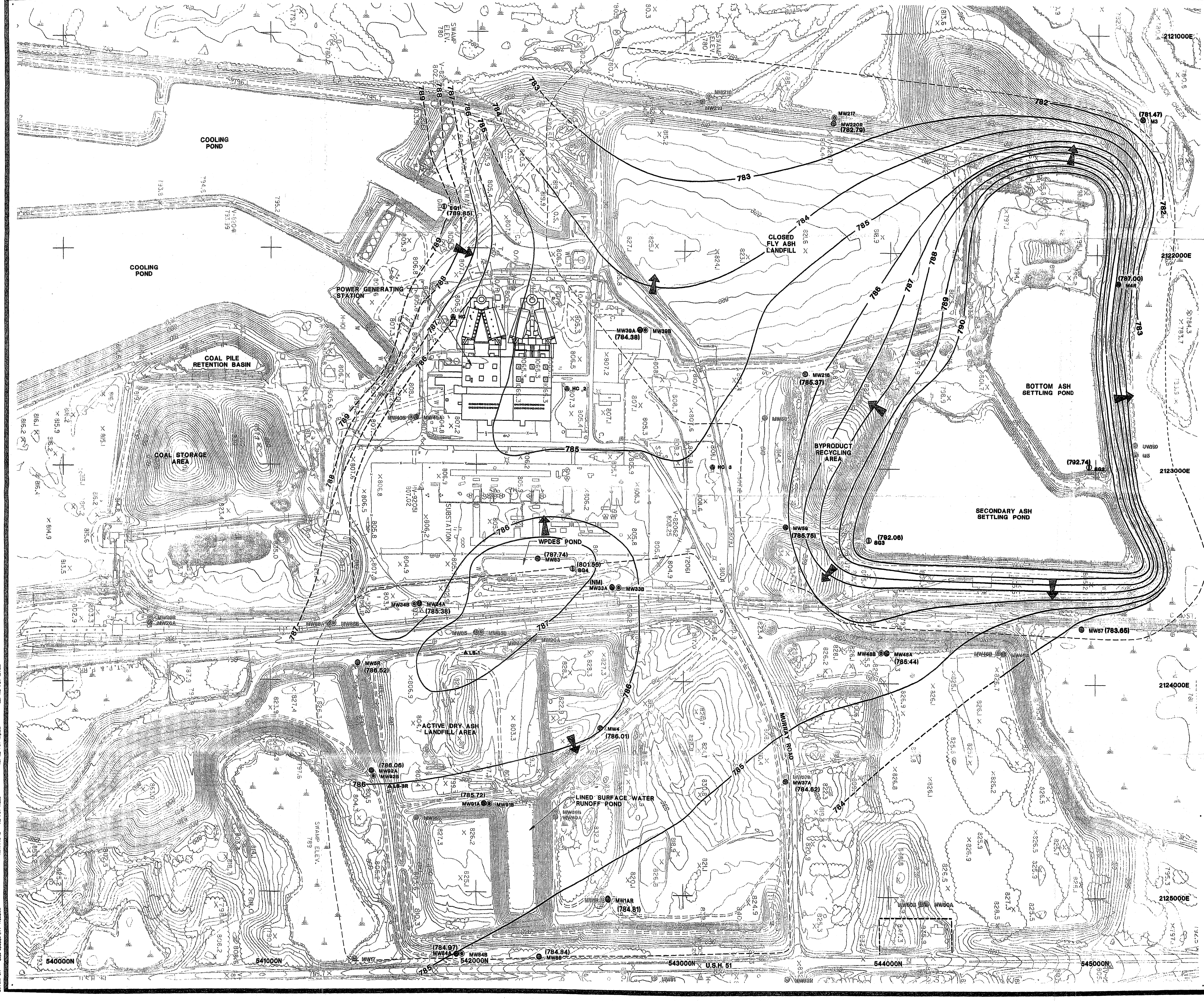
NO.	BY	DATE	REVISION	APP'D

WATER TABLE CONTOUR MAP 2/4/81

PLAN OF OPERATION – ASH DISPOSAL FACILITY
COLUMBIA SITE
WISCONSIN POWER & LIGHT COMPANY
PART OF SECTIONS 27 & 34, T12N, R9E
TOWN OF PACIFIC COLUMBIA CO. WISCONSIN

WARZYN ENGINEERING INC

DRAWN TDH	SCALE 1"=300'	SHEET 39 OF 39	
CHECKED RJK	DATE 2/10/81	DRAWING NO. C7134-94	
APPROVED			
REFERENCE		PRINTED 8/3/88	



LEGEND

	PROPERTY LINE
	EXISTING RAILROAD TRACKS
	EXISTING GROUND CONTOUR
	CONTOUR DEPRESSION
	EXISTING PAVED ROAD
	EXISTING UNPAVED ROAD
	EXISTING FENCE
	EXISTING BUILDING
	EXISTING SPOT ELEVATION
	TREES AND/OR BRUSH
	WETLAND AREA
	EDGE OF WATER
HC 1	WATER SUPPLY WELL
MW91A	WATER TABLE WELL
MW91B	PIEZOMETER
	ABANDONED WATER TABLE WELL
	ABANDONED PIEZOMETER
SG1	STAFF GAUGE
LS-1	LYSIMETER
	DESIGN MANAGEMENT ZONE
	PROPERTY LINE
O.S.	OPEN STORAGE
O.H.	OVERHEAD STRUCTURE
E.P.S.	ELECTRICAL POWER STATION
T	TANK
W	WALL
(785.31)	WATER TABLE ELEVATION (FT-MSL) (N.M. = NOT MEASURED)
786	GROUNDWATER CONTOUR LINE (1FT INTERVAL- FT. M.S.L.) (DASHED WHERE INFERRED)
	GROUNDWATER FLOW DIRECTION

NOTES

1. BASE MAP IS PROVIDED BY WISCONSIN POWER & LIGHT CO. AND IS BASED ON PHOTOS TAKEN ON APRIL 6, 1995 BY AERO-METRIC ENGINEERING, SHEBOYGAN, WI.
2. HORIZONTAL DATUM IS BASED ON THE WISCONSIN STATE PLANE COORDINATE SYSTEM, SOUTH ZONE - DATUM: NAD 83(91).
3. VERTICAL DATUM IS REFERENCED TO U.S.G.S. MEAN SEA LEVEL (MSL). TOPOGRAPHIC CONTOUR INTERVAL IS TWO FEET.
4. MONITORING WELL LOCATIONS AND ELEVATIONS SURVEYED BY WISCONSIN POWER & LIGHT CO. IN DECEMBER 1994 & NOVEMBER 1996.
5. THE LOCATION OF THE DESIGN MANAGEMENT ZONE DEMARCATION LINE IS APPROXIMATE.
6. WATER ELEVATION USED TO PREPARE THIS MAP WERE MEASURED ON OCTOBER 24, 2002.
7. THE WATER LEVEL AT MW 33A AND MW 33B COULD NOT BE MEASURED DURING OCTOBER 2002 DUE TO AN OBSTRUCTION IN THE WELL CASING.

NO.	BY	DATE	REVISION	APP'D.
3.				
2.				
1.				

PROJECT: **ALLIANT ENERGY - WP&L COLUMBIA ASH PONDS & DRY ASH DISPOSAL FACILITY**

SHEET TITLE: **WATER TABLE MAP (OCTOBER 2002)**

DRAWN BY: defoej	SCALE: 1"=200'	PROJ. NO. 3024.28
CHECKED BY: JMR		FILE NO. WATERTBL.PLT
APPROVED BY: JCO	DATE PRINTED:	**FIGURE 3**
DATE: JANUARY 2003		

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