Muskegon Environmental Redevelopment Group, LLC
12601 Plantside Drive
Louisville, KY 40299
(502) 245-1353 (Office)

September 3, 2020

Mr. Timothy Unseld
Grand Rapids District Solid Waste Engineer
Materials Management Division
350 Ottawa Avenue NW, Unit 10
Grand Rapids, MI 49503-2341

Dear Mr. Unseld,

Enclosed please find the Coal Combustion Residual (CCR) License to Operate a Solid Waste Disposal Area application for the B.C. Cobb Plant Ponds 0-8 and Bottom Ash Pond, identified by WDS number 498104 located at 161 North Causeway, Muskegon, Michigan. This submittal package includes the Part 115 permit application form and required supplemental forms provided as attachments. Application fee checks will be sent to the MI EGLE casher's office as directed in the Part 115 application form.

We have included in this application package the hydrogeologic monitoring plan (HMP). Data appendices that support the HMP are also included as one document for your review.

This application to obtain a solid waste operating license under Michigan Part 115 solid waste rules will allow the site to operate as a solid waste facility as closure is achieved. Operations include closure construction and the closure monitoring activities. The referenced CCR unit is no longer receiving waste, and is currently in the process of closure by removal of regulated CCR waste in accordance with the currently permitted closure work plan. Once closure construction and the site closure groundwater monitoring is complete per the Closure Work Plan approved on October 16, 2018, this site will no longer require a solid waste operating license. There is no post-closure period or perpetual care fund for this site due to the implementation of clean closure procedures. The operating license will be maintained through the closure construction and groundwater monitoring period. Financial assurance will be adjusted accordingly once construction is complete.

If you have any questions or would like to discuss this submittal further, please do not hesitate to contact the undersigned.

Sincerely,

Kyle Hoover, PE, PG, PMP *(PE: NC, VA; PG: NC, TN)*
Director of Engineering
Muskegon Environmental Redevelopment Group, LLC (MERG)
Charah Solutions, Inc.

Attachments: CCR License to Operate a Solid Waste Disposal Area Application Form
Copy of Application Checks
Financial Assurance Documentation
Facility Map
Financial Assurance Forms
Hydrogeologic Monitoring Plan (with data appendices)

CC: Kent Walters, MI EGLE; Norman Divers, Charah Solutions; Eric Effinger, Charah Solutions

[DRAFT - ELECTRONIC REVIEW]

MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY
MATERIALS MANAGEMENT DIVISION

COAL COMBUSTION RESIDUALS (CCR)
LICENSE TO OPERATE A SOLID WASTE DISPOSAL AREA APPLICATION

This information is required under the provisions of Part 115, Solid Waste Management, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. Providing false information may result in civil or criminal penalties.

This application is hereby made to the director, Michigan Department of Environment, Great Lakes, and Energy for a Coal Combustion Residuals (CCR) License to Operate a Solid Waste Disposal Area. Completion of this form is required to obtain a license.

If help is needed to fill out these forms, please contact your Materials Management Division (MMD) District Office. MMD District Office location information is available on the Department of Environment, Great Lakes, and Energy (EGLE), MMD, web site at: https://www.michigan.gov/egle and by clicking on "Locations" in the upper right hand corner. All fields are required.

I. FACILITY NAME AND LOCATION

A CCR solid waste disposal area includes coal ash landfills and coal ash surface impoundments. Two or more disposal areas may be combined into one facility on a single license. If separate disposal areas are desired, then separate applications are needed.

NAME OF FACILITY: BC Cobb Ash Ponds 0-8 and Bottom Ash Pond			WDS ID NUMBER: 498104
PHYSICAL ADDRESS: 161 N. Casuseway	TOWNSHIP: Muskegon	COUNTY: Muskegon	
CITY: Muskegon	STATE: MI	ZIP CODE: 49445	TELEPHONE: ( ) - x
LEGAL NAME OF FACILITY OWNER: Muskegon Environmental Redevelopment Group, LLC (MERG)			

II. OPERATOR/APPLICANT

A Michigan Corporate ID Number is 9 digits. Municipally owned facilities usually do not have a Michigan Corporate ID Number. Enter "N/A" or "Municipality" for these.

LEGAL NAME OF OPERATOR/APPLICANT: Muskegon Environmental Redevelopment Group, LLC (MERG)			
MAILING ADDRESS: 12601 Plantside Drive			CITY: Louisville
STATE: KY	ZIP CODE: 40299-	TELEPHONE: (502) 245-1353 x	MICHIGAN CORPORATE ID NUMBER: 802363647
RESPONSIBLE INDIVIDUAL: Scott Sewell	TITLE: CEO	TELEPHONE: (502) 245-1353 x	
PERSON PREPARING APPLICATION: Kyle Hoover	TITLE: Director of Engineering	TELEPHONE: (502) 415-8844 x (Cell)	

III. PROPERTY OWNER(S) and MINERAL RIGHTS OWNER(S)

List all entities that own a portion of either the property and/or mineral rights. If there are multiple owners and/or contact persons, attach a separate sheet, and indicate in space provided.

NAME OF OWNER: Muskegon Environmental Redevelopment Group, LLC	TELEPHONE: (502) 245-1353 x		
CONTACT PERSON Scott Sewell	TELEPHONE: (502) 245-1353 x		
ADDRESS: 12601 Plantside Drive	CITY: Louisville	STATE: KY	ZIP CODE: 40299

IV. APPLICATION TYPE:

- ☒ First application for a new disposal area
- ☐ Renewal of previous activities
- ☐ Previous license expired
- ☐ Change in owner
- ☐ Renewal with application for additional authorization (Landfills only)

V. CONSTRUCTION PERMIT (Number(s) and date(s) issued)

List all that currently apply to facility. Attach separate sheet if necessary.

PERMIT NUMBER	ISSUE DATE	PERMIT NUMBER	ISSUE DATE

[DRAFT - ELECTRONIC REVIEW]

VI. TYPE OF DISPOSAL AREA *Check all that apply. More than one may be selected.*

	RENEWAL	NEW
☐ Coal Ash Landfill	☐	☐
☒ Coal Ash Surface Impoundment	☐	☒

VII. FEE AND APPLICATION DOCUMENTS *Check all that apply*

Combined Facility Area Summary and License Application/Annual Fee Worksheet:	☒ Attached		
Copy of Application Fee check:	☒ Attached	☐ N/A	Amount $13,000
Construction Certification:	☐ Attached	☒ No new construction	
Declaration of Restrictive Covenant:	☒ Attached	☐ N/A	☐ Previously submitted
Perpetual Care Fund (PCF) Agreement:	☐ Attached	☒ N/A	☐ Previously submitted
PCF Financial Statement:	☐ Attached	☒ N/A	
Financial Assurance documents:	☒ Attached	☐ N/A	
Facility Map:	☒ Attached		
Financial Assurance forms:	☒ A	☐ D	

VIII.TYPE OF WASTE: *Check one*

☐ Same as previously authorized ☒ Change or first application: Separate description attached as necessary

IX. SPECIAL CONDITION(S): *Check all that apply. Attach separate sheet if necessary.*

☒ N/A	☐ Alternative Daily Cover(s)	☐ Request Attached	☐ Request Previously Approved (date):
	☐ Leachate Recirculation	☐ Request Attached	☐ Request Previously Approved (date):
	☐ Other:	☐ Request Attached	☐ Request Previously Approved (date):

The undersigned certify that they are fully authorized as a signatory by the party they represent, and that this information and all attached pages are correct and complete.
Any person signing as a representative for the operator, facility owner, and/or property owner must certify that they are an authorized signatory for that person.

OPERATOR'S SIGNATURE: JosephBWatson DATE: 9/3/2020
TYPED or PRINTED NAME: Joe Watson TITLE: Director of Operations

FACILITY OWNER'S SIGNATURE: Scott Sewell DATE: 9/3/2020
TYPED or PRINTED NAME: Scott Sewell TITLE: CEO

PROPERTY OWNER'S SIGNATURE: Scott Sewell DATE: 9/3/2020
TYPED or PRINTED NAME: Scott Sewell TITLE: CEO

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FACILITY AREA SUMMARY

LEGAL NAME OF FACILITY: BC Cobb Ash Ponds 0-8 and Bottom Ash Pond	**WDS ID NUMBER:** 498104

DETAILED FACILITY DESCRIPTION			
Active Portion(s): To be an active portion, it must have been included in the previous license as active, a constructed area certified with the previous application, or an unconstructed area with financial assurance that was both constructed and certified during the previous license period.			
This format should be used to describe the following individual areas: ***Area identifier, acreage, date certified closed.***			
1.	**Coal Ash Landfill (number of cells or units)** SUBTOTAL	0	acres
2.	**Coal Ash Surface Impoundment (number of cells or units)** 1 SUBTOTAL	25.3	acres
3.	**Unconstructed Area(s) with Financial Assurance** *Permitted but unconstructed.* SUBTOTAL	0 acres	
Closed Portion(s): To be a closed portion, a final cover must be in place, a final cover must be properly certified, and certification must be approved by MMD.			
4.	Coal Ash Landfill (number of cells or units) SUBTOTAL	0	acres
5.	Coal Ash Surface Impoundment (number of cells or units) SUBTOTAL	0	acres
Facility Area *NOTE: This area is the entire property and should equal the total of Items 1 – 5 above.*		**TOTAL**	**25.3 acres**

Preparer's Signature: _____ Date: 9/3/2020

Typed or Printed Name: Kyle Hoover Title: Director of Engineering

Telephone: Office: _____ Cell: 502-415-8844 Fax: _____ E-mail: khoover@charah.com

[DRAFT - ELECTRONIC REVIEW]

For Cashier's Use Only:	CCR
Accounting Template:	761RSWCCR

LICENSE TO OPERATE APPLICATION FEE WORKSHEET/TABLE

WASTE AMOUNT: Remaining Capacity: 0 cubic yards
Air Space (cubic yards) OR Years Projected: 0

LEGAL NAME OF FACILITY: BC Cobb Ash Ponds 0-8 and Bottom Ash Pond	**WDS ID NUMBER:** 498104

ANNUAL FEE				
	Type of Disposal Area		**Annual Fee**	
☐	Coal Ash Landfill	$13,000/unit	$	
☒	Coal Ash Surface Impoundment	$13,000/unit	$13,000 x 5 year license	
	ANNUAL FEE SUBTOTAL		$65,000	
	ANNUAL FEE TOTAL (Enter here and Section VII of the License Application Form)			**$65,000**

LICENSE APPLICATION FEE				
	Type of Disposal Area		**License Application Fee**	
☐	Coal Ash Landfill	$13,000/unit	$	
☒	Coal Ash Surface Impoundment	$13,000/unit	$13,000	
	LICENSE APPLICATION FEE SUBTOTAL		$13,000	
	LICENCE APPLICATION FEE TOTAL (Enter here and Section VII of the License Application Form)			**$13,000**

Preparer's Signature: _____ Date: 9/3/2020
Typed or Printed Name: Kyle Hoover Title: Director of Engineering
Telephone: Office: _____ Cell: 502-415-8844 Fax: _____ E-mail: khoover@charah.com

Make check or money order payable to:	REMIT TO:
STATE OF MICHIGAN	**MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY** **CASHIER OFFICE** **PO BOX 30657** **LANSING, MI 48909-8157**
Return this completed and signed Worksheet and the fee to the Cashier Office.	

All facilities return the remainder of the application documents, a *copy* of this Worksheet, a *copy* of the application fee, and any attachments directly to the Department of Environment, Great Lakes, and Energy through the Materials Management Division's District Office. If the proposed disposal area is located in Wayne County, return a *copy* of the remainder of the application documents, a *copy* of this Worksheet, a *copy* of the application fee, and *copies* of any attachments to Wayne County Land Resource Management Division.

[DRAFT - ELECTRONIC REVIEW]

BC Cobb – Part 115 Application Fee Checks

[To be sent as required – not part of electronic submittal]

BC Cobb – Restrictive Covenant

[DRAFT - ELECTRONIC REVIEW]

Received & Sealed for Record
MARK F. FAIRCHILD REGISTER OF DEEDS
Muskegon County Michigan
03/04/2020 02:19 PM Liber: 4214 Page: 252

MARK F. FAIRCHILD Liber: 4214 Page: 252
REGISTER OF DEEDS PAGE: 1 of 6
Muskegon County Michigan 03/04/2020 02:19 PM
044 5679960

DECLARATION OF RESTRICTIVE COVENANT

Recorded to fulfill a licensure requirement under provisions of Part 115, Solid Waste Management, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, MCL 324.11501 et seq.

THIS INDENTURE made the 13th, day of February 2020, by Consumers Energy Company whose address is One Energy Plaza, Jackson, Michigan.

WHEREAS, application for licensure under provisions of Part 115, for the purpose of conducting, managing, maintaining, or operating a coal ash impoundment upon lands situated in the City of Muskegon and City of North Muskegon, County of Muskegon, will be properly made by Consumers Energy Company or its successor; and

WHEREAS, the Director of the Department of Environment, Great Lakes, and Energy (EGLE) will contemporaneously issue such license to the 62.2 net acres, more or less, as defined on the attached survey; and

WHEREAS, Part 115, Section 11518, requires that at the time of licensing of a coal ash impoundment an instrument which imposes a restrictive covenant upon the land involved shall be executed by all the owners of, or other holders of an easement in, the tract of land upon which the coal ash impoundment is located.

NOW THEREFORE, the legal description of the 62.2 net acres, more or less, area upon which this restrictive covenant is imposed is set forth in Attachment A and Attachment B. Attachments A and B contain drawings depicting the following:

a. the facility boundary,
b. the solid waste boundary, and,
c. the boundary of the land upon which the restrictive covenant is imposed, as described in Attachment A, with Metes and Bounds for each section of traverse labeled.

NOW THEREFORE, CONSUMERS ENERGY COMPANY, a Michigan Corporation, One Energy Plaza, Jackson, Michigan, 49201, do for themselves, their heirs, successors, lessees, or assigns declare, covenant, and agree:

1. That the lands upon which this restrictive covenant is imposed have been used as coal ash impoundments, and that neither they, nor their servants, agents, employees, nor any of the heirs, successors, lessees or assigns shall (or shall by their leave or sufferance permit others to) engage in filling, grading, excavating, drilling, or mining of the lands and premises above described until 50 years after completion of the impoundments upon the same, unless written authorization therefore is obtained from the Department of Environment, Great Lakes, and Energy (EGLE) which includes authorization to remove waste coal ash per the approved BC Cobb Generating Facility Bottom Ash Pond and Ponds 0-8 Closure Work Plan. Planned excavation for the purpose of non-emergency, planned installation of new poles, towers, guys, groundwires, or similar equipment or sewer lines and appurtenances shall be performed only with EGLE's prior approval. Prior approval of EGLE is not required for a) maintenance of the structural integrity of the surface impoundment; b) installation, maintenance, and repair of utility series lines outside of the solid waste boundary; c) any and all above ground activities, including but not limited to patrolling, inspecting, construction, maintenance, alteration, modification or any other work related to electric or communication lines on the property; or d) emergency work within the solid waste boundary, including emergency excavation to install new poles, towers, guys, groundwires, or similar equipment or to address failing sewer lines. An emergency includes any damage to or unplanned failure of the equipment that requires immediate response to prevent an impending electric service disruption or to fully restore electric service or sewer conveyance in a safe manner. EGLE shall be notified at the earliest practical time of any such emergencies.

[DRAFT - ELECTRONIC REVIEW]

2. That at the time of the sealing and delivery of this instrument, the above described premises are free from all encumbrances (other than liens, mortgages, judgment liens, easements, mechanics' liens, accrued or unpaid taxes, leases other than mineral leases, or other security interests).
3. Muskegon County signs below solely to acknowledge the provisions relating to sewer lines and easements.
4. This restrictive covenant may be executed simultaneously in two or more counterparts, each of which shall be deemed an original and all of which together shall constitute one and the same instrument. It is not necessary that all parties execute any single counterpart if each party executes at least one counterpart.

CONSUMERS ENERGY COMPANY, a Michigan corporation

By: _____
Brad Krabel

Its: Real Estate Acquisition Manager

STATE OF MICHIGAN)
COUNTY OF JACKSON)

The foregoing instrument was acknowledged before me this 13 day of February, 2020 by Brad Krabel, the Real Estate Acquisition Manager, of Consumers Energy Company, a Michigan Corporation.

_____
Stephen J. Schoenow Notary Public
State of Michigan, County of Grand Traverse
My Commission Expires: 11-08-2022
Acting in the County of Jackson

MICHIGAN ELECTRIC TRANSMISSION COMPANY, LLC a Michigan limited liability company

By: ITC Holdings Corp., a Michigan corporation
Its: Manager

By: _____
Jean Kim D'Anna

Its: Assistant General Counsel – Utility Operations

MARK F. FAIRCHILD Liber: 4214 Page: 252
REGISTER OF DEEDS PAGE: 2 of 6
Muskegon County Michigan 03/04/2020 02:19 PM
044 5679960

STATE OF MICHIGAN)
COUNTY OF OAKLAND)

On this _____ day of _____, 2020, personally appeared Jean Kim D'Anna, Assistant General Counsel – Utility Operations, on behalf of ITC Holdings Corp, to me known to be the person described and who executed the foregoing instrument and acknowledge that she executed the same as her free act and deed.

_____
_____Notary Public
State of Michigan, County of _____
My Commission Expires: _____
Acting in the County of _____

[DRAFT - ELECTRONIC REVIEW]

2. That at the time of the sealing and delivery of this instrument, the above described premises are free from all encumbrances (other than liens, mortgages, judgment liens, easements, mechanics' liens, accrued or unpaid taxes, leases other than mineral leases, or other security interests).
3. Muskegon County signs below solely to acknowledge the provisions relating to sewer lines and easements.
4. This restrictive covenant may be executed simultaneously in two or more counterparts, each of which shall be deemed an original and all of which together shall constitute one and the same instrument. It is not necessary that all parties execute any single counterpart if each party executes at least one counterpart.

CONSUMERS ENERGY COMPANY, a Michigan corporation

By: _____
Brad Krabel

Its: Real Estate Acquisition Manager

STATE OF MICHIGAN)
COUNTY OF JACKSON)

The foregoing instrument was acknowledged before me this _____ day of _____, 2020 by Brad Krabel, the Real Estate Acquisition Manager, of Consumers Energy Company, a Michigan Corporation.

_____
_____Notary Public
State of Michigan, County of _____
My Commission Expires: _____
Acting in the County of _____

MICHIGAN ELECTRIC TRANSMISSION COMPANY, LLC a Michigan limited liability company

By: ITC Holdings Corp., a Michigan corporation
Its: Manager

By: _____
Jean Kim D'Anna

Its: Assistant General Counsel – Utility Operations

MARK F. FAIRCHILD Liber: 4214 Page: 252
REGISTER OF DEEDS PAGE: 3 of 6
Muskegon County Michigan 03/04/2020 02:19 PM
044 5679960

STATE OF MICHIGAN)
COUNTY OF OAKLAND)

On this 17th day of February, 2020, personally appeared Jean Kim D'Anna, Assistant General Counsel – Utility Operations, on behalf of ITC Holdings Corp, to me known to be the person described and who executed the foregoing instrument and acknowledge that she executed the same as her free act and deed.

Constance M. Scott
_____Notary Public
State of Michigan, County of Oakland
My Commission Expires: 9/10/2021
Acting in the County of Oakland

CONSTANCE M. SCOTT
NOTARY PUBLIC, STATE OF MI
COUNTY OF OAKLAND
MY COMMISSION EXPIRES Sep 10, 2021
ACTING IN COUNTY OF Oakland

[DRAFT - ELECTRONIC REVIEW]

MUSKEGON COUNTY

By: _____
Gary Foster

Its: Chair of Board of Public Works

STATE OF MICHIGAN)
COUNTY OF MUSKEGON)

The foregoing instrument was acknowledged before me this 18th day of February, 2020, by Gary Foster, the Chair, of the Muskegon County Board of Public Works.

_____
Kathryn A. Tharp Notary Public
State of Michigan, County of Muskegon
My Commission Expires: 1/15/2016
Acting in the County of n/a

By: _____
Rhonda S. Oyer, Manager,

Solid Waste Section,
Materials Management Division
for the Director Liesl Eichler Clark
Department of Environment, Great Lakes, and Energy

STATE OF MICHIGAN)
COUNTY OF INGHAM)

The foregoing instrument was acknowledged before me this 28th day of February, 2020, by Rhonda S. Oyer, Section Manager, of the Solid Waste Section, Materials Management Division, for the Director of the Department of Environment, Great Lakes, and Energy, on behalf of the state of Michigan.

_____
Sueann Marie Murphy Notary Public
State of Michigan, County of Montcalm
My Commission Expires: March 5, 2026
Acting in the County of Ingham

Prepared by:
Michelle Marion
Consumers Energy
One Energy Plaza
Jackson, 49201

SUEANN MARIE MURPHY
NOTARY PUBLIC - STATE OF MICHIGAN
COUNTY OF MONTCALM
My Commission Expires March 5, 2026
Acting in the County of Ingham

When recorded, return to:
Michigan Department of Environment, Great Lakes, and Energy
Materials Management Division
Solid Waste Section
P.O. Box 30241, Lansing, Michigan 48909-7741

MARK F. FAIRCHILD Liber: 4214 Page: 252
REGISTER OF DEEDS PAGE: 4 of 6
Muskegon County Michigan 03/04/2020 02:19 PM
044 5679960
[DRAFT - ELECTRONIC REVIEW]

Rev. A 9/18/2019:
Excepted out existing easement for public pathway L.4132-P.32, MCR.
Rev.B 2/7/2020:
Added solid waste area to Attachment B on SB-23644 Sheet 5.

Attachment A

BC Cobb Plant
Ash Ponds 0-8
Restrictive Covenant

Legal Description: Restrictive Covenant Area - BC Cobb Plant Ash Ponds 0-8

That part of Block "D" of the City of North Muskegon Map of 1900, North Muskegon, Michigan, and that part of Sections 17 & 18, Town 10 North, Range 16, West, City of Muskegon, Muskegon County, Michigan, described as: Commencing at the South 1/4 Corner of said Section 17; thence North 02°35'44" East 2658.13 feet along the North-South 1/4 Line of said Section 17 to the Center of said Section; thence North 02°36'12" East 250.63 feet along said North-South 1/4 Line; thence North 87°23'48" West 1887.21 feet to a point on the westerly right-of-way line of State Highway M-120 (locally known as Causeway Drive)(650' wide) for **THE PLACE OF BEGINNING OF THIS DESCRIPTION**; thence South 59°21'25" West 492.01 feet; thence Southwesterly 350.04 feet along a 204.49 foot radius non-tangent curve to the left, said curve having a chord bearing South 53°47'40" West and chord distance 308.84 feet; thence South 08°19'57" West 16.85 feet; thence South 86°31'17" West 67.56 feet; thence South 13°17'50" East 81.08 feet; thence South 62°52'23" West 91.17 feet; thence North 35°19'24" West 279.43 feet; thence North 26°42'34" West 356.37 feet; thence North 37°56'32" West 161.52 feet; thence North 65°15'09" West 109.14 feet; thence North 83°23'31" West 449.24 feet; thence North 82°37'29" West 466.37 feet to **Point "A"** (said point being North 83°26'56" West 2248.51 feet from the place of beginning); thence North 82°37'29" West 320 feet, more or less, to the center of Cedar Creek; thence Northeasterly 1880 feet, more or less, along the center of Cedar Creek to the Southwesterly right-of-way line of said State Highway M-120; thence Southeasterly 185 feet, more or less, along said line to **Point "B"** (said point being North 40°26'45" West 2304.60 feet along the Westerly right-of-way line of State Highway M-120 from the Point of Beginning); thence South 40°26'45" East 2304.60 feet along said Westerly right-of-way line to the **Point of Beginning**.

The Intermediate Traverse Line for Cedar Creek is described as: **BEGINNING** at the aforedescribed Point "A"; thence North 35°33'42" East 196.60 feet to Point "C" (said point being North 78°53'01" West 2160.02 feet from the place of beginning); thence North 11°26'45" West 168.48 feet; thence North 15°14'54" East 489.66 feet; thence North 35°30'13" East 779.99 feet; thence North 49°33'15" East 100.00 feet to aforedescribed **Point "B"** for the place of ending of this Intermediate Traverse Line.

EXCEPTING therefrom an area of land used for an existing easement for a public pathway as described in Liber 4132, Page 32, Muskegon County Records

Contains 62.2 Net Acres, more or less.

STATE OF MICHIGAN
NICHOLAS J. RYAN
PROFESSIONAL SURVEYOR
No. 64402
LICENSED PROFESSIONAL SURVEYOR

MARK F. FAIRCHILD Liber: 4214 Page: 252
REGISTER OF DEEDS PAGE: 5 of 6
Muskegon County Michigan 03/04/2020 02:19 PM
044 5679960

Basis of Bearing: Michigan State Plane Coordinate System South Zone - NAD83 2011 - International Feet
Avg. Combined Scale Factor = 0.99990477. Ground Distances are shown.

Consumers Energy
1945 WEST PARNALL
JACKSON, MICHIGAN 49201
517-788-1526

BC Cobb Plant
Ash Ponds 0-8
Sections 17, 18
T10N-R16W
City of Muskegon &
City of North Muskegon
Muskegon Co., Michigan

Drawing No. SB-23644

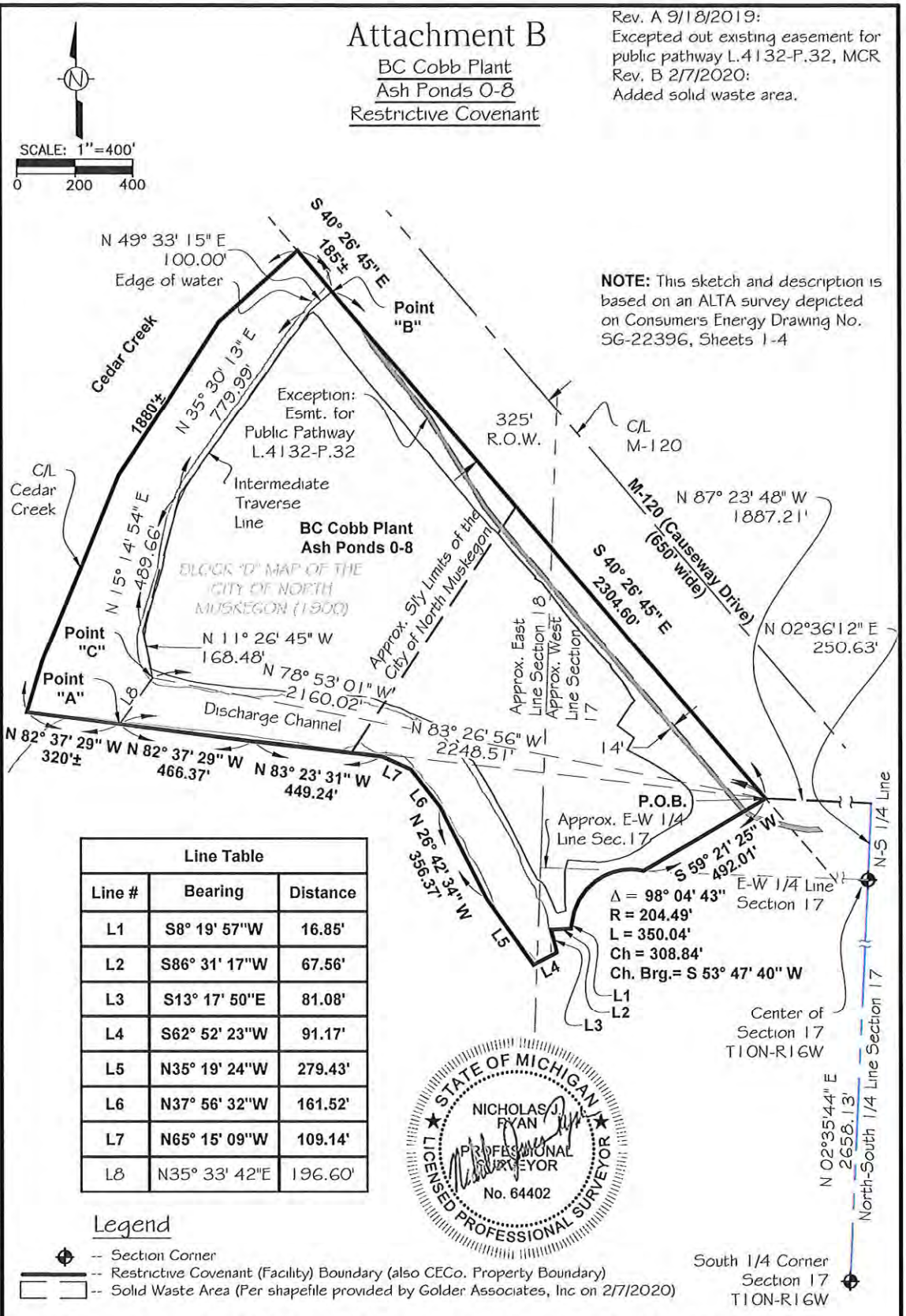
Filename: 23644base.dwg
Drawn By: N. Ryan, PS
Date: 8/26/2019
Scale: N/A
Sheet 4

[DRAFT - ELECTRONIC REVIEW]

Attachment B

BC Cobb Plant
Ash Ponds 0-8
Restrictive Covenant

Rev. A 9/18/2019:
Excepted out existing easement for public pathway L.4132-P.32, MCR
Rev. B 2/7/2020:
Added solid waste area.



NOTE: This sketch and description is based on an ALTA survey depicted on Consumers Energy Drawing No. SG-22396, Sheets 1-4

Line Table		
Line #	Bearing	Distance
L1	S8° 19' 57"W	16.85'
L2	S86° 31' 17"W	67.56'
L3	S13° 17' 50"E	81.08'
L4	S62° 52' 23"W	91.17'
L5	N35° 19' 24"W	279.43'
L6	N37° 56' 32"W	161.52'
L7	N65° 15' 09"W	109.14'
L8	N35° 33' 42"E	196.60'

STATE OF MICHIGAN
NICHOLAS J. RYAN
PROFESSIONAL SURVEYOR
No. 64402
LICENSED PROFESSIONAL SURVEYOR

Legend

- -- Section Corner
- -- Restrictive Covenant (Facility) Boundary (also CECo. Property Boundary)
- -- Solid Waste Area (Per shapefile provided by Golder Associates, Inc on 2/7/2020)

Basis of Bearing: Michigan State Plane Coordinate System South Zone - NAD83 2011 - International Feet
Avg. Combined Scale Factor = 0.99990477. Ground Distances are shown.

9:04 AM k:\agency\cad\projects\23644 cobb plant restrictive covenant\dwg\23644base.dwg

Consumers Energy
1945 WEST PARNALL

BC Cobb Plant
Ash Ponds 0-8
Sections 17,18
T1ON-R16W
City of Muskegon & rth Muskegon
Co., Michigan

Drawing No. SB-23644

Filename: 23644base.dwg
Drawn By: N. Ryan, PS
Date: 8/26/2019
Scale: 1" = 400'
Sheet 5

MARK F. FAIRCHILD Liber: 4214 Page: 252
REGISTER OF DEEDS PAGE: 6 of 6
Muskegon County Michigan 03/04/2020 02:19 PM
044 5679960
[DRAFT - ELECTRONIC REVIEW]

BC Cobb – Financial Assurance Documents

[DRAFT - ELECTRONIC REVIEW]

EGLE

MICHIGAN DEPARTMENT OF ENVIRONMENT GREAT LAKES, AND ENERGY
MATERIALS MANAGEMENT DIVISION

SURETY BOND FOR A
SOLID WASTE DISPOSAL AREA - LANDFILL

Required by Section 11523(1), Part 115, Solid Waste Management, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, being Section 324.11523 of the Michigan Compiled Laws Annotated. An operating license shall not be issued unless financial assurance has been filed as a part of an application for a license.

Facility Name: B. C. Cobb Plant		Surety Bond Number: [redacted]
Waste Data System (WDS) Number: 498104		
Facility Address: 161 N. Causeway		County: Muskegon
City: Muskegon	State: MI 49445	Zip Code:

Muskegon Environmental Redevelopment Group, LLC a Michigan Limited Liability Company, of 161 N. Causeway, Muskegon, MI 49445 as Principal, and Liberty Mutual Insurance Company, an insurer authorized to transact the business of surety and fidelity insurance in the State of Michigan and an acceptable surety on federal bonds listed in Circular 570 of the United States Department of Treasury (the "Surety") are firmly bound unto the Director of the Michigan Department of Environment, Great Lakes, and Energy (the "Department"), on behalf of the State of Michigan, his or her successor or successors in office, or his or her authorized representative(s), in the sum of Five Hundred FiftyTwo Thousand and no/100 ($552,000.00), lawful money of the United States of America, for the payment of which we bind ourselves, our executors, administrators and heirs, successors and assigns, jointly and severally.

Sealed with our seals, dated the 2nd day of September, 2020.

WHEREAS, the Principal has made application for a license to establish, maintain, and/or operate a solid waste disposal area that is a landfill within the State of Michigan in accordance with the provisions of Part 115 and the administrative rules promulgated thereunder; and

WHEREAS, the Principal is required by law to provide, as part of the application for a license, a Surety Bond to cover the cost of closure, post-closure maintenance and monitoring, and if necessary, corrective action.

WHEREAS, the Surety Bond shall provide assurance for the maintenance of the finished landfill site for a period of 30 years after the landfill or any approved portion is completed.

NOW, THEREFORE, the conditions of this obligation are such that the Surety shall become liable on this Surety Bond obligation only uncer the following conditions: (1) If the Principal shall fail to perform closure, whenever required to do so, of each facility for which this Surety Bond guarantees closure, in accordance with the closure requirements of all applicable laws, statutes, rules, and regulations, as such laws, statutes, rules, and regulations may be amended; or (2) If the Principal shall fail to perform closure, post-closure maintenance and monitoring, and corrective action, if necessary, of the disposal area pursuant to the closure, post-closure maintenance and monitoring, and corrective action requirements of all applicable laws, statutes, rules, and regulations, as such laws, statutes, rules, and regulations may be amended.

In the event that the Director of the Department, in accordance with Part 115, issues a notice of violation or other order indicating that the Principal has failed to comply with the closure, post-closure maintenance and monitoring, or corrective action requirements of Part 115, or the rules promulgated under Part 115, the Surety either perform closure, post-closure maintenance and monitoring, or corrective action, or make payment of the closure, post-closure maintenance and monitoring or corrective action amounts guaranteed by this Surety Bond for the Facility to the Director of the Department.

The Surety hereby waives notification of amendments to closure plans, licenses, applicable laws, statutes, rules, and regulations and agrees that no such amendment shall in any way alleviate its obligation on this Surety Bond.

The liability of the Surety shall not be discharged by any payment or succession of payments hereunder, unless and until such payment or payments shall amount in the aggregate to the penal sum of the Surety Bond, but in no event shall the obligation of the Surety hereunder exceed the amount of said penal sum.

Under the terms of the Surety Bond, the Surety shall notify both the Department and the Principal by certified mail at least 120 days before any cancellation of the Surety Bond. If the Principal does not extend the effective date of the Surety Bond or establish alternate financial assurance within 90 days after receipt of a cancellation notice by the Surety, the Department may draw on the Surety Bond.

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The Principal may terminate this Surety Bond by sending written notice to the Surety provided, however, that no such notice shall become effective until the Surety receives written authorization for termination of the Surety Bond from the Director of the Department, or authorized representative.

This Surety Bond shall be continuous until canceled by the Department.

The persons whose signatures appear below certify that they are authorized to execute this Surety Bond on behalf of the Principal and the Surety, and that the wording of the Surety Bond is identical to the wording provided by the Director as of the date shown immediately below.

In witness whereof, the Principal and the Surety have executed this Surety Bond and have affixed their seals and have attached the justification or power of attorney as of the day and date first above written.

Muskegon Environmental Redevelopment Group, LLC

_____
Principal

By: _____

Liberty Mutual Insurance Company
Surety

By: _____
George V. Baus, Jr., Authorized Agent and Attorney in Fact

111 Veterans Blvd., Suite 1130, Metairie, LA 70005
Address of Surety

504-888-1100
Phone Number of Surety

When completed send this document to:

MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY
MATERIALS MANAGEMENT DIVISION
SOLID WASTE SECTION
PO BOX 30241
LANSING, MI 48909-7741

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This Power of Attorney limits the acts of those named herein, and they have no authority to bind the Company except in the manner and to the extent herein stated.

Liberty Mutual. SURETY

Liberty Mutual Insurance Company
The Ohio Casualty Insurance Company
West American Insurance Company

Certificate No: [redacted]

POWER OF ATTORNEY

KNOWN ALL PERSONS BY THESE PRESENTS: That The Ohio Casualty Insurance Company is a corporation duly organized under the laws of the State of New Hampshire, that Liberty Mutual Insurance Company is a corporation duly organized under the laws of the State of Massachusetts, and West American Insurance Company is a corporation duly organized under the laws of the State of Indiana (herein collectively called the "Companies"), pursuant to and by authority herein set forth, does hereby name, constitute and appoint, George V. Baus, Jr., Kathleen L. Berni, Elizabeth Hamrick, Edward J. Murphy III, Jean Viola, Greg R. Weston

all of the city of Metairie state of LA each individually if there be more than one named, its true and lawful attorney-in-fact to make, execute, seal, acknowledge and deliver, for and on its behalf as surety and as its act and deed, any and all undertakings, bonds, recognizances and other surety obligations, in pursuance of these presents and shall be as binding upon the Companies as if they have been duly signed by the president and attested by the secretary of the Companies in their own proper persons.

IN WITNESS WHEREOF, this Power of Attorney has been subscribed by an authorized officer or official of the Companies and the corporate seals of the Companies have been affixed thereto this 4th day of February, 2020.

LIBERTY MUTUAL INSURANCE COMPANY INCORPORATED 1912 MASSACHUSETTS — THE OHIO CASUALTY INSURANCE COMPANY INCORPORATED 1919 NEW HAMPSHIRE — WEST AMERICAN INSURANCE COMPANY INCORPORATED 1991 INDIANA

Liberty Mutual Insurance Company
The Ohio Casualty Insurance Company
West American Insurance Company

By: David M. Carey, Assistant Secretary

State of PENNSYLVANIA
County of MONTGOMERY ss

On this 4th day of February, 2020 before me personally appeared David M. Carey, who acknowledged himself to be the Assistant Secretary of Liberty Mutual Insurance Company, The Ohio Casualty Company, and West American Insurance Company, and that he, as such, being authorized so to do, execute the foregoing instrument for the purposes therein contained by signing on behalf of the corporations by himself as a duly authorized officer.

IN WITNESS WHEREOF, I have hereunto subscribed my name and affixed my notarial seal at King of Prussia, Pennsylvania, on the day and year first above written.

TERESA PASTELLA COMMONWEALTH OF PENNSYLVANIA NOTARY PUBLIC

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Teresa Pastella, Notary Public
Upper Merion Twp., Montgomery County
My Commission Expires March 28, 2021
Member, Pennsylvania Association of Notaries

By: Teresa Pastella, Notary Public

This Power of Attorney is made and executed pursuant to and by authority of the following By-laws and Authorizations of The Ohio Casualty Insurance Company, Liberty Mutual Insurance Company, and West American Insurance Company which resolutions are now in full force and effect reading as follows:

ARTICLE IV – OFFICERS: Section 12. Power of Attorney.
Any officer or other official of the Corporation authorized for that purpose in writing by the Chairman or the President, and subject to such limitation as the Chairman or the President may prescribe, shall appoint such attorneys-in-fact, as may be necessary to act in behalf of the Corporation to make, execute, seal, acknowledge and deliver as surety any and all undertakings, bonds, recognizances and other surety obligations. Such attorneys-in-fact, subject to the limitations set forth in their respective powers of attorney, shall have full power to bind the Corporation by their signature and execution of any such instruments and to attach thereto the seal of the Corporation. When so executed, such instruments shall be as binding as if signed by the President and attested to by the Secretary. Any power or authority granted to any representative or attorney-in-fact under the provisions of this article may be revoked at any time by the Board, the Chairman, the President or by the officer or officers granting such power or authority.

ARTICLE XIII – Execution of Contracts: Section 5. Surety Bonds and Undertakings.
Any officer of the Company authorized for that purpose in writing by the chairman or the president, and subject to such limitations as the chairman or the president may prescribe, shall appoint such attorneys-in-fact, as may be necessary to act in behalf of the Company to make, execute, seal, acknowledge and deliver as surety any and all undertakings, bonds, recognizances and other surety obligations. Such attorneys-in-fact subject to the limitations set forth in their respective powers of attorney, shall have full power to bind the Company by their signature and execution of any such instruments and to attach thereto the seal of the Company. When so executed such instruments shall be as binding as if signed by the president and attested by the secretary.

Certificate of Designation – The President of the Company, acting pursuant to the Bylaws of the Company, authorizes David M. Carey, Assistant Secretary to appoint such attorneys-in-fact as may be necessary to act on behalf of the Company to make, execute, seal, acknowledge and deliver as surety any and all undertakings, bonds, recognizances and other surety obligations.

Authorization – By unanimous consent of the Company's Board of Directors, the Company consents that facsimile or mechanically reproduced signature of any assistant secretary of the Company, wherever appearing upon a certified copy of any power of attorney issued by the Company in connection with surety bonds, shall be valid and binding upon the Company with the same force and effect as though manually affixed.

I, Renee C. Llewellyn, the undersigned, Assistant Secretary, The Ohio Casualty Insurance Company, Liberty Mutual Insurance Company, and West American Insurance Company do hereby certify that the original power of attorney of which the foregoing is a full, true and correct copy of the Power of Attorney executed by said Companies, is in full force and effect and has not been revoked.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed the seals of said Companies this 2nd day of September, 2020.

LIBERTY MUTUAL INSURANCE COMPANY INCORPORATED 1912 MASSACHUSETTS — THE OHIO CASUALTY INSURANCE COMPANY INCORPORATED 1919 NEW HAMPSHIRE — WEST AMERICAN INSURANCE COMPANY INCORPORATED 1991 INDIANA

By: Renee C. Llewellyn, Assistant Secretary

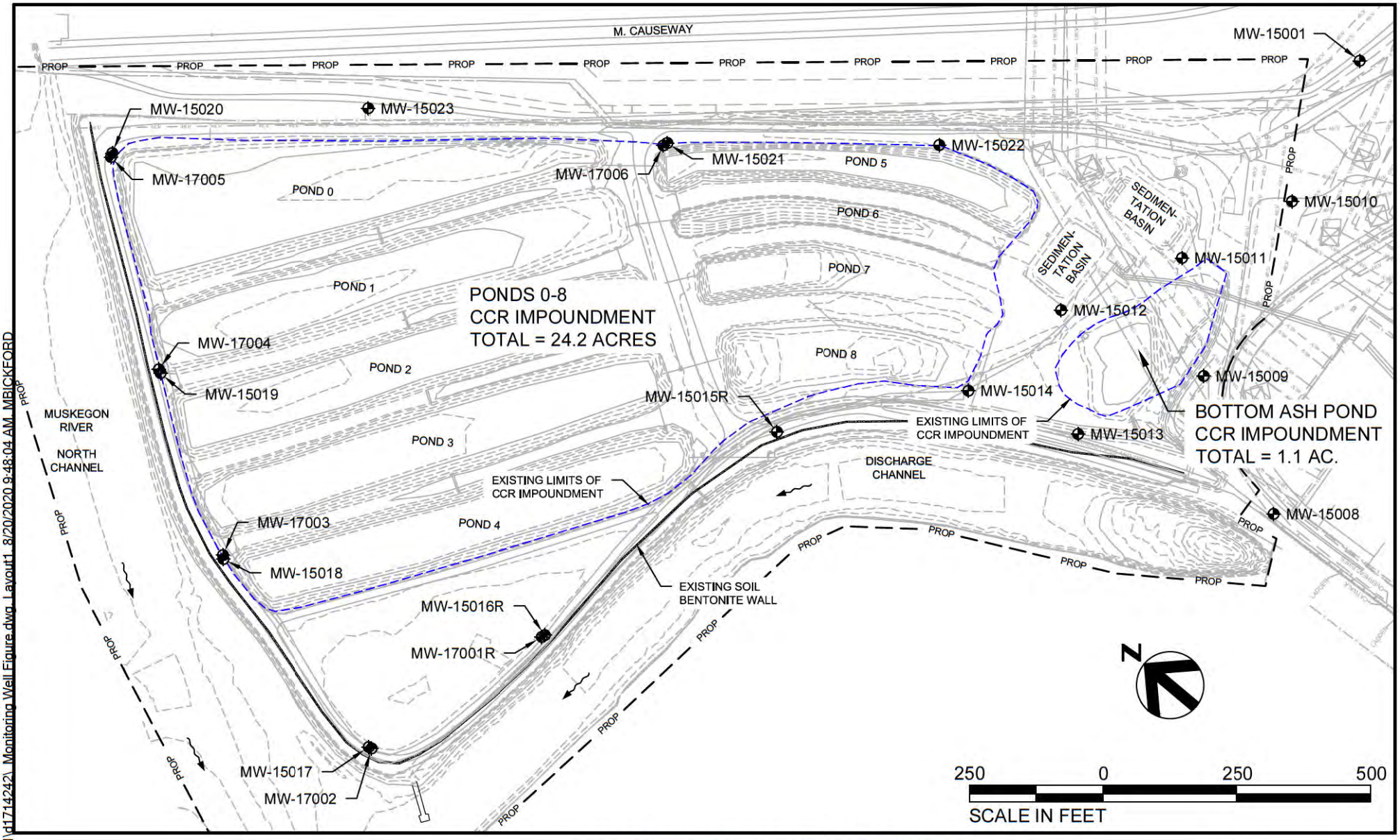
Not valid for mortgage, note, loan, letter of credit, currency rate, interest rate or residual value guarantees.

To confirm the validity of this Power of Attorney call 1-610-832-8240 between 9:00 am and 4:30 pm EST on any business day.

[DRAFT - ELECTRONIC REVIEW]

BC Cobb – Facility Map

[DRAFT - ELECTRONIC REVIEW]



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HDR

MUSKEGON ENVIRONMENTAL REDEVELOPMENT GROUP, L.L.C. (MERG)
BC COBB ASH POND CLOSURE

FACILITY PLAN

DATE
AUGUST 2020

FIGURE
1

BC Cobb – Financial Assurance Forms

[DRAFT - ELECTRONIC REVIEW]

FORM A (CCR ONLY)
FINANCIAL ASSURANCE REQUIRED[1]

LEGAL NAME OF FACILITY: BC Cobb Ash Ponds 0-8 and Bottom Ash Pond	**WDS ID NUMBER:** 498104

Reason for Submittal:
☒ License Application ☐ Reduction in Cost Estimate ☐ Release in Cost Estimate

FACILITY CLOSURE COST ESTIMATE				
1.	Total Acreage of Unit(s):	25.3 acres		
2.	Bonding for Unit(s) (line 1 x $20,000) (Maximum Bond Amount of $1,000,000, Minimum of $20,000)		$506,000	
3.	Corrective Action Cost Estimate (Form D, line 10)	$0		
4.	Other required Financial Assurance:	$0		
5.	**Total Cost Estimate (lines 2 + 3 + 4):**			**$506,000**
FINANCIAL ASSURANCE PROVIDED				
6.	Existing Bond(s) to be used during licensing period (Submit evidence of continuation if applicable): Financial Institution Name(s) (List on separate sheet if needed)	Amount(s)	Type(s)[2]	Account Number(s)
a.		$		
b.		$		
7.	New Bond(s) to this application: Financial Institution Name(s) (List on separate sheet if needed)	Amount(s)	Type(s)[2]	Account Number(s)
a.	Liberty Mutual Insurance Company	$552,000	Surety Bond	
b.		$		
8.	**Total of Bonds (lines 6a + 6b + 7a + 7b:**	**$552,000**		
9.	Current Balance of Perpetual Care Fund (Attach current statement) Financial Institution Name(s) (List on separate sheet if needed)	PCF Amount(s)		PCF Account #(s)
a.		$		
b.		$		
10.	**Total Perpetual Care Fund Balance**			**$**
11.	**Total Financial Assurance (lines 8 + 10):**		Must be ≥ line 5	**$552,000**
12.	Bond(s) to be Reduced/Released (i.e. will not count toward financial assurance requirement) Financial Institution Name(s)	Amount(s)	Type(s)[3]	Account Number(s)
a.		$		
b.		$		
13.	Are all units on the same closure schedule? If No, attach a separate summary sheet.	☒ Yes ☐ No		

Preparer's Signature: _____ Date: 9/3/2020
Typed or Printed Name: Kyle Hoover Title: Director of Engineering
Telephone: Office: _____ Cell: 502-415-8844 Fax: _____ E-mail: khoover@charah.com

[1] This form may also be used to request a reduction in the approved cost estimates and corresponding financial assurance.
[2] Insurance may not be used to cover corrective action costs.
[3] Bond types include surety bond, certificate of deposit, cash bond, irrevocable letter of credit, insurance, trust fund, or escrow account.

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BC Cobb – Hydrogeologic Monitoring Plan (including Appendices)

[DRAFT - ELECTRONIC REVIEW]

Hydrogeologic Monitoring Plan

for Compliance with the Part 115 Solid Waste Management

Former BC Cobb Power Plant

Muskegon, Michigan

Muskegon Environmental Redevelopment Group, LLC

August 14, 2020

[DRAFT - ELECTRONIC REVIEW]

Table of Contents

1.0 Introduction 1
1.1 Background 1
1.2 Purpose 1
1.3 Site Description 4
1.4 Hydrogeologic Conceptual Model 4
2.0 Groundwater Monitoring 5
2.1 Monitoring Well Network 5
2.1.1 Background Monitoring Locations 6
2.1.2 Point of Compliance Monitoring Locations 6
2.2 Well Construction 6
3.0 Groundwater Sampling and Analysis 13
3.1 Ongoing CCR Rule Compliance Monitoring Program 13
3.1.1 Background Monitoring 13
3.1.2 Detection Monitoring 14
3.1.3 Assessment Monitoring 14
3.2 Part 115 Compliance Monitoring Program 15
3.2.1 Background Monitoring 15
3.2.2 Detection Monitoring 15
3.2.3 Assessment Monitoring Program 16
3.3 Monitoring Schedule and Frequency 17
3.4 Sampling Procedures 18
3.4.1 Quality Control 18
3.5 Monitoring Parameters and Analytical Methods 19
3.5.1 Sample Parameters 19
3.5.2 Sample Analysis 21
3.6 Data Validation 22
3.6.1 Field Data Review 22
3.6.2 Laboratory Data Review 22
3.6.3 Verification 23
3.6.4 Data Validation 24
3.6.5 Data Usability Assessment 26
3.7 Data Management 28
3.7.1 Data Package Deliverables 28

[DRAFT - ELECTRONIC REVIEW]

3.7.2 Data Handling and Management 30
3.7.3 Data Tracking and Control 30
4.0 Statistical Approach 31
5.0 Groundwater Reporting 31
6.0 Response Action Plan 32
7.0 Assessment of Corrective Measures 32
8.0 Remedy Selection and Remedial Action Plan 32
9.0 References 33

List of Tables

Table 1. Well Construction Details for Groundwater Monitoring at Former BCC 9
Table 2. Groundwater Quality Parameters in Compliance with the CCR Rule Part 257 13
Table 3. Groundwater Sample Locations 17
Table 4. CCR Groundwater Sample Collection Frequency 18
Table 5. Groundwater Quality Parameters to be Analyzed 19
Table 7. Data Verification and Validation Inputs 23
Table 8. Minimum QC Procedures for Project Parameters 27

List of Figures

Figure 1. General Location. 2
Figure 2. CCR Unit and monitoring wells. 3
Figure 3. Groundwater elevation contours from May 2020. 8

List of Appendices

Appendix A Hydrogeologic Monitoring Plan Checklist
Appendix B Cross Section through the Ponds
Appendix C Monitoring Well Boring Logs and Well Construction Logs
Appendix D Groundwater Sampling Collection Standard Operating Procedure
Appendix E Statistical Procedures Plan

List of Attachments

Attachment 1 2019 and 2017 Groundwater Monitoring Reports for Statistical Evaluations

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Table of Abbreviations and Acronyms

Abbreviation	Definition
ACM	Assessment of Corrective Measures
AMSL	Above Main Sea Level
ASD	Alternative Source Demonstration
BTOC	Below Top of Casing
BTV	Background Threshold Values
CC	Contracted consultant
CCR	Coal Combustion Residuals
CEC	Consumers Energy Company
CFR	Code of Federal Regulations
COC	Chain of Custody
COI	Constituents of Interest
DO	Dissolved Oxygen
EDD	Electronic Data Deliverable
EGLE	Michigan Department of Environment, Great Lakes & Energy
EPA	U.S. Environmental Protection Agency
EFT	Environmental Field Technician
GPS	Groundwater Protection Standards
HMP	Hydrogeologic Monitoring Plan
ICP	Inductively Coupled Plasma
LCS	Laboratory Control Sample
MERG	Muskegon Environmental Redevelopment Group, LLC
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Unit
ORP	Oxidation Reduction Potential
PC	Project Chemist
ES	Environmental Specialist
PVC	Poly Vinyl Chloride
RPD	Relative Percentage Differences
SSI	Statistically Significant Increase
SSL	Statistically Significant Level
TDS	Total Dissolved Solids
TOC	Top of Casing

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Abbreviation	Definition
TSS	Total Suspended Solids
USGS	U.S. Geologic Survey
UTL	Upper Tolerance Limit

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Geologist Certification

Hydrogeologic Monitoring Plan

Former B.C. Cobb Power Station, Michigan

Molly M. Reeves

Certified Professional Geologist

American Institute of Professional Geologist

Certification No. 11546

[DRAFT - ELECTRONIC REVIEW]

1.0 Introduction

This Hydrogeologic Monitoring Plan (HMP) was prepared for the former BC Cobb Power Plant (BCC or Site) to support the application to the Michigan Department of Environment, Great Lakes & Energy (EGLE) for a Solid Waste Operating License under Michigan Statute Part 115. BCC is the site of a former coal-fired power generation facility located in Muskegon, Michigan (Figure 1). During operations, coal combustion residuals (CCR) were deposited in Ponds 0-8 and the Bottom Ash Pond (Figure 2).

This HMP sets forth the requirements and procedures of the CCR groundwater monitoring program at BCC. The HMP was developed in accordance with the EGLE Hydrogeologic Monitoring Plan Checklist (Appendix A).

1.1 Background

Consumers Energy Company (CEC) operated BCC between 1948 and 2016. The Site has ten CCR ponds subject to the U.S. Environmental Protection Agency's (EPA) CCR Rule (40 CFR Part 257): a bottom ash pond and Ponds 0-8 (collectively referred to as the BCC Ponds) (Figure 2). In accordance with §257.91, CEC installed a groundwater monitoring network around the bottom ash pond as one CCR unit; and a monitoring network around Ponds 0-8 as a second CCR unit. Background groundwater monitoring was completed as required by §257.93. As documented in the CEC January 14, 2019 *Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g),* lithium was observed present at statistically significant levels above the Groundwater Protection Standard (GPS) developed for the CCR Rule compliance program in two downgradient monitoring wells at the Ponds 0-8 CCR unit, thus necessitating CEC develop the September 2019 *Assessment of Corrective Measures*.

The Muskegon Environmental Redevelopment Group, LLC (MERG) has since acquired the BCC property and has initiated the process of removing CCR material from the ponds as part of pond remediation and closure efforts. MERG has begun implementation of the federal CCR Rule groundwater monitoring program, as required by §257.90-95, as a continuation of the CEC monitoring program. Pond closure is anticipated in March 2023.

1.2 Purpose

The State of Michigan has adopted recent legislation requiring that CCR impoundments be permitted under Part 115 Solid Waste Management. MERG is required to obtain a solid waste operating license from EGLE no later than December 28, 2020. The BCC surface impoundments, Ponds 0-8 and the Bottom Ash Pond, will be regulated under Part 115 until closure is achieved. Part 115 permitting application requirements include submittal of an HMP. This HMP was developed to comply with Part 115 solid waste rules, specifically the Coal Ash Landfill and Coal Ash Impoundments HMP Checklist and the Assessment Monitoring Program Checklist. Once permitted by the State, MERG will implement both the federal and state groundwater monitoring programs concurrently to comply with both the federal CCR Rule and Part 115 operating license.

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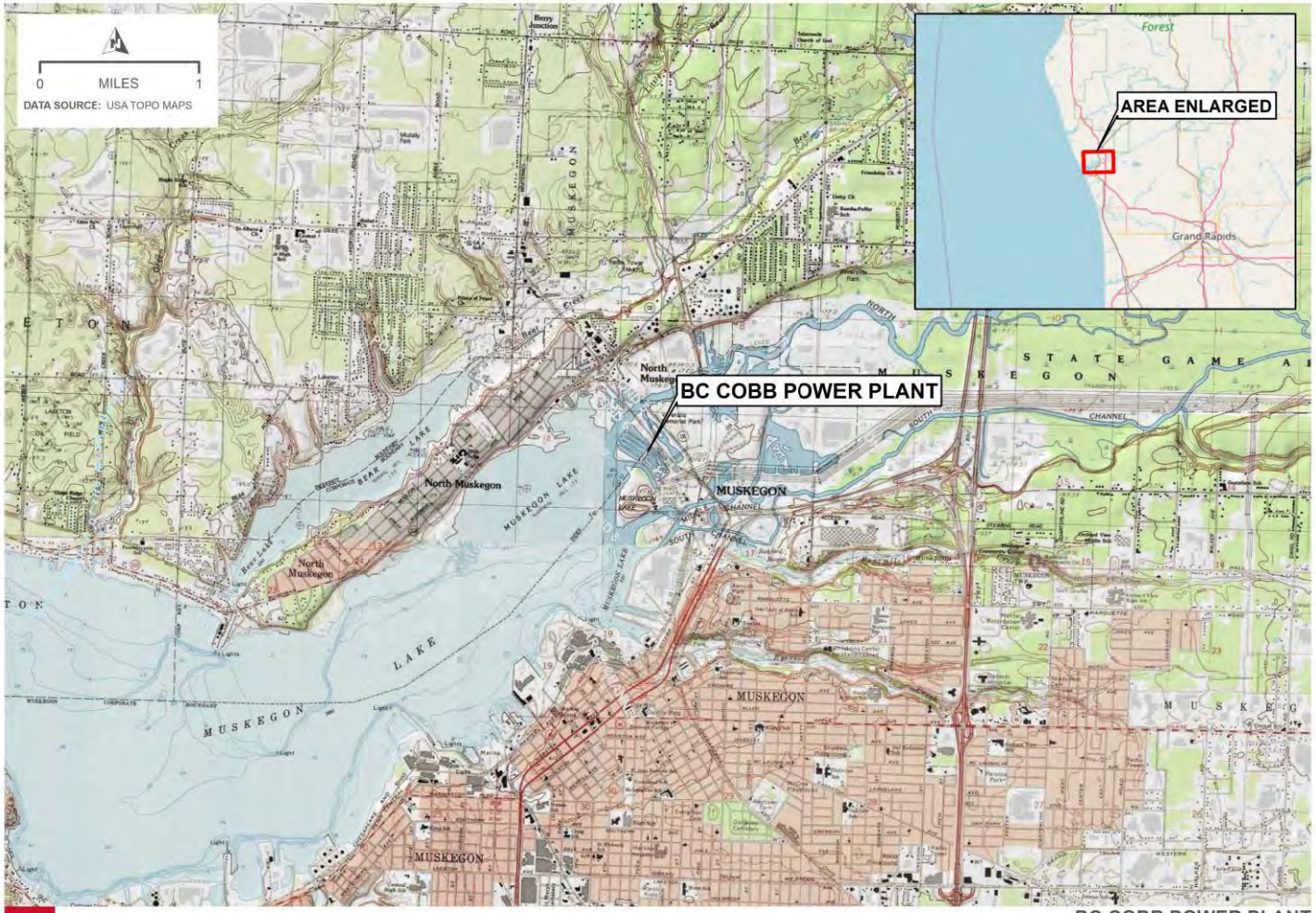

Figure 1. General Location.

Figure 2. CCR Unit and monitoring wells.

1.3 Site Description

The Site is in close proximity with several water bodies. Muskegon Lake is located to the east, Muskegon River to the northwest, and the Veterans Memorial Pond to the northeast. The Discharge Channel is along the southern border of the Site and discharges into Muskegon Lake. The two CCR units associated with the Site, the Bottom Ash Pond and Ponds 0-8, were wet ash wastewater treatment units. From 1984 through plant closure in 2016, CCR have been deposited in the ponds by utilizing sluicing methods. Bottom ash slurry was directed into the Bottom Ash Pond, with Bottom Ash Pond overflow being directed into Ponds 5 or 6. Fly ash from the power plant was directed into Ponds 7 and 8. The ponded CCR was routed through the remaining ponds in series. Each pond allowed a portion of CCR particles to settle out before the overflow was transferred to the next pond. The overflow from Pond 4 was discharged to a National Pollutant Discharge Elimination System (NPDES) outfall located on the Discharge Channel. CCR was periodically removed from the ponds and disposed or beneficially reused. During operation of the CCR units, the pond surface water elevations were at 588 feet. Since plant closure in 2016, the pond water elevation has lowered and appears to be approximately that of the adjacent Muskegon River.

1.4 Hydrogeologic Conceptual Model

Ponds 0-8 are primarily comprised of CCR and sand fill. According to historic U.S. Geologic Survey (USGS) topographic maps and aerial photographs dating back to 1929, the area currently occupied by the ash ponds was originally marsh land. The subsurface materials in the pond area generally consist of CCR ranging from 3 to 28 feet below ground surface (ft bgs) overlying 10 to 20 feet of poorly graded, fine-grained sand. Discontinuous layers of organic materials (i.e., humus and peat) are present within the fine-grained sand. Organic-rich silt was also encountered at depths ranging from 20 to 30 ft bgs, beneath the fine grained sand, ranging in thickness from approximately 1 to 13 feet. The organic-rich silt deposits are thickest in the perimeter berms along the southernmost edge of the pond area (toward Muskegon Lake). Thinner deposits of the organic-rich silt were encountered toward the northernmost edge of the pond area. Silty clay and/or poorly graded, fine- to medium-grained sand is generally observed within 30 to 40 ft bgs, beneath the organic-rich silt. An underlying clay was encountered throughout the pond area at approximately 40 ft bgs, beneath the fine to medium-grained sand. A cross section is provided in Appendix B.

Geologic maps of Michigan and local well records indicate that 120 to 190 feet of glacio-lacustrine sand, gravel, moraine and lacustrine clay deposits are present throughout Muskegon County. These lacustrine deposits are situated on top of the sandstone bedrock that is part of the Marshall Formation, typically encountered at approximately 200 to 250 ft bgs throughout Muskegon County. Glacio-lacustrine sands dominate in the western and southern areas surrounding Muskegon Lake. The site is located in the central area of the County.

Ponds 0-8 are bound by surface water features (Figure 2): The North Branch Muskegon River and former plant-associated discharge channel adjoin the western and southernmost boundaries of the pond area, and Veterans Memorial Pond is located north and northeast of the pond area.

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Groundwater flow within the uppermost aquifer has varied during plant operations and the post-shutdown period. While the ponds were actively receiving CCR and non-CCR wastewater, groundwater in the pond area was several feet higher than the surrounding surface water in Muskegon River and upgradient groundwater, creating a mound under the BCC surface impoundments, with groundwater flowing outward toward the surface water features. During shutdown there have been significant changes to the groundwater flow direction as a result of the lack of loading to the ponds that began in April 2016, and for a period of time in 2017 the Veterans Memorial Pond was dewatered for maintenance activities. Since shutdown, groundwater is encountered at a similar elevation to the surrounding surface water, generally within the range of 579 to 583 feet above mean sea level (ft AMSL).

The most recent monitoring event in May 2020 groundwater elevations varied little across the site, ranging between 582.85 and 581.46 ft AMSL, with a flow direction generally northeast (Figure 3). The gradient across the site in May 2020 was 0.0016 ft/ft. Using the average hydraulic conductivity measured at the Ponds 0-8 monitoring wells of 58 feet/day (ARCADIS, 2016), and an assumed effective porosity of 0.3, this results in groundwater flow rate of approximately 0.31 feet/day (approximately 113 feet/year).

2.0 Groundwater Monitoring

2.1 Monitoring Well Network

The CCR Rule requires, at a minimum, one upgradient and three downgradient monitoring wells per CCR unit to be completed in the uppermost aquifer. Section § 257.90 of the Rule states that the operator: *"…may install a multiunit groundwater monitoring system instead of separate groundwater monitoring systems for each CCR unit."* In addition, the Rule states that downgradient monitoring wells should be installed to: *"accurately represent the quality of groundwater passing the waste boundary of the CCR unit. The downgradient monitoring system must be installed at the waste boundary that ensures detection of groundwater contamination in the uppermost aquifer."*

The certified monitoring network at BC Cobb includes seven background wells on the southeast end of the Site to evaluate groundwater conditions unaffected by the CCR units. Ponds 0-8 are separated by narrow embankments that are not recommended for well installation (Figure 2). To install downgradient wells at the waste boundary, wells would need to be installed on the embankments. The CEC federal CCR Rule compliance monitoring program was developed for two CCR units (Ponds 0-8 as a multiunit and the Bottom Ash Pond). However, due to the proximity of the CCR ponds, the ash removal excavation area planned for the BCC ponds, the water quality results from CEC (described in Section 3.1), and the existing well network that complies with federal and state monitoring well location guidelines, MERG will monitor the BCC ponds as one CCR unit, including the Ponds 0-8 and the Bottom Ash Pond as a single CCR multiunit. The groundwater monitoring network will be composed of 20 wells at the waste boundary of the one CCR unit. The CCR unit boundary and the monitoring well locations are shown on Figure 2.

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2.1.1 Background Monitoring Locations

Seven wells (MW-15002 through MW-15008) were installed in the southeast area of the Site to evaluate water quality unaffected by the CCR unit. Figure 3 illustrates that these background wells are still upgradient or at a side gradient to the CCR unit and therefore even with groundwater flow changes at the site these wells remain appropriate background wells. MW-15001 was sampled during the background monitoring phase of the CCR Rule compliance program but now serves as a nature and extent well with only static water level measurement required.

2.1.2 Point of Compliance Monitoring Locations

The following twenty wells were installed in 2015 and 2017 and form the MERG multiunit monitoring well network around the CCR unit (Ponds 0-8 and the Bottom Ash Pond):

- MW-15009
- MW-15010
- MW-15011
- MW-15013
- MW-15014
- MW-15015R
- MW-15016R
- MW-15017
- MW-15018
- MW-15019
- MW-15020
- MW-15021
- MW-15022
- MW-15019
- MW-17001R
- MW-17002
- MW-17003
- MW-17004
- MW-17005
- MW-17006

Shallow wells (identified as MW-17001-MW-17006) were installed in 2017 and were paired with existing wells MW-15016 through MW-15021 to better characterize shallow groundwater quality and flow direction (Figure 2). MW-15016R through MW-15021 now provide data on deeper groundwater while MW-17001R through MW-17006 provide shallow groundwater data.

To accommodate pond closure construction in 2020, wells MW-15015, MW-15016, and MW-17001 have been relocated to within 10 feet of the original location. They are distinguished with an “R” following the well identifier (MW-15015R, MW-15016R and MW-17001R). Additionally, well MW-15012, which was part of the CEC CCR Rule compliance monitoring network, was removed to accommodate pond closure construction in 2020. Based on the CCR unit boundary, it was determined this well does not need to be replaced. As described in Section 3.1, this former well location has not had any exceedances of groundwater protection standards.

2.2 Well Construction

All of the monitoring wells proposed as part of the MERG groundwater monitoring network were constructed by CEC for compliance with the federal CCR Rule, except for the three recent replacement wells described above in Section 2.1 that were installed by MERG (MW-15015R, MW-15016R and MW-17001R) (Arcadis, 2016). Monitoring wells were constructed as 2-inch diameter polyvinyl chloride (PVC) wells completed in 6-inch diameter boreholes. The screen depths were targeted for placement at or below the top of the water table. Boreholes were drilled to a depth of approximately 10 to 15 feet below the uppermost saturated zone. The length of screen intervals was determined based on observations of each location during the soil boring. This resulted in borehole depths between 19 and 50 feet below ground surface

[DRAFT - ELECTRONIC REVIEW]

(bgs). Once the target drilling depth was reached at each borehole, the 2-inch diameter, Schedule 40 PVC casing and 3-10 foot well screen (0.010-inch slots) were assembled and installed. After well placement in the borehole, the filter pack sand and the bentonite pellet seal was placed via gravity feed from the surface into the annular space. The medium-grained sand filter pack was placed around each well screen to a minimum of 2 feet above the well screen. A 2-foot thick bentonite grout seal was placed on top of the well screen. A cement-bentonite grout of approximately 1.5 feet sealed the remainder of the annular space. All original wells (installed in 2015 and 2017) were finished with a 3-foot stickup well cover set in a 2-feet by 2-feet concrete pad. Each well is accompanied by two yellow bollards for protection. Relocated wells MW-15015R, MW-15016R, and MW-17001R are flush mount and installed with manhole covers instead of a locking stickup cover. Well construction details for all wells are included in Table 1. Boring logs and well construction logs are provided in Appendix C. Each well was developed by surging and purging until turbidity readings were below 10 NTUs.

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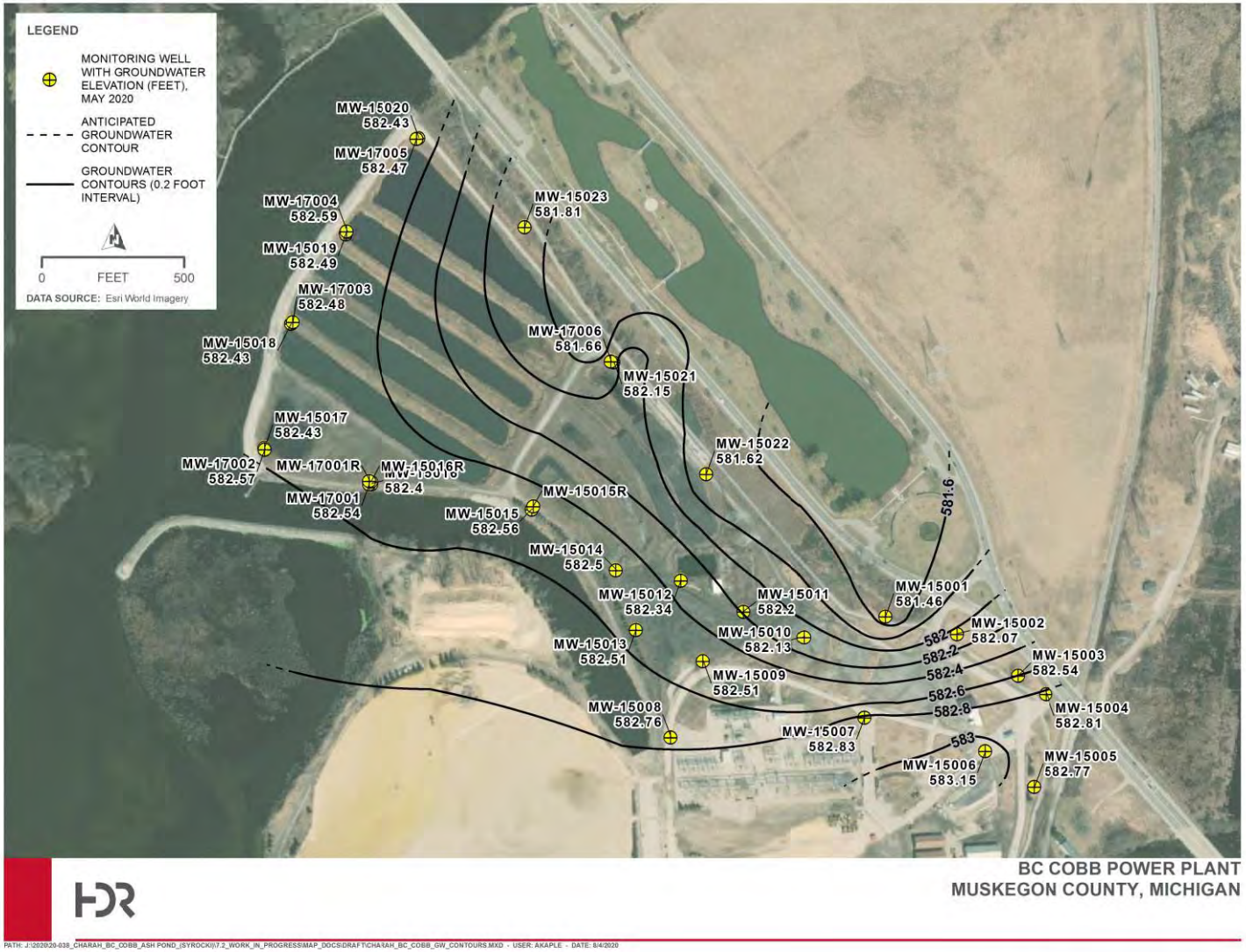

Figure 3. Groundwater elevation contours from May 2020.

Table 1. Well Construction Details for Groundwater Monitoring at Former BCC

Well ID	Easting NAD83 State Plane, Michigan South 2113 (feet)	Northing NAD83 State Plane, Michigan South 2113 (feet)	Elevation TOC (feet) NAVD88	Depth of Screen Interval (feet bgs)	Well Total Depth (feet bgs)	Well Stickup[3] (feet)	Casing Type	Static Depth to Water[2] (feet BTOC)	Static Water Elevation (feet)
MW-15001 Water Level Only	12624262.18	645763.32	586.52	10-20	20	2.92	2-inch Sch. 40 PVC	5.06	581.45
MW-15002	12624512.86	645701.73	586.87	15-20	20	3.07	2-inch Sch. 40 PVC	4.08	582.07
MW-15003	12624726.22	645555.93	587.12	13-18	18	3.02	2-inch Sch. 40 PVC	6.28	582.54
MW-15004	12624824.48	645491.68	590.57	5-15	15	2.87	2-inch Sch. 40 PVC	7.76	582.81
MW-15005	12624783.15	645166.74	587.77	5-15	15	2.97	2-inch Sch. 40 PVC	5.00	582.77
MW-15006	12624610.52	645291.65	587.81	5-15	15	2.91	2-inch Sch. 40 PVC	4.66	583.15
MW-15007	12624188.85	645409.39	587.43	4-10	10	2.93	2-inch Sch. 40 PVC	4.60	582.83
MW-15008	12623510.47	645340.01	587.76	4-9	9	2.96	2-inch Sch. 40 PVC	5.00	582.76
MW-15009	12623622.98	645606.92	589.27	14-24	24	2.97	2-inch Sch. 40 PVC	6.76	582.51

Table 1. Well Construction Details for Groundwater Monitoring at Former BCC

Well ID	Easting NAD83 State Plane, Michigan South 2113 (feet)	Northing NAD83 State Plane, Michigan South 2113 (feet)	Elevation TOC (feet) NAVD88	Depth of Screen Interval (feet bgs)	Well Total Depth (feet bgs)	Well Stickup[3] (feet)	Casing Type	Static Depth to Water[2] (feet BTOC)	Static Water Elevation (feet)
MW-15010	12623979.47	645690.69	588.11	12-22	22	2.91	2-inch Sch. 40 PVC	5.98	582.13
MW-15011	12623765.87	645780.29	595.22	21-31	31	2.92	2-inch Sch. 40 PVC	13.02	582.20
MW-15012 Abandoned for Construction	12623545.99	645889.92	597.39	21-31	31	2.89	2-inch Sch. 40 PVC	15.05	582.34
MW-15013	12623389.21	645716.41	598.50	30-40	40	2.60	2-inch Sch. 40 PVC	15.99	582.51
MW-15014	12623318.73	645925.93	599.04	23-31	31	2.84	2-inch Sch. 40 PVC	16.54	582.50
MW-15015[1] Abandoned	12623024.09	646138.93	596.75	20-30	30	2.85	2-inch Sch. 40 PVC	14.19	582.56
MW-15015R	12623028.78	646150.02	586.52	13-23	23	-0.27	2-inch Sch. 40 PVC	3.67	582.85
MW-15016[1] Abandoned	12622459.26	646227.56	589.05	35-40	45	2.85	2-inch Sch. 40 PVC	6.65	582.40
MW-15016R	12622458.17	646237.39	586.62	40-44	44	-0.20	2-inch Sch. 40 PVC	4.04	582.58

Table 1. Well Construction Details for Groundwater Monitoring at Former BCC

Well ID	Easting NAD83 State Plane, Michigan South 2113 (feet)	Northing NAD83 State Plane, Michigan South 2113 (feet)	Elevation TOC (feet) NAVD88	Depth of Screen Interval (feet bgs)	Well Total Depth (feet bgs)	Well Stickup[3] (feet)	Casing Type	Static Depth to Water[2] (feet BTOC)	Static Water Elevation (feet)
MW-15017	12622085.55	646354.69	588.61 586.33[4]	35-40	40	2.91	2-inch Sch. 40 PVC	6.18	582.43
MW-15018	12622179.74	646789.54	592.43 586.33[4]	37.5-42.5	42.5	3.03	2-inch Sch. 40 PVC	10.00	582.43
MW-15019	12622369.93	647103.13	592.42 586.32[4]	37-42	42	3.02	2-inch Sch. 40 PVC	9.93	582.49
MW-15020	12622626.85	647436.97	592.23 586.26[4]	35-40	40	2.73	2-inch Sch. 40 PVC	9.80	582.43
MW-15021	12623310.03	646654.84	593.73	39.5-42.5	42.5	3.03	2-inch Sch. 40 PVC	11.58	582.15
MW-15022	12623634.96	646263.16	595.82	24-30	30	3.22	2-inch Sch. 40 PVC	14.20	581.62
MW-15023	12622999.24	647125.15	588.08	12-19.5	19.5	2.68	2-inch Sch. 40 PVC	6.27	581.81
MW-17001[1] Abandoned	12622452.1	646228.0	589.29	15-20	20	3.19	2-inch Sch. 40 PVC	6.75	582.54
MW-17001R	12622452.13	646239.58	586.61	15-20	20	-0.22	2-inch Sch. 40 PVC	3.79	582.82

Table 1. Well Construction Details for Groundwater Monitoring at Former BCC

Well ID	Easting NAD83 State Plane, Michigan South 2113 (feet)	Northing NAD83 State Plane, Michigan South 2113 (feet)	Elevation TOC (feet) NAVD88	Depth of Screen Interval (feet bgs)	Well Total Depth (feet bgs)	Well Stickup[3] (feet)	Casing Type	Static Depth to Water[2] (feet BTOC)	Static Water Elevation (feet)
MW-17002	12622087.2	646348.8	588.79 586.26[4]	13.5-18.5	18.5	2.99	2-inch Sch. 40 PVC	6.22	582.57
MW-17003	12622184.8	646794.9	592.37 586.31[4]	17-22	22	3.07	2-inch Sch. 40 PVC	9.89	582.48
MW-17004	12622373.4	647110.1	591.84 586.27[4]	17.5-22.5	22.5	2.74	2-inch Sch. 40 PVC	9.25	582.59
MW-17005	12622619.7	647433.9	592.42 586.33[4]	20-25	25	3.12	2-inch Sch. 40 PVC	9.95	582.47
MW-17006	12623301.6	646657.7	593.78	24.5-29.5	29.5	3.28	2-inch Sch. 40 PVC	12.12	581.66

[1]Wells were removed in May 2020 during the construction of a soil bentonite wall (SBW) and relocated within 10 feet of previous location. Relocated wells denoted with "R" after original well ID number. Easting/Northing location data obtained from MERG survey May 21, 2020.

[2]Static water level for wells MW-15001 – MW-17006 was measured the week of May 4, 2020 – May 8, 2020. Water level for relocated wells MW-15015R, MW-15016R, and MW-17001R was measured on May 21, 2020.

[3]Location and construction data (Easting/Northing, Elevation TOC, Screen Interval, Well Stickup, and Casing Type) for wells MW-15001 – MW-15023 was obtained from *Summary of Monitoring Well Design, Installation, and Development* report by Arcadis 2016. Location and construction data for wells MW-17001 – MW-17006 was obtained from the *2019 Annual Groundwater Monitoring Report* prepared by TRC. Construction data was obtained for MW-15015R, MW-15016R, and MW-17001R from Final Boring-Well Logs prepared by SME May 12, 2020.

[4]Well elevations changed from stick up to flush mount for construction activities May 12, 2020.

3.0 Groundwater Sampling and Analysis

3.1 Ongoing CCR Rule Compliance Monitoring Program

3.1.1 Background Monitoring

The BC Cobb groundwater monitoring program was implemented by CEC after the CCR Rule was initiated on October 19, 2015. The CCR Rule Part §257.93 requires a minimum of eight background samples to be collected before October 17, 2017 for the 40 CFR Part 257 Appendix III and IV constituents (Table 2). CEC conducted quarterly CCR Rule compliance Background monitoring between November 2015 and September 2017.

Table 2. Groundwater Quality Parameters in Compliance with the CCR Rule Part 257

Appendix III Constituents for Detection Monitoring	Analytical Reporting Limit of CEC Federal Monitoring Compliance Program (2015-2019)	Units
Boron	5.0	ug/L
Calcium	5.0	mg/L
Chloride	25.0	mg/L
Fluoride	100	ug/L
pH	0.1	SU
Sulfate	0.25	mg/L
Total Dissolved Solids (TDS)	20.0	mg/L
Appendix IV Constituents for Assessment Monitoring		
Antimony	1.0	ug/L
Arsenic	1.0	ug/L
Barium	10	ug/L
Beryllium	0.20	ug/L
Cadmium	0.20	ug/L
Chromium	1.0	ug/L
Cobalt	1.0	ug/L
Fluoride	100	ug/L
Lead	1.0	ug/L
Lithium	10.0	ug/L

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Table 2. Groundwater Quality Parameters in Compliance with the CCR Rule Part 257		
Mercury	0.20	ug/L
Molybdenum	1.0	ug/L
Selenium	1.0	ug/L
Thallium	1.0	ug/L
Radium 226 and 228 combined	1.0	pCi/L
Additional Parameters		
Total Suspended Solids (TSS)	25	mg/L

3.1.2 Detection Monitoring

The eight rounds of background water quality data for the background/upgradient wells (MW-15002 – MW-15008) were used to develop background threshold values (BTVs) for each Appendix III and IV constituent of interest (COI). CEC used the upper tolerance limit (UTL) of the background wells (lumped) for each COI to develop the BTVs. Detection monitoring analyzed Appendix III COIs and identified a statistically significant increase (SSI) of boron, fluoride, and pH in at least one of the downgradient wells. CEC's contracted consultant, TRC, performed an Alternative Source Demonstration (ASD) but did not find evidence of a source other than the Ponds. Therefore, CEC initiated assessment monitoring.

3.1.3 Assessment Monitoring

The first CCR Rule compliance assessment monitoring sampling event took place in April 2018. Per CCR Rule, CEC sampled and analyze the groundwater in each well for all COIs in Appendix IV of Part §257, for the purposes of determining detected COIs. Within 90 days of obtaining results from the initial assessment monitoring sample event, and on a semiannual basis thereafter, CEC initiated a program to sample all wells for Appendix III and detected Appendix IV COIs. CEC sampled semiannually between June 2018 and September 2019 as part of the assessment monitoring program. MERG acquired the property in April 2020 and continued CCR Rule assessment monitoring by monitoring in May 2020.

Under the assessment monitoring program and in accordance with 40 CFR § 257.95(e-g), Appendix III and IV monitoring results must be compared to BTVs and the groundwater protection standards (GPS). In accordance with 40 CFR § 257.95(g-h), CEC developed GPS for each Appendix IV COI and identified concentrations of lithium at statistically significant levels (SSLs) above the GPS at two downgradient wells, MW-17001 and MW-17002 on the first semiannual assessment monitoring event (June 2018). The notification to the operating record of the SSLs was followed up with a Response Action Plan submitted to the EGLE on March 15, 2019 laying out the preliminary understanding of water quality and actions that were underway to mitigate unacceptable risk associated with the identified release from the CCR unit. The Assessment of Corrective Measures (ACM) was initiated on April 15, 2019 and was certified and submitted to the EGLE on September 11, 2019 and provided in the Response Action Plan.

[DRAFT - ELECTRONIC REVIEW]

MERG has acquired the Site and has initiated the source removal corrective measure by installing a slurry wall and dewatering pumps. MERG anticipates ash removal between August 2020 and December 2021. MERG will continue the CCR Rule compliance semiannual groundwater assessment monitoring along with annual and semiannual reporting until closure groundwater conditions are observed.

Attachment 1 provides the 2019 and 2017 Groundwater Monitoring Reports for the Site to provide prior statistical evaluations completed, including the development of background values and assessment monitoring statistical evaluations.

3.2 Part 115 Compliance Monitoring Program

3.2.1 Background Monitoring

The BC Cobb CCR Rule compliance groundwater monitoring program has BTVs developed for Appendix III and IV COIs. The Michigan Statute 324.11511a(3)(c) provides the list of detection monitoring parameters, which are the same as the detection monitoring parameters for the CCR Rule compliance (Appendix III, Table 2), with the exception that the State Statute also includes total iron. The Michigan Statute 324.11519b(2) provides the list of assessment monitoring parameters, which are the same as the assessment monitoring parameters for the CCR Rule compliance (Appendix III and IV, Table 2), with the exception that the State Statute also includes total copper, nickel, silver, vanadium, and zinc. The existing groundwater dataset for the Site does not include iron, copper, nickel, silver, vanadium, or zinc. The current groundwater monitoring status by MERG is semiannual Assessment Monitoring at the site. Because the source removal corrective measure for the Site is currently underway, and future findings for these six new concentrations at the site will not change the corrective measure approach (ash removal for Ponds 0-8 and the Bottom Ash Ponds), additional site visits (more frequent or earlier in time) to collect these new COI data are not warranted. Therefore, to develop BTVs for total iron, copper, nickel, silver, vanadium, and zinc, MERG proposes to add these six additional State COIs to the existing COI list for each monitoring event moving forward, from both background wells and downgradient wells. With continuation of the semiannual assessment monitoring during pond closure, MERG will develop a BTV for each of these six new COIs by lumping the background well data after four sample events (November 2020, May and November 2021 and May 2022) and calculating the 95 UTL for iron, copper, nickel, silver, vanadium, and zinc to be consistent with the existing statistical program.

3.2.2 Detection Monitoring

According to Michigan Statute 324.11511a(3), 11512a(1), and 11519a(1)(h), semiannual detection monitoring for CCR surface impoundments is required. Detection monitoring was completed by CEC under the BC Cobb CCR Rule compliance program, which identified SSIs for boron, fluoride, and pH in downgradient wells. As described in 3.2.1, total iron is the only new COI required in Part 11511a(3)(c) for the State compliance groundwater monitoring program not already monitored at BC Cobb under the CCR Rule compliance program. After the BTV for iron has been developed, as described above in 3.2.1, the concentrations of iron from each downgradient well during each semiannual assessment monitoring event will be compared to the BTV for iron. Should an SSI be detected for iron, a notice will be placed in the operating record within 14 days of the determination and notify the director that the notice was placed in

[DRAFT - ELECTRONIC REVIEW]

the operating record. However, the Site is already in Assessment Monitoring, therefore no additional monitoring program status change will be required. Alternatively MERG may document that the SSI resulted from an error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

3.2.3 Assessment Monitoring Program

According to Michigan Statute 324.11519b(2), if the detection monitoring confirms a statistically significant increase over background for 1 or more of the constituents listed in section 11511a(3), the owner shall conduct assessment monitoring. The constituents to be monitored in the assessment monitoring program shall include those listed in section 11519b(2). Detection monitoring performed by CEC identified SSIs of boron, fluoride, and pH in at least one of the downgradient wells; therefore assessment monitoring was initiated by CEC at the Site in 2018 under the federal monitoring program.

Under the CCR Rule compliance groundwater program, MERG is currently in assessment monitoring, performing semiannual groundwater monitoring. MERG proposes to initiate State Part 115 compliance groundwater monitoring by starting within Assessment Monitoring status. The list of COIs required in Part 11519b(2) for assessment monitoring compliance has five COIs not previously analyzed at the Site under the existing CCR Rule compliance Assessment Monitoring Program, these include copper, nickel, silver, vanadium, and zinc. Therefore background data collection will be required for those five parameters (plus iron from the detection monitoring Part 115 COI list). After the BTVs for copper, nickel, silver, vanadium, and zinc are developed, a GPS will be developed for each of these new COIs.

MERG will continue to perform semiannual assessment monitoring, sampling from background wells and downgradient wells around the CCR unit. MERG will analyze samples for the COIs in Part 11511a(3) and 11519b(2).

After each semiannual sample event, MERG will update the statistics for each downgradient well to determine:

- If the concentrations of all constituents listed in 11519b(2) are shown to be at or below background values for 2 consecutive sampling events, then MERG will notify the director of the finding and may return to detection monitoring (R 299.4441(5)).
- If there are detects of concentrations of one or more constituents listed in Michigan Statute 324.11511a(3) and 324.11519b(2) at statistically significant levels above the GPS the State will be notified within 14 days. In addition, the Assessment of Corrective Measures semiannual updates will include the addition of the additional SSLs as well as any description if the identification of the new SSL COIs would be reason to evaluate additional corrective measures not previously described. The Response Action Plan will also be assessed to determine if it requires edits to reflect the newly identified SSLs. Typically identification of SSLs would also trigger ceasing acceptance of coal ash at the impoundment and a requirement to begin implementation of closure; however BC Cobb has already completed those steps.

[DRAFT - ELECTRONIC REVIEW]

As described above, CEC previously identified SSLs for lithium at two shallow wells based on the federal CCR Rule compliance groundwater program GPS values; however the concentrations of lithium (lower confidence limits from each downgradient well) are below the GPS values developed for lithium under this State Part 115 compliance groundwater program (GPS values provided in the Statistical Procedures Plan in Appendix E). For copper, nickel, silver, vanadium, and zinc, this SSL test cannot be completed until November 2022 assessment monitoring event for background water quality to be collected and BTVs developed.

3.3 Monitoring Schedule and Frequency

Semiannual Assessment Monitoring will continue until the CCR units are closed, as approved by EGLE. See Table 3 and Table 4 below for the sample locations and frequencies, respectively.

Table 3. Groundwater Sample Locations

Background Monitoring Wells	MW-15002 MW-15003 MW-15004 MW-15005 MW-15006 MW-15007 MW-15008
Downgradient Monitoring Wells	MW-15009 MW-15010 MW-15011 MW-15013 MW-15014 MW-15015R MW-15016R MW-15017 MW-15018 MW-15019 MW-15020 MW-15021 MW-15022 MW-15023 MW-17001R MW-17002 MW-17003 MW-17004 MW-17005 MW-17006
Total Monitoring Wells to be Sampled	28
QC Samples to be collected per sample event (Field Duplicate 1 per 10 sampled wells)	1-3
Total samples submitted to lab for analysis for each sample event	29
Water Level Only Monitoring Wells	MW-15001

[DRAFT - ELECTRONIC REVIEW]

Table 4. CCR Groundwater Sample Collection Frequency

Type of Monitoring	Wells	Year	Frequency	Water Quality Constituents of Interest
Background Monitoring*	Background Wells	Nov 2020-May 2022	Semiannual - 4 events	Iron, Copper, Nickel, Silver, Vanadium, and Zinc
Assessment Monitoring*	Background and Downgradient	Nov 2020-until Clean Closure	Semiannual	Michigan Statute 324.11511a(3) and 324.11519b(2)

*These events are the same field sample events – semiannual sampling of background and downgradient wells for all MI Statute 324.11511a(3) and 324.11519b(2) parameters; however concentrations for the six new COIs from the first 4 events will be used to develop the BTVs for those COIs.

3.4 Sampling Procedures

Appendix D provides the proposed sample collection and safety procedures. Procedures are consistent with EPA guidelines and the CCR Rule. MERG or a Contracted Consultant will collect all samples.

3.4.1 Quality Control

Quality Control (QC) checks of both the field procedures and laboratory analyses will be used to assess and document data quality and to identify discrepancies in the measurement process that need correction. Quality control samples will be used to assess various data quality parameters such as representativeness of the environmental samples, the precision of sample collection and handling procedures, and the accuracy of laboratory analyses. In addition, all sample containers, preservation methods, and holding times will be in accordance with QC requirements.

The analytical laboratory will use a series of QC samples, as identified in the laboratory's Quality Assurance Plan and specified in the standard analytical methods. The types of samples include method blanks, surrogate spikes, laboratory control samples, laboratory control sample duplicates, matrix spikes, and matrix spike duplicates. Analyses of QC samples will be performed for samples of similar matrix type and concentration and for each sample batch. Laboratory accuracy is assessed through the analysis of matrix spike/matrix spike duplicate (MS/MSD) samples. The number of MS/MSD analyses is based on laboratory quality control standards. MERG approved contract laboratory will run MS/MSD samples at a rate of 5 percent, or one for every 20 samples analyzed. MS/MSD analysis results reflect the ability of the laboratory and method to accurately determine the quantity of an analyte in a particular sample. The measurement of "standards", or materials of accepted reference values, provides an assessment of the accuracy of laboratory instruments and analytical methods. Accuracy will be evaluated through the use of EPA Quality Control Samples or Standard Reference Materials. Accuracy at the laboratory is expressed as percent recovery of the control sample. Laboratory MS recovery requirement is 80 to 120 percent, and MSD maximum difference is 20 percent.

The precision of field sampling procedures will be evaluated by collection and analysis of field duplicate samples. Duplicate samples are two or more samples collected or processed so that the samples are considered to be essentially identical in composition. Duplicate samples will be

[DRAFT - ELECTRONIC REVIEW]

used to evaluate the reproducibility (precision) of analyte concentration values reported by the laboratory. Although two replicates are not adequate to assess precision, they can be used to show whether variability of results for the samples is within the range of expected precision.

The number of duplicate samples to be collected would typically be at a rate of ten percent (approximately one for every ten samples). Sample identification for duplicates will be the same as the sample identification with the addition of a "Duplicate" (e.g. MW-15018 and MW-15018D). The precision will be measured through the evaluation of relative percentage differences (RPDs) between sample and duplicate sample and between matrix spike and matrix spike duplicates and calculated as follows:

$$\text{Relative Percentage Difference (\%)} = \frac{\text{concentration SA-concentration SB}}{\text{Average concentration of SA+SB}} \times 100$$

Where SA denotes Sample A; SB denotes the duplicate, sample B.

Duplicate RPD requirement is 20 percent. Accuracy is measured by the difference between the measured or observed value and the true or assigned value. Accuracy in the field is assessed through the adherence to all sample handling, preservation, and holding times.

Calibration of field equipment is completed by the rental equipment company prior to each rental, and calibration records are included with the equipment. Therefore, calibration of field equipment measuring field parameters (YSI or similar) will be calibrated at the beginning of each sample event. The calibration record from the equipment company will be reviewed to ensure accurate calibration. The sample crew will photograph the calibration documentation provided with the equipment.

Laboratory data will be reviewed, validated and qualified if necessary prior to use. The laboratory data validation procedure is described in Section 3.6.

3.5 Monitoring Parameters and Analytical Methods

3.5.1 Sample Parameters

Parameters to be analyzed for each semiannual assessment monitoring event are shown on Table 5. These parameters include all of the constituents required for groundwater sampling by the Part 115 Solid Waste Regulations. Analytical testing of water samples will be performed by Trace Analytical, a contract laboratory in Muskegon, Michigan. Field measurements will be collected by the sampling team during the purging process. The field measurements are specific conductance, temperature, dissolved oxygen, pH, turbidity, and oxidation/reduction potential (ORP).

Table 5. Groundwater Quality Parameters to be Analyzed
Constituents for Assessment Monitoring*
Boron
Calcium

[DRAFT - ELECTRONIC REVIEW]

Table 5. Groundwater Quality Parameters to be Analyzed
Chloride
Iron
Fluoride
pH
Sulfate
Total Dissolved Solids (TDS)
Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Copper
Fluoride
Lead
Lithium
Mercury
Molybdenum
Nickel
Selenium
Silver
Thallium
Vanadium
Zinc
Radium 226 and 228 combined
Additional Constituents
Total Suspended Solids

*All metals are to be analyzed as total metals.

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3.5.2 Sample Analysis

Error! Reference source not found. lists the constituents of interest that will be analyzed by he contract laboratory and the analytical methods, preservation, and sample holding times.

Table 6. Water Quality Parameters to be Analyzed

Parameter		Sample Bottle	Units to be reported	Preservation	Method	Holding Time	Laboratory Reporting Limits
Sb, total	Antimony	250 mL plastic	mg/L	Nitric Acid	200.8	6 mos	0.00025
As, total	Arsenic		mg/L	Nitric Acid	200.8	6 mos	0.00055
Ba, total	Barium		mg/L	Nitric Acid	200.8	6 mos	0.0025
Be, total	Beryllium		mg/L	Nitric Acid	200.8	6 mos	0.00025
B, total	Boron		mg/L	Nitric Acid	200.7	6 mos	0.00875
Cd, total	Cadmium		mg/L	Nitric Acid	200.8	6 mos	0.00025
Cr, total	Chromium		mg/L	Nitric Acid	200.8	6 mos	0.00025
Co, total	Cobalt		mg/L	Nitric Acid	200.8	6 mos	0.000525
Cu, total	Copper		mg/L	Nitric Acid	200.8	6 mos	0.00025
Fe, total	Iron		mg/L	Nitric Acid	200.7	6 mos	0.008
Pb, total	Lead		mg/L	Nitric Acid	200.8	6 mos	0.00055
Li, total	Lithium		mg/L	Nitric Acid	200.7	6 mos	0.0012
Hg, total	Mercury		mg/L	Nitric Acid	7470A	28 d	0.0002
Mo, total	Molybdenum		mg/L	Nitric Acid	200.8	6 mos	0.00125
Ni, total	Nickel		mg/L	Nitric Acid	200.8	6 mos	0.00025
Se, total	Selenium		mg/L	Nitric Acid	200.8	6 mos	0.0005
Ag, total	Silver		mg/L	Nitric Acid	200.8	6 mos	0.00005
Tl, total	Thallium		mg/L	Nitric Acid	200.8	6 mos	0.000375
V, total	Vanadium		mg/L	Nitric Acid	200.8	6 mos	0.00125
Zn, total	Zinc		mg/L	Nitric Acid	200.8	6 mos	0.00125
Ca	Calcium	250 mL plastic 1 L Plastic	mg/L	Nitric Acid	6010D	6 mos	0.255
F	Fluoride		mg/L	Chill	300.0	28 d	0.02
Cl	Chloride		mg/L	Chill	300.0	28 d	0.1
SO_4	Sulfate		mg/L	Chill	300.0	28 d	0.6

[DRAFT - ELECTRONIC REVIEW]

TDS	Total Dissolved Solids	1 L plastic	mg/L	Chill	SM 2540C	7 d	10
TSS	Total Suspended Solids	1 L plastic	mg/L	Chill	SM 2540D	7 d	10
RA226/228	Radium 226 and 228 combined	(2) 1 L plastic	pCi/L	HNO_3	903.0/904.0	6 mos	1.0ea 2.0comb

3.6 Data Validation

This section describes the processes for data review and validation. MERG or it's Contracted Consultant (CC) will perform the data validation, statistical analysis, interpretation, and reporting. The scanned field forms, the laboratory reports (pdf and EDD), and the chain of custody (COC) will be used to complete the process.

3.6.1 Field Data Review

The field data review will be performed by MERG or it's CC and include verification that QC checks and calibrations are recorded properly in the field data sheets and that any necessary and appropriate corrective actions were implemented and recorded. Such data will be written into field data sheets immediately after measurements are taken. If errors are made, results will be legibly crossed out and corrected in a space adjacent to the original (erroneous) entry. If transcription errors have been made, the LS and EFT will address the errors to provide resolution.

Field measurement data will be entered by the CC into electronic files for data validation and data interpretation. Table 6 lists the field records that will be validated and verified and who is responsible.

3.6.2 Laboratory Data Review

External laboratory data-reduction procedures will be performed according to the laboratory's Quality Assurance Manual. Paper and electronic data files will be maintained by the laboratory to document the sample identification number and the sample tag number with sample results and other details, such as analytical method used, name of analyst, date of analysis, matrix sampled, reagent concentrations, instrument settings, and raw data.

The laboratory review process will include a review by the analyst, a second-level review by a supervisor or designee, and a completeness review by the laboratory's Project Manager prior to final data reporting. QC data (for example, laboratory duplicates, LCSs, MSs, and MSDs) will be compared to the acceptance criteria. The laboratory will appropriately flag unacceptable data in the data package.

Table 6 lists the analytical data package records that will be validated and verified and who is responsible.

[DRAFT - ELECTRONIC REVIEW]

Table 6. Data Verification and Validation Inputs				
Item	**Description**	**Verification (Completeness)**	**Validation (Conformance to Specifications)**	**Who Will Verify or Validate**
Field Records				
1	Field equipment calibration records	X	X	CC
2	Chain-of-Custody forms	X		CC
3	Field decontamination documentation	X		CC
4	Sample collection field forms	X		CC
5	Drilling logs	X		CC
6	Well construction logs	X		CC
7	Well development field forms	X		CC
Analytical Data Package				
9	Cover sheet (laboratory identifying information)	X	X	CC
10	Case narrative	X	X	CC
11	Internal laboratory Chain-of-Custody forms	X	X	CC
12	Sample chronology and consistency (that is, dates and times of receipt, preparation, and analysis)	X	X	CC
13	Communication records with laboratory	X	X	CC
14	EDD format consistency	X		CC
15	Sample identification, results nomenclature, and data qualifier consistency	X		CC
16	Method detection limit consistency	X	X	CC
17	Instrument calibration records	X	X	CC
18	Laboratory Report	X	X	CC
19	Field QC sample results and calculation of accuracy and precision	X	X	CC

3.6.3 Verification

Verification is a completeness check that is performed before the data review process continues in order to determine whether the required information was collected and is available. Verification is not designed for use in qualitative review but ensures the availability of sufficient

[DRAFT - ELECTRONIC REVIEW]

information for subsequent steps of the data review process. Example inputs for conducting the completeness check are listed in Table 6 above.

The following procedures will be completed by the CC for data verification:

- COC forms and shipping documents will be reviewed and verified for completeness and accuracy against the actual contents of the laboratory report and EDD.
- Field notes will be reviewed for completeness and accuracy.

3.6.4 Data Validation

The purposes of data validation are to minimize suspect analytical data, designate a data qualifier for any data quality limitation discovered, and eliminate analytical data that do not pass validation acceptance criteria. A formal data validation will be performed by CC and will include a review of field QC sample analyses and laboratory data. The CC will determine whether the measurement performance criteria have been met and will calculate the data completeness for the project.

EVALUATING FIELD DATA

The results of field QC sample analyses associated with each laboratory data package will be reviewed by the CC to evaluate field QC samples and further indications of the data quality. If a problem is identified through reviewing field QC data, all related field samples will be identified by the CC, and, if possible, corrective actions will be instituted and documented. If data are compromised because of a problem identified via field QC sample review, appropriate data qualifications will be used by the CC to identify the data for future data users.

The handling, preservation, and storage of samples collected during the sampling program will be monitored by the CC on an ongoing basis. The sample receipt records (a required data package deliverable) as well as the COC documentation will also be assessed by the CC during data validation. Sample handling, storage, or preservation problems identified during data validation will result in appropriate qualification of data.

EVALUATING LABORATORY DATA

Data verification will be performed by the CC on 100 percent of the data to ensure completeness of the data packages. The purpose of chemistry data validation is to verify that the data are of known quality, are technically valid, are defensible, and are usable for their intended purpose. The objectives of the data validation process are to:

- Verify completeness of data packages and corresponding EDDs.
- Assess compliance with project-specific procedures and programs.
- Evaluate system process control to ensure that no systematic errors exist within the data sets.
- Assess field QC samples to determine whether sampling has adversely affected the reported results and, therefore, usability.
- Assess both method and laboratory performance through tabulation of QC outliers.

[DRAFT - ELECTRONIC REVIEW]

- Provide measures of data quality in terms of precision, accuracy, and completeness so that overall usability can be determined.

Data validation will be performed by CC using the general protocols and processes described in the following documents, as applicable:

- Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (USEPA, 2010) (as a general guidance and using professional judgment for the validation in support of or in the absence of method-specific direction)
- Guidance for Labeling Externally Validated Laboratory Analytical Data (USEPA, 2009a)

One hundred percent of the data will undergo a Stage 2B validation by the CC. The following specific QC elements will be reviewed during the validation:

- Presence and completeness of COC and sample receipt documentation
- Sample index (correlation of field sample identifier [ID] to laboratory sample ID)
- Laboratory case narrative (method deviations and QC anomalies)
- Analytical holding times
- Method blank
- Field duplicate RPD values
- Laboratory duplicate RPD values
- Summaries of instrument blanks (for example, internal calibration blank [ICB] and continuous calibration blank, if specified in the method)
- Interference check samples (ICP and ICP–mass spectrophotometry [ICP-MS])
- Review of LCSs
- Serial dilutions (ICP and ICP-MS)
- Post-digestion spikes
- Summaries of internal standards

Each data package will be accompanied by an EDD prepared by the laboratory. Additional laboratory QC data can be included in the EDD as long as the data fields specified in the EDD are also maintained. EDDs will be cross checked by the CC against corresponding data reports to confirm consistency in the results reported in these two separate formats. The following data qualifiers will be applied during data validation by the CC:

U	The analyte was analyzed for, but was not detected at, a level greater than or equal to the level of the adjusted reporting limit (RL) for the sample and method.
J	The analyte was positively identified, and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain QC criteria were not met, or to the concentration of the analyte being below the RL).

[DRAFT - ELECTRONIC REVIEW]

J+	Same as J, and the reported concentration is potentially biased high.
J–	Same as J, and the reported concentration is potentially biased low.
UJ	The analyte was not detected at a level greater than or equal to the adjusted method detection limit (MDL). However, the reported adjusted MDL is approximate and might be inaccurate or imprecise.
R	The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte might or might not be present in the sample.

After the fieldwork and the final analytical data have been completed and reviewed by the CC for each sampling event, a Data Quality Summary Report will be prepared by the CC for the project. The report will summarize quality assurance and audit information, including the results of the data review; will evaluate field QC sample data, such as field duplicates; and will describe any corrective actions taken. The Data Quality Summary Reports will be appended to the project report.

3.6.5 Data Usability Assessment

Data collected from the field activities will be evaluated against the following data quality parameters.

PRECISION

Precision refers to the degree to which repeated measurements are similar to one another when obtained under prescribed conditions. Precision will be assessed by evaluating the results of field duplicates to determine RPD. QC procedures and acceptance criteria are summarized in **Table 8**.

For precision:

RPD for field duplicates percent RPD = $\left[\frac{|Amount\ in\ sample\ 1 - Amount\ in\ Sample\ 2|}{Amount\ in\ Sample\ 1 + Amount\ in\ sample\ 2}\right] x\ 100$

ACCURACY

Accuracy is defined as the measure of the closeness of an individual measurement or the average of a number of measurements to the actual or "true" value. Laboratory accuracy will be assessed by evaluating LCSs and MSs and calculating the percent recovery (percentR). QC procedures and acceptance criteria are summarized in Table 7.

For accuracy:

Percent recovery for MS percentR = $\left(\frac{Spike\ conc. - Sample\ conc.}{Amount\ of\ spike\ added}\right) x\ 100$

Percent recovery for LCS percentR = $\left(\frac{Spike\ conc.}{Amount\ of\ spike\ added}\right) x\ 100$

[DRAFT - ELECTRONIC REVIEW]

COMPLETENESS

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount of data that was expected or planned for. A qualified datum will be considered unless it has been rejected (R), in which case it is unusable. The goal for completeness is 100 percent; however, a rejected (unusable) datum will be evaluated to determine whether data gaps exist or whether the project objectives were met without it.

For completeness:

Percent completeness = $\left(\frac{Number\ of\ usable\ measurements}{Number\ of\ planned\ measurements}\right) x\ 100$

A brief Data Validation Report will be developed for each semiannual sample event and will document the results of the data verification and validation. This report will describe the conclusions made during the data assessment regarding data usability. Any limitations on the usability of the data will be explained, including the reasons for data qualifiers, the definitions of the qualifiers, and a summary of the specific acceptance criteria that were assessed and found to be outside control limits.

Table 7. Minimum QC Procedures for Project Parameters

Quality Check	Minimum Frequency	Acceptance Criteria	Corrective Action(s)
Metals by ICP-MS			
Laboratory control sample (percent recovery)*	One per analytical batch	75–125	Correct the problem, then reanalyze. If still out, reprep and reanalyze the LCS and all samples in the affected batch.
Laboratory matrix spike/matrix spike duplicate (percent recovery)*	One per analytical batch	75–125	Assess data to determine whether there is a matrix effect or analytical error. Analyze LCS for failed target analytes. Communicate matrix effects to the prime contractor so an evaluation can be made by the PC with respect to the project quality objectives.
Field duplicate relative percent difference	One per 10 sampled wells	20	None. Field duplicates are collected to provide information about overall precision and the ability of sampling techniques to produce a representative sample.
Total Suspended Solids and Total Dissolved Solids			
Laboratory control sample (percent recovery)*	One per analytical batch	75–125	Correct the problem, then reanalyze. If still out, reprep and reanalyze the LCS and all samples in the affected batch.
Laboratory matrix spike/matrix spike duplicate (percent recovery)*	One per analytical batch	Not applicable	Not applicable.
Field duplicate relative percent difference	One per 10 sampled wells	20	None. Field duplicates are collected to provide information about overall precision and the ability of sampling techniques to produce a representative sample.

[DRAFT - ELECTRONIC REVIEW]

Table 7. Minimum QC Procedures for Project Parameters			
Quality Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action(s)**
Anions			
Laboratory control sample (percent recovery)*	One per analytical batch	75–125	Correct the problem, then reanalyze. If still out, reprep and reanalyze the LCS and all samples in the affected batch.
Laboratory matrix spike/matrix spike duplicate (percent recovery)*	One per analytical batch	75–125	Assess data to determine whether there is a matrix effect or analytical error. Analyze LCS for failed target analytes. Communicate matrix effects to the prime contractor so an evaluation can be made by the PC with respect to the project quality objectives.
Field duplicate relative percent difference	One per 10 sampled wells	20	None. Field duplicates are collected to provide information about overall precision and the ability of sampling techniques to produce a representative sample.
Radium 226/228			
Laboratory control sample (percent recovery)*	One per analytical batch	75–125	Correct the problem, then reanalyze If still out, reprep and reanalyze the LCS and all samples in the affected batch.
Laboratory matrix spike/matrix spike duplicate (percent recovery)*	One per analytical batch	75–125	Assess data to determine whether there is a matrix effect or analytical error. Analyze LCS for failed target analytes. Communicate matrix effects to the prime contractor so an evaluation can be made by the PC with respect to the project quality objectives.
Field duplicate relative percent difference	One per 10 sampled wells	20	None. Field duplicates are collected to provide information about overall precision and the ability of sampling techniques to produce a representative sample.

* Other laboratory quality controls (for example, method blanks) will be completed following the laboratory quality assurance plan. The laboratory will be responsible for reporting the data verification codes on reports.

3.7 Data Management

All project data and information must be documented in a format that is usable by project personnel. This section describes how project data and information will be documented, tracked, and managed, from generation in the field to final use and storage, in a manner that ensures data integrity and retrieval.

3.7.1 Data Package Deliverables

Data package deliverables for off-site analyses are listed below.

<u>SAMPLE COLLECTION AND FIELD MEASUREMENTS DATA PACKAGE DELIVERABLES</u>

Sample collection documentation will include field form entries, field measurements, and COC forms.

[DRAFT - ELECTRONIC REVIEW]

Field measurements will be taken by the sampling team for groundwater samples collected by low-flow sampling. The measurements are specific conductance, temperature, dissolved oxygen, pH, turbidity, and ORP. All field and QC sample results, calibrations, and calibration verifications will be recorded by the sampling team on field forms. The hard-copy versions of the field data will be scanned by the sampling team and filed with other project data.

OFF-SITE LABORATORY DATA PACKAGE DELIVERABLES

The contract laboratory will provide laboratory data packages for each set of samples analyzed. Data and summary sufficient for the data validator to perform verification and data usability assessment are to be sent by email to the CC within 15 business days of receiving the sample. Delivery of a hard-copy data package will not be required.

The laboratory will email the CC an analytical report and an electronic data deliverable (EDD).

The information provided by the laboratory will be sufficient to review the data with respect to:

- Holding times and sample conditions
- Calibrations and instrument performance
- Detection/quantitation limits
- Spike and surrogate recoveries
- Duplicate analyses (laboratory duplicates and matrix spike [MS]/MS duplicates [MSD])
- Laboratory control sample (LCS)
- Blank contamination
- Target compound identification and quantitation

A laboratory report will be provided that includes the following hard-copy information for each analytical data package:

- Cover sheet listing the name and number of samples included in the report.
- Narrative comments describing problems encountered in analysis; identification of any analyses not meeting QC criteria, including holding times; and cautions regarding unusable data due to QC results that are outside the control limit.
- COC forms.
- Documentation of extraction, clean-up, and analytical methods used.
- Tabulated results of inorganic compounds identified and quantified, with analyte-specific detection limits. Analytes will be reported for each sample as a detected concentration or as not detected above the specific limits of quantitation, which must be stated. The laboratory will also report dilution factors, date of analysis, surrogate percent recoveries, batch run logs, and analytical batch number for each sample, with corresponding sample results.

[DRAFT - ELECTRONIC REVIEW]

- Analytical results for QC sample spikes, laboratory duplicates, initial and continuing calibration, verifications of standards and laboratory blanks, standard procedural blanks, LCSs, laboratory reference materials, inductively coupled plasma (ICP) interference check samples, and detection limit check samples.
- Documentation of rationale for the use of method of standard addition, if required.

Corresponding to each individual laboratory report, an EDD will be prepared and submitted along with the laboratory data package.

3.7.2 Data Handling and Management

This section describes computerized and manual procedures that trace the paths of all data from generation to final use and storage, as well as the associated quality checks for error detection that are performed to ensure data integrity.

DATA RECORDING

Data recording in the field will be performed as described herein and using the forms and formats in Appendix D.

3.7.3 Data Tracking and Control

The project quality records will be maintained by the CC. These records, either electronic or hard copy in form, will include the following:

1. Project work plans with any approved modifications, updates, and/or addendums
2. Project Sampling SOP and Statistical Method Certification, with any approved modifications, updates, and/or addendums
3. Field documentation
4. COC records
5. Laboratory documentation (results received from the laboratory will be documented in an electronic format)
6. Data validation and verification reports
7. Final project reports and deliverables

Hard-copy field and laboratory records will be maintained in the project's central data file, where original field and laboratory documents are filed chronologically for future reference. These records are also scanned to produce electronic copies in portable document format (PDF). The electronic versions of these records will be maintained in the CC network and has a routine backup schedule.

All project records listed above will be provided to MERG and maintained on file by MERG for a minimum of three years after completion of the work. Besides acting as a central data repository, the database will further facilitate data analysis and reporting. The information stored in the database will consist of sampling information (for example, sample identification, location, and sampling date and time), and analytical chemistry data specified in different fields of the EDD format selected for the project. Field data previously transferred from hard-copy

[DRAFT - ELECTRONIC REVIEW]

documents into electronic files and laboratory EDDs will be reviewed for completeness and accuracy by the CC.

RECORDKEEPING

MERG will place the following groundwater monitoring information, as it becomes available, in the facility's operating record:

- Annual groundwater monitoring and corrective action report
- Semiannual Remedy Selection Progress Report
- Documentation of the design, installation, development, and decommissioning of any monitoring wells
- Groundwater monitoring system certification
- Selection of a statistical method certification

4.0 Statistical Approach

The statistical procedures use for the groundwater monitoring program will be in accordance with Part 115 Rule 908. These statistical procedures will be consistent with those used for CCR Rule compliance monitoring program in accordance with 40 CFR §257.93(f and g). Appendix E

provides the Statistical Procedures Plan, including components for preliminary data analysis (outliers, distributions, serial correlation, trend analysis, seasonality); approach to computing background threshold values; the test for statistically significant levels above groundwater protection standards for assessment monitoring; and test for closure.

5.0 Groundwater Reporting

MERG will submit annual groundwater monitoring reports to EGLE not later than 30 days after the end of the calendar year. Annual reports will summarize key monitoring actions completed, describe any problems encountered, discuss actions to resolve the problems, and project key activities for the upcoming year. The annual groundwater monitoring report will contain the following information, to the extent available:

1. A map showing the CCR units, background and downgradient monitoring wells;
2. 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;
3. Determine rate and direction of groundwater flow each time groundwater is sampled; and
4. In addition to all the monitoring data, 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. Also, determine rate and direction of groundwater flow each time groundwater is sampled.

[DRAFT - ELECTRONIC REVIEW]

MERG will notify the EGLE prior to undertaking well abandonment, plugging, replacement, or repair at the Site. MERG will notify EGLE when sampling and analysis program documentation has been placed in the operating record.

6.0 Response Action Plan

According to Michigan Statutes 324.11519b(2), if detection monitoring confirms a statistically significant increase over background, the owner shall prepare a response action plan in compliance with R 299.4442 of the part 115 rules. Consumers Energy first provided EGLE a Response Action Plan for the Site prepared in accordance with R 299.4442 of the part 115 rules on March 15, 2019 after calculating a potential SSL for lithium at BCC Ponds (CEC, 2019a). That report documented sources of contamination, interim response activities taken to control possible sources of contamination, and a schedule for terminating receipt of waste and initiating closure of the BCC Ponds. That report was approved by EGLE on May 14, 2019. Should additional SSLs be identified, or MERG propose any changes to the Action Plan, MERG will submit a revised Response Action Plan to EGLE.

7.0 Assessment of Corrective Measures

The CEC completed the ACM for the Site, which was submitted to EGLE on September 11, 2019. The ACM complied with all required components of the §257.96. The ACM stated that an adaptive management strategy would be implemented at the Site that includes measures to remove source material, reduce infiltration, and/or minimize the potential future migration. MERG is adopting the ACM as written, and has begun implementation of the source removal.

8.0 Remedy Selection and Remedial Action Plan

The CEC prepared a Semiannual Progress Report for the Site as a requirement of §257.97(a) of the CCR Rule, which described progress toward selecting and designing the final remedy for the CCR unit. In accordance with the CCR Rule, MERG will prepare a remedy selection progress report semiannually until the final remedy is selected.

The CEC first reported the potential for SSLs over GPS in the *Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g)* (CEC, 2019b). Subsequently, the Assessment of Corrective Measures Report (TRC, 2019) was completed on September 11, 2019.

In 2018, CEC developed the February 2018 Closure Plan and placed it in the Operating Record, which confirmed the CEC plan to close the BCC Ponds in accordance with the CCR Rule §257.102(c). The CEC also submitted a Closure Work Plan to EGLE, who approved it on October 16, 2018 (clarifications of the Work Plan on August 13, 2018 and September 20, 2019). Excavation of CCR removal was planned to commence in 2020; with elements of construction such as design, permitting, and procurement having commenced in 2019. Removal activities are planned to be completed and documented in an excavation completion report by 2023.

The statistical assessments from CEC 2019 semiannual groundwater monitoring events have confirmed that lithium is the only CCR Rule COI present at statistically significant levels above

[DRAFT - ELECTRONIC REVIEW]

the GPS. Although lithium concentrations exceed the GPS at two shallow downgradient wells, on-site groundwater is not used for drinking water and concentrations of lithium are below applicable State of Michigan unrestricted cleanup criteria. The nearest off-site drinking water well is more than 2,000 feet away on the other side of the North Branch of the Muskegon River. Groundwater chemistry appears to be improving as a result of discontinuing the hydraulic loading of BCC Ponds and is expected to further improve following the CCR ash source removal.

The CEC first provided EGLE a Response Action Plan prepared in accordance with Part 115 on March 15, 2019 after calculating a potential SSL for lithium at BCC Ponds. That report documented sources of contamination, interim response activities taken to control possible sources of contamination, and a schedule for terminating receipt of waste and initiating closure of the BCC Ponds. That report was approved by EGLE on May 14, 2019. CEC also completed the ACM for the Site, which was submitted to EGLE on September 11, 2019. The ACM stated that an adaptive management strategy would be implemented that includes measures to remove source material, reduce infiltration, and/or minimize the potential future migration.

Construction associated with source removal has been initiated in June 2020, including installation of a slurry wall and dewatering pumps. Dewatering is scheduled to begin in July 2020 to allow for excavation of the vertical and lateral extent of waste CCR. The CCR ash removal is scheduled to begin in August 2020. The reduction of hydraulic loading and recharge of the aquifer are expected to have changed groundwater redox conditions (e.g. from aerobic to anaerobic) and the physical removal of CCR is expected to further improve groundwater quality. It is anticipated that the remedy selection process for addressing affected groundwater will proceed following the implementation of the CCR source material. Additionally, MERG will continue semiannual assessment monitoring that will inform the remedy selection. The final remedy will be formally selected per §257.97 and R 299.4445 once the selected option is reviewed and commented on by EGLE and a public meeting is conducted at least 30-days prior to the final selection as required under §257.96(e). At the time of remedy selection, MERG will prepare a Remedial Action Plan in compliance with R 299.4445.

9.0 References

ARCADIS. May 13, 2016. Summary of Monitoring Well Design, Installation, and Development. BC Cobb Electric Generation Facility – Muskegon, Michigan. Prepared for Consumers Energy Company.

Consumer Energy Company. March 30, 2018. Notification of Intent to Close Two CCR Units. B.C. Cobb Generating Facility Bottom Ash Pond and Ponds 0-8 Closure Plan, Muskegon, Michigan. Prepared for Consumers Energy Company.

Consumer Energy Company, March 15, 2019a. Response Action Plan B.C. Cobb Generating Facility Bottom Ash Pond and Ponds 0-8 Closure Plan, Muskegon, Michigan.

Consumer Energy Company. January 15, 2019b. Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g). B.C. Cobb Generating Facility

[DRAFT - ELECTRONIC REVIEW]

Bottom Ash Pond and Ponds 0-8, Muskegon, Michigan. Prepared for Consumers Energy Company.

Consumer Energy Company. January 30, 2019c. Initial Semiannual Progress Report - Selection of Final Remedy. B.C. Cobb Generating Facility Bottom Ash Pond and Ponds 0-8, Muskegon, Michigan.

Golder Associates Inc. February 2018. BC Cobb Generating Facility Bottom Ash Pond and Ponds 0-8 Closure Plan, Muskegon, Michigan. Prepared for Consumers Energy Company.

Golder Associates Inc. 2018, May 30, 2018 clarified October 16, 2018 and September 20, 2019. BC Cobb Ponds 0-8 and Bottom Ash Closure Work Plan, Muskegon, Michigan. Prepared for Consumers Energy Company.

TRC Environmental Corporation. September 11, 2019a. Assessment of Corrective Measures, Consumers Energy, Former BC Cobb Power Plant, Bottom Ash Pond & Ponds 0-8, Muskegon, Michigan. Prepared for Consumers Energy Company.

TRC Environmental Corporation. January 2019b. 2018 Annual Groundwater Monitoring Report, Consumers Energy, Former BC Cobb Power Plant, Bottom Ash Pond & Ponds 0-8, Muskegon, Michigan. Prepared for Consumers Energy Company.

TRC Environmental Corporation. January 2020. 2019 Annual Groundwater Monitoring and Corrective Action Report, Consumers Energy, Former BC Cobb Power Plant, Bottom Ash Pond & Ponds 0-8, Muskegon, Michigan. Prepared for Consumers Energy Company.

[DRAFT - ELECTRONIC REVIEW]

Appendix A

EGLE Hydrogeologic Monitoring Plan Checklist

[DRAFT - ELECTRONIC REVIEW]

2019

PART 115 RULES CHECKLIST
COAL ASH LANDFILL AND COAL ASH IMPOUNDMENTS
HYDROGEOLOGICAL MONITORING PLAN

Facility Name BC Cobb Date 8/14/2020 Initials

Report Name BC Cobb Hydrogeologic Monitoring Plan Report Date

ITEM			HMP Section where Item may be Reviewed
1.	Design and siting ensure groundwater will not exceed: R306(1)		N/A – CCR Unit in Closure
	MCLs in 40 CFR Part 257 and Appendix I. (Note: if the design and siting ensure GW will not exceed MCLs identified in appendix I, they will likely ensure that Michigan's cleanup criteria are not exceeded)		
	Existing concentrations, where these already exceed 40 CFR Part 257 and Appendix I, unless groundwater has greater than 10,000 mg/L TDS.		
2.	Design and siting ensure that requirements of Part 31 and its rules will be met. R306(2)		N/A – CCR Unit in Closure
3.	Hydrogeologic monitoring plan for the coal ash landfill or coal ash impoundment includes the following components:		
	A monitoring well system which complies with R906. R905(1)a		2.1
	Leachate and SCS monitoring programs as specified in R432, if required. R905(1)b		N/A – Impoundments
	Surface water monitoring program for surface waters that may receive runoff from the "active work area" (see R101(g)). R905(1)c		N/A
4.	Contains the following specific information: R905(2)		
	All GW sampling locations. R905(2)a		2.1
	Sampling constituents/parameters and frequency. R905(2)b		3.2-3.3
	Sampling and analysis procedures for each parameter including: R905(2)c		
		Sample collection.	Appendix D
		Sample preservation and shipment.	Appendix D
		Analytical procedures, including detection limits.	3.5
		Chain of custody control.	Appendix D
		Laboratory and field quality assurance and quality control procedures.	3.6, Appendix D

[DRAFT - ELECTRONIC REVIEW]

ITEM	HMP Section where Item may be Reviewed
Procedures for prevention of cross contamination in wells during well installation, purging and sampling.	Appendix D
Statistical procedures for data evaluation in compliance with R908.	Appendix E
5. Sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that represent the quality of: R906(1)	2.1
Background water quality not affected by leakage from a unit. R906(1)a	2.1.1
Meets conditions for use of wells other than true upgradient. R906(1)(a)i or ii	2.1.1
Downgradient groundwater and ensures detection of groundwater contamination in the uppermost aquifer, and other groundwater specified by the Director. R906(1)b	2.1.2
Meets conditions for downgradient monitor well installation at locations other than the solid waste boundary.	2.1.2
Wells installed at the closest practicable distance from the solid waste boundary.	2.1.2
6. Meets conditions for a multi-unit groundwater monitoring system instead of separate monitoring systems for each landfill unit when the facility has several discrete units. R906(2)	2.1
Monitoring wells not more than 150 meters from the solid waste boundary of each unit, located on land owned by the owner of the unit R906(2)a	2.1
Sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer. R906(2)b	2.1, 2.2
Is as protective of human health and environment as individual monitoring systems for each unit, based on the following: R906(2)b	
Number, spacing and orientation of the units.	1.0
Hydrogeologic setting.	1.4
Site history.	1.1
Engineering design of the units.	2.2
Type of waste accepted at the units.	1.1

[DRAFT - ELECTRONIC REVIEW]

ITEM	HMP Section where Item may be Reviewed
7. Monitoring wells cased in a manner that maintains the integrity of the well borehole. R 906(3)	2.2
8. Well casings screened or perforated and packed with gravel or sand, where necessary, to enable the collection of groundwater samples. R906(3)	2.2
9. Annular space in each monitoring well sealed to prevent contamination of the samples and groundwater. R906(3)	2.2
10. Notified the Director that the design, installation, development, and decommission of any monitoring wells, piezometers, and other measurement, sampling, and analytical devises documentation have been placed in the operating record. R906(4)	Will be done as part of 6.0 Reporting
11. All monitoring wells, piezometers, and other measurement, sampling, and analytical devices designed, operated and maintained to perform to design specifications throughout the life of the monitoring program. R906(5)	2.2
12. Monitoring wells designed to minimize the time necessary to recharge well, given hydraulic conductivity of the aquifer. R906(6)	2.2
13. Number, spacing, and depths of monitoring systems in compliance with the following conditions: R906(7)	
Site-specific technical information that includes thorough characterization of both of the following: R906(7)(a)	
The uppermost aquifer, including all of the following information: R906(7)(a)i	1.4, 2.0
Aquifer thickness.	
Groundwater flow rate.	
Groundwater flow direction including seasonal and temporal fluctuations in groundwater flow.	
Saturated and unsaturated geologic units and fill materials overlying the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the uppermost aquifer, including all of the following: R906(7)(a)ii	1.4, 2.0
Thickness.	
Stratigraphy.	
Lithology.	
Hydraulic conductivities.	

[DRAFT - ELECTRONIC REVIEW]

ITEM			HMP Section where Item may be Reviewed
		Porosities.	
		Effective Porosities.	
	Certified by a Geologist.	R906(7)b	v
	Approved by the Director. Within 14 days of this approval, the owner or operator shall notify the Director that the certification and approval have been placed in the operating record.	R906(7)c	
14.	All wells clearly labeled, properly vented, capped, and locked when not in use.	R906(8)	2.2
15.	All wells visible throughout the year.	R906(8)	2.2
16.	Owner or operator to notify the Director or designee prior to undertaking well abandonment, plugging, replacement, or repair.	R906(9)	5.0
17.	Groundwater monitoring program includes sampling and analysis procedures designed to ensure monitoring results that provide an accurate representation of groundwater quality at the background and downgradient wells installed in compliance with R906.	R907(1)	3.0
18.	Owner or operator has notified Director that sampling and analysis program documentation has been placed in the operating record.	R907(1)	5.0
19.	The sampling and analysis program shall include all of the following:		
	Sample collection.	R907(1)a	Appendix D
	Sample preservation and shipment.	R907(1)b	Appendix D
	Analytical procedures.	R907(1)c	3.5
	Chain of custody control.	R907(1)d	Appendix D
	Quality assurance and quality control.	R907(1)e	Appendix D
20.	Sampling and analysis programs include sampling and analytical methods appropriate for groundwater sampling and accurately measure hazardous constituents and other monitoring parameters in groundwater samples.	R907(2)	Appendix D
21.	Groundwater samples shall not be field filtered.	324.11511a(3)e	Appendix D
22.	Sampling procedures and frequency are protective of human health and the environment.	R907(3)	Appendix D
23.	Analytical methods and practical quantitation limits for groundwater monitoring are approved by the Director.	R907(4)	

[DRAFT - ELECTRONIC REVIEW]

ITEM			HMP Section where Item may be Reviewed
24.	Groundwater elevations measured immediately prior to purging each time groundwater is sampled. R907(5)		Appendix D
25.	Owner or operator to determine rate and direction of groundwater flow each time groundwater is sampled. R907(5)		5.0
26.	Facility to measure groundwater elevations within a period of time short enough to avoid temporal variations in groundwater flow which could preclude accurate determination of groundwater flow rate and direction. R907(5)		1.4
27.	Groundwater elevations measured by methods giving precision to 1/8 inch or 0.01 foot, measured from the top of the well reference point using a determined USGS datum point. R907(6)		Appendix D
28.	Facility has established background water quality in a hydraulically upgradient or background well or wells for each of the monitoring parameters or constituents required in groundwater monitoring program. (Background groundwater quality may be established at wells not located hydraulically upgradient from the unit if the well meets R906(1)(a)). R907(7)		2.1
29.	Number of samples to establish groundwater quality data consistent with statistical procedures determined per R908. The sampling procedures are those specified pursuant to the provisions of the following: R907(8)		
	For detection monitoring	R440	3.1.2, 3.2.2
	For assessment monitoring	R441	3.1.3, 3.2.3
	For remedial action	R444	3.1.3, 3.2.3
30.	All samples obtained shall be representative of the site's groundwater quality. R907(9)		Appendix A
	Each well will be purged until dry or until not less than 3 times the amount of water in the well casing has been removed.		Appendix D
	Monitoring wells will be sampled immediately after purging where recovery rates allow.		Appendix D
	If well pumped dry during purging, samples will be taken within 24 hours.		Appendix D
31.	If nondedicated pumps or mobile sampling equipment is used, facility will use the following procedures to minimize the potential for cross-contamination: R907(10)		Appendix D
	Sample wells from upgradient to downgradient, except areas of known contamination will be sampled from least contaminated to most contaminated well. R907(10)a		Appendix D

[DRAFT - ELECTRONIC REVIEW]

ITEM		HMP Section where Item may be Reviewed
	Each piece of equipment will be thoroughly cleaned and rinsed with distilled water before use in each well. R907(10)b	Appendix D
	Other decontamination procedures approved by the Department. R907(10)c	AppendixD
32	The owner and operator shall submit all monitoring results to the director or designee not later than 30 days after the end of the calendar quarter. R907(11)	5.0 – Annual reporting since semi-annual monitoring
33.	The owner and operator of a landfill will sample and analyze groundwater by methods specified in "Standard Methods for the Examination of Water and Wastewater…. Or other methods approved by the director or his or her designee. (we would accept SW-846 methods). 324.11511a(4)	3.5.2
34.	Detection monitoring parameter list includes: 324.11511a(3)(c)	3.5.1
	Boron 324.11511a(3)(c)i	
	Calcium 324.11511a(3)(c)ii	
	Chloride 324.11511a(3)(c)iii	
	Fluoride 324.11511a(3)(c)iv	
	Iron 324.11511a(3)(c)v	
	pH 324.11511a(3)(c) vi	
	Sulfate 324.11511a(3)(c)vii	
	Total Dissolved Solids 324.11511a(3)(c)viii	
35.	Contains a statistics plan or statistical procedures that meets the requirements of Rule 908. (Use Part 115 Rules Checklist – Landfill Groundwater Monitoring Statistical Procedures). R908	4.0
36.	Detection monitoring is conducted quarterly during the active life and semiannually during the post-closure period, except as provided for in R440(5). R440(1)(a)	3.1.2
37.	Meets conditions for deletion of R452 to R454 parameters.	

[DRAFT - ELECTRONIC REVIEW]

ITEM		HMP Section where Item may be Reviewed
	Parameters and breakdown products are not in leachate for not less than 2 consecutive and historic samplings. R440(4)	N/A
38.	Meets conditions for alternative monitoring frequency for R450-451 parameters (at least semiannually) or for R452-454 parameters (at least annually) based on following factors: R440(5)	N/A
	Lithology of aquifer and unsaturated zone. R440(5)a	
	Hydraulic conductivity of aquifer and unsaturated zone. R440(5)b	
	Groundwater flow rates. R440(5)c	
	Minimum distance from the waste and the closest downgradient well screen, or presence of SCS. R440(5)d	
	Resource value of aquifer. R440(5)e	
39.	First sampling event includes 4 independent samples from each well. Subsequent events include minimum of 1 sample from each well. R440(7)	3.1-3.2
40.	In case of statistically significant increase over background:	
	Place notice in operating record within 14 days. R440(8)a	3.2.3
	Prepare assessment monitoring plan per R441 and a response action plan within 45 days. R440(8)b	3.2.3
41.	If statistically significant increase over background due to other source or is due to an error, has owner:	3.1-3.2
	Documented a demonstration of this and placed notice in operating record within 30 days. R440(9)	
	If a successful demonstration is made,	
	Continue detection monitoring. R440(9)(a)	
	Determined if the unit remains monitorable R440(9)(b)	
	If a successful demonstration is not made, then 15 days after notification by the director, prepare an assessment monitoring plan and a response action plan. R440(10)	

[DRAFT - ELECTRONIC REVIEW]

ITEM		HMP Section where Item may be Reviewed
42.	Text in the HMP indicates an assessment monitoring program will be developed if required under R441 or the Assessment Monitoring Program is included with the HMP. (use the assessment monitoring program checklist if the program is provided) or the Assessment Monitoring program has already been approved and is referenced in the HMP. R441 Or a schedule, approved by the department, that leads to compliance by no later than December 28, 2020 has been provided. 324.11511a(3)(f)ii	3.2
43.	Text in the HMP indicates a response action plan will be developed if required under R442 or the Response Action Plan is included. (use the response action plan checklist if a plan is provided) or the Response Action Plan has already been approved and is referenced in the HMP. R442 Or a schedule, approved by the department, that leads to compliance by no later than December 28, 2020 has been provided. 324.11511a(3)(f)ii	3.1.3, 6.0
44.	Text in the HMP indicates that corrective measures will be assessed if required under R443 or the assessment of corrective measures is included in the HMP or the assessment of corrective measures has already been approved and is referenced in the HMP. R443 Or a schedule, approved by the department, that leads to compliance by no later than December 28, 2020 has been provided. 324.11511a(3)(f)ii	3.2.3, 7.0
45.	Text in the HMP indicates that a remedy will be selected, if required, in compliance with R444 or the remedy selection and remedial action plan is included with the HMP or the remedy selection and remedial action plan has already been approved and is referenced in the HMP. R444 Or a schedule, approved by the department, that leads to compliance by no later than December 28, 2020 has been provided. 324.11511a(3)(f)ii	8.0
46.	Text in the HMP indicates that a remedial action plan will be implemented, if required, in compliance with R445 or the remedial action plan implementation details are included with the HMP or the remedial action plan has already been implemented and is referenced in the HMP. R445 Or a schedule, approved by the department, that leads to compliance by no later than December 28, 2020 has been provided. 324.11511a(3)(f)ii	8.0
COMMENTS:		

[DRAFT - ELECTRONIC REVIEW]

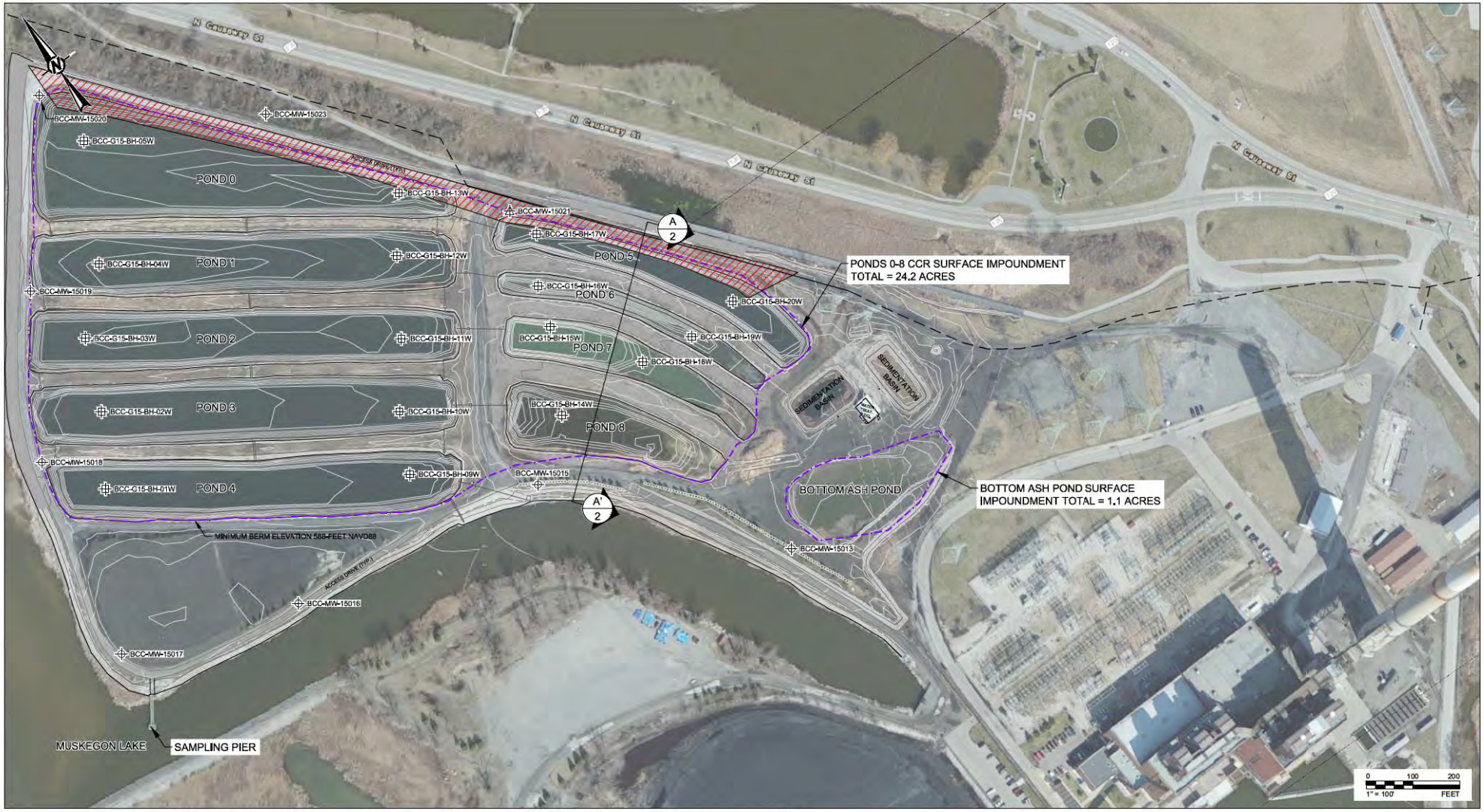
ITEM	HMP Section where Item may be Reviewed

[DRAFT - ELECTRONIC REVIEW]

Appendix B

Cross Section through the Ponds

[DRAFT - ELECTRONIC REVIEW]



LEGEND

- POND 0-8 SAMPLING LOCATION
- EXTERIOR BERM SAMPLING LOCATION
- INTERIOR SLOPE OF EXTERIOR BERM SAMPLING LOCATION
- EXISTING MAJOR AND MINOR TOPOGRAPHIC CONTOUR
- SURFACE IMPOUNDMENTS
- POWER LINE AND TOWER STRUCTURE
- 20-INCH DUCTILE IRON SANITARY PIPE (SEE REFERENCE 5)
- 20-INCH DUCTILE IRON SANITARY PIPE (SEE REFERENCE 6)
- CULVERT
- CONCRETE VAULT
- TREE LINE
- AREA OF CONCERN

REFERENCE(S)

1. TOPOGRAPHIC SURVEY PROVIDED BY SUMMIT SURVEYING, INC. DATED JANUARY 28, 2015.
2. DASHED PORTION OF 20-INCH DUCTILE IRON SANITARY PIPE FROM GIS SHAPEFILE WASTEWATER_PRESSURIZED_MAIN.SHP, PROVIDED BY MUSKEGON COUNTY WASTE MANAGEMENT SYSTEM ON JUNE 22, 2018.
3. SOLID PORTION OF 20-INCH DUCTILE IRON SANITARY PIPE LOCATED BY GOLDER FIELD PERSONNEL USING GPS UNIT ON JULY 24, 2018.
4. BOREHOLE LOCATIONS FROM GOLDER FIELD PERSONNEL (BCCOBB_GPS_20170522.XLSX AND BC COBB PONDS 0-8 2017 BORING LOCATIONS.XLSX).
5. DASHED PORTION OF 20-INCH DUCTILE IRON SANITARY PIPE FROM GIS SHAPEFILE WASTEWATER_PRESSURIZED_MAIN.SHP, PROVIDED BY MUSKEGON COUNTY WASTE MANAGEMENT SYSTEM ON JUNE 22, 2018.
6. SOLID PORTION OF 20-INCH DUCTILE IRON SANITARY PIPE LOCATED BY GOLDER FIELD PERSONNEL USING GPS UNIT ON JULY 24, 2018.

CLIENT
CONSUMERS ENERGY COMPANY
151 N. CAUSEWAY
MUSKEGON, MI 49445

CONSULTANT
GOLDER

YYYY-MM-DD	2018-08-06
DESIGNED	MAB
PREPARED	AM
REVIEWED	JRP
APPROVED	MAB

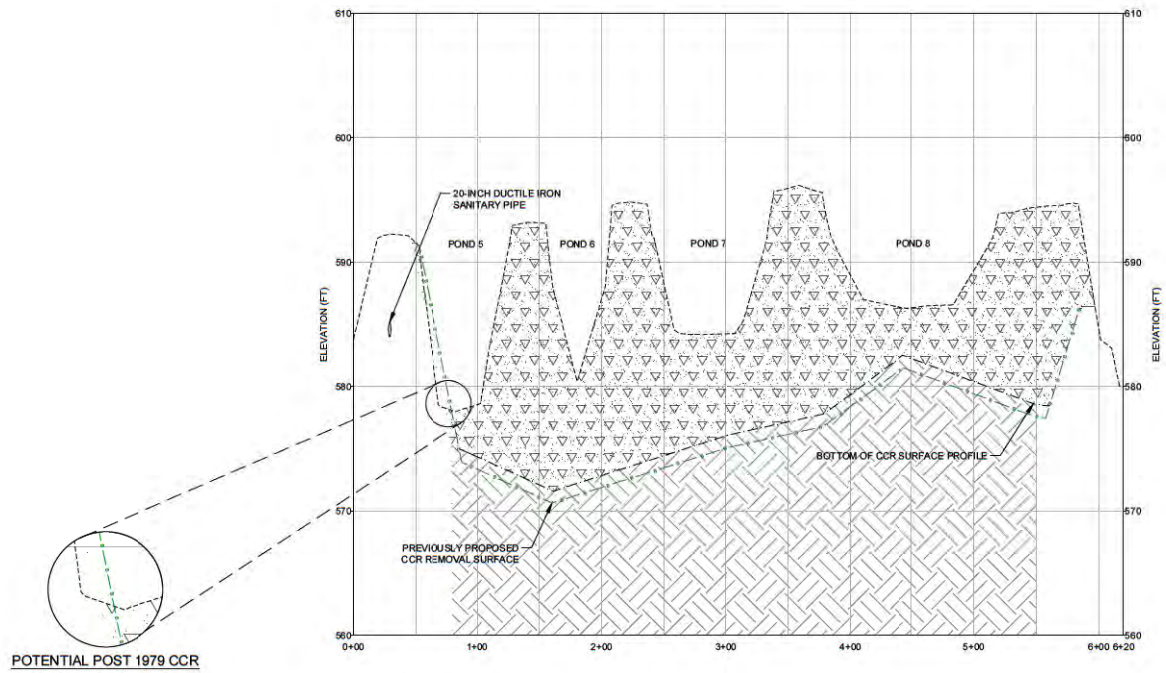
PROJECT
B.C. COBB PLANT
BOTTOM ASH POND AND PONDS 0-8 CLOSURE
MUSKEGON, MI 49445

TITLE
SITE PLAN

PROJECT NO.	CONTROL	REV.	FIGURE
18101309	0004-002	0	1

[DRAFT - ELECTRONIC REVIEW]

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D



LEGEND

- CCR MATERIAL
- NATIVE MATERIAL
- EXISTING GROUND
- BOTTOM OF CCR SURFACE PROFILE
- PROPOSED EXCAVATION SURFACE PROFILE

NOTES

1. EXISTING CONDITIONS MAY VARY FROM THOSE SHOWN.
2. CONTRACTOR IS RESPONSIBLE FOR DEVELOPING AND IMPLEMENTING STORMWATER MANAGEMENT AND EROSION CONTROL PLANS CONSISTENT WITH THE SITE SWPPP.
3. CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ADHERENCE TO CONSUMERS ENERGY COMPANY'S HEALTH AND SAFETY PROCEDURES AS WELL AS ANY STATE AND FEDERAL HEALTH AND SAFETY REQUIREMENTS.
4. CONSTRUCTION MATERIALS, SUBCONTRACTORS, AND STOCKPILE LOCATIONS SHALL BE SUBJECT TO APPROVAL BY CONSUMERS ENERGY COMPANY OR ITS DESIGNATED REPRESENTATIVE.
5. TEMPORARY ROADS FOR SITE ACCESS AND STOCKPILE ACCESS TO BE APPROVED BY CONSUMERS ENERGY COMPANY OR ITS DESIGNATED REPRESENTATIVE.
6. CONTRACTOR SHALL VERIFY ALL DIMENSIONS, ELEVATIONS, AND SITE CONDITIONS PRIOR TO STARTING WORK AND SHALL NOTIFY THE ENGINEER IF CONFLICTS EXIST ON THE DRAWINGS.
7. CONTRACTOR IS RESPONSIBLE FOR SURVEY CONTROL AND COORDINATION WITH OWNER'S SURVEYOR TO ACQUIRE INFORMATION NECESSARY TO PRODUCE AS-BUILT DRAWINGS.
8. CONTRACTOR SHALL PERFORM HOUSEKEEPING DUTIES ON A DAILY BASIS TO KEEP WORK AREAS CLEAN. HOUSEKEEPING SHALL BE PERFORMED AT THE COMPLETION OF THE WORK TO THE SATISFACTION OF THE OWNER.
9. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL MATERIALS REQUIRED TO FULLY CONSTRUCT THE SYSTEM ACCORDING TO THE DESIGNS IN THESE DRAWINGS.
10. EXCAVATIONS SHALL CONFORM TO CONSUMERS ENERGY COMPANY AND MIOSHA REQUIREMENTS.
11. BOTTOM OF CCR SURFACE DEVELOPED FROM 2015-2017 SITE INVESTIGATIONS.

HORIZONTAL SCALE 1" = 50' (0, 50, 100 FEET)

VERTICAL SCALE 1" = 5' (0, 5, 10 FEET)

CLIENT
CONSUMERS ENERGY COMPANY
151 N. CAUSEWAY
MUSKEGON, MI 49445

CONSULTANT
GOLDER

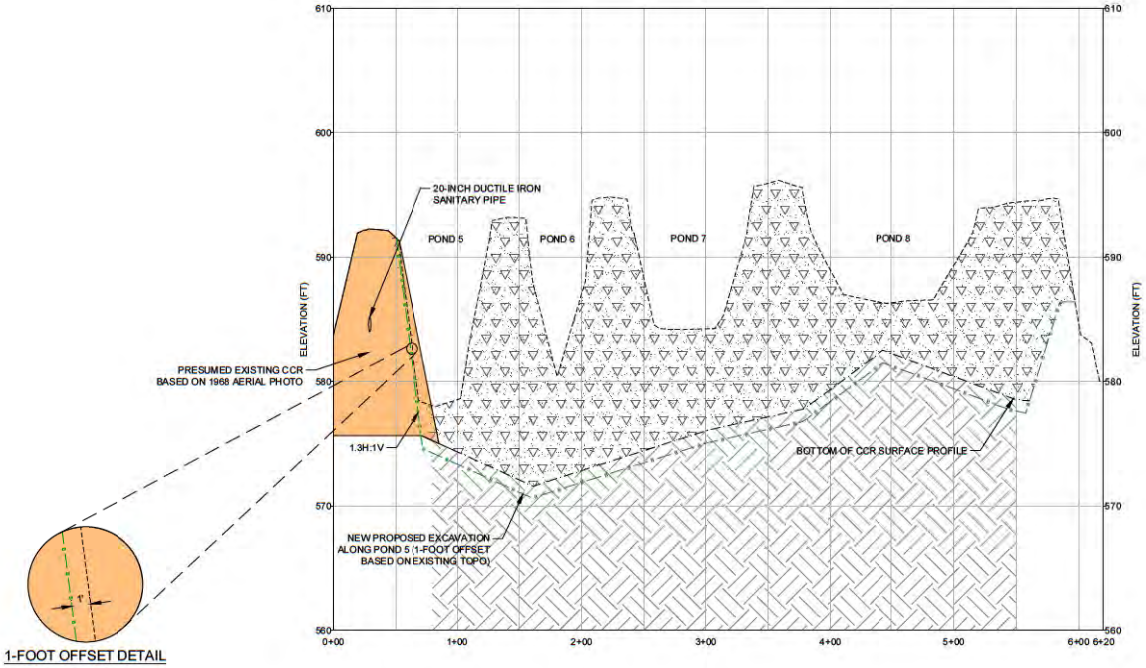
YYYY-MM-DD	2018-08-06
DESIGNED	MAB
PREPARED	AM
REVIEWED	JRP
APPROVED	MAB

PROJECT
B.C. COBB PLANT
BOTTOM ASH POND AND PONDS 0-8 CLOSURE
MUSKEGON, MI 49445

TITLE
SECTION A-A'

PROJECT NO.	CONTROL	REV.	FIGURE
18101309	0004-004	0	2

[DRAFT - ELECTRONIC REVIEW]



1-FOOT OFFSET DETAIL

LEGEND

- CCR MATERIAL
- NATIVE MATERIAL
- EXISTING GROUND
- BOTTOM OF CCR SURFACE PROFILE
- PROPOSED EXCAVATION SURFACE PROFILE

NOTES

1. EXISTING CONDITIONS MAY VARY FROM THOSE SHOWN.
2. CONTRACTOR IS RESPONSIBLE FOR DEVELOPING AND IMPLEMENTING STORMWATER MANAGEMENT AND EROSION CONTROL PLANS CONSISTENT WITH THE SITE SWPPP.
3. CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ADHERENCE TO CONSUMERS ENERGY COMPANY'S HEALTH AND SAFETY PROCEDURES AS WELL AS ANY STATE AND FEDERAL HEALTH AND SAFETY REQUIREMENTS.
4. CONSTRUCTION MATERIALS, SUBCONTRACTORS, AND STOCKPILE LOCATIONS SHALL BE SUBJECT TO APPROVAL BY CONSUMERS ENERGY COMPANY OR ITS DESIGNATED REPRESENTATIVE.
5. TEMPORARY ROADS FOR SITE ACCESS AND STOCKPILE ACCESS TO BE APPROVED BY CONSUMERS ENERGY COMPANY OR ITS DESIGNATED REPRESENTATIVE.
6. CONTRACTOR SHALL VERIFY ALL DIMENSIONS, ELEVATIONS, AND SITE CONDITIONS PRIOR TO STARTING WORK AND SHALL NOTIFY THE ENGINEER IF CONFLICTS EXIST ON THE DRAWINGS.
7. CONTRACTOR IS RESPONSIBLE FOR SURVEY CONTROL AND COORDINATION WITH OWNER'S SURVEYOR TO ACQUIRE INFORMATION NECESSARY TO PRODUCE AS-BUILT DRAWINGS.
8. CONTRACTOR SHALL PERFORM HOUSEKEEPING DUTIES ON A DAILY BASIS TO KEEP WORK AREAS CLEAN. HOUSEKEEPING SHALL BE PERFORMED AT THE COMPLETION OF THE WORK TO THE SATISFACTION OF THE OWNER.
9. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL MATERIALS REQUIRED TO FULLY CONSTRUCT THE SYSTEM ACCORDING TO THE DESIGNS IN THESE DRAWINGS.
10. EXCAVATIONS SHALL CONFORM TO CONSUMERS ENERGY COMPANY AND MIOSHA REQUIREMENTS.
11. BOTTOM OF CCR SURFACE DEVELOPED FROM 2015-2017 SITE INVESTIGATIONS.

HORIZONTAL SCALE 1" = 50' (0, 50, 100 FEET)

VERTICAL SCALE 1" = 5' (0, 5, 10 FEET)

CLIENT
CONSUMERS ENERGY COMPANY
151 N. CAUSEWAY
MUSKEGON, MI 49445

CONSULTANT
GOLDER

YYYY-MM-DD	2018-08-06
DESIGNED	MAB
PREPARED	AM
REVIEWED	JRP
APPROVED	MAB

PROJECT
B.C. COBB PLANT
BOTTOM ASH POND AND PONDS 0-8 CLOSURE
MUSKEGON, MI 49445

TITLE
ADJUSTED CCR REMOVAL SECTION

PROJECT NO.	CONTROL	REV.	FIGURE
18101309	0004-007	0	3

[DRAFT - ELECTRONIC REVIEW]

RECORD OF BOREHOLE BCC-G15-BH-01W

SHEET 1 of 1

PROJECT: BC Cobb Ash Pond
PROJECT NUMBER: 1540973
LOCATION: Pond 4
CLIENT: Consumers Energy Company

DRILLING METHOD: Sonic
DRILLING DATE: 10-12-15
DRILL RIG: Sonic

DATUM: NAVD88
AZIMUTH: ---
NAD83 MI PLANE-S COORDS: N 646664.2, E 12622260

GS ELEVATION (ft): 585.8
TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION (VEGETATION:)	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	RUN NUMBER	RUN REC / ATT	SAMPLES NUMBER	SAMPLES TYPE	POCKET PENETROMETER (tons/ft²)	LAB TESTS: ENVIRONMENTAL (SPLP & TOTAL METALS)	LAB TESTS: GRAIN SIZE DISTRIBUTION	NOTES WATER LEVELS
0	Sonic	0.0 - 8.5 WATER.			577.3								
		8.5 - 16.8 (CCR) COAL COMBUSTION RESIDUALS, dark gray, wet, soft to firm.			8.5	1	3.10 / 5.00	1	SONIC		●	●	
								2	SONIC		●	●	
						2	5.00 / 5.00	3A	SONIC		●	●	
					569.0			3B	SONIC		●		
		16.8 - 18.5 ORGANICS, some fine sand, brown, wood debris, wet.			16.8 567.3								
		18.5 - 26.4 (SP) SAND, poorly graded, fine, brown, wood debris and decomposing organics, non-cohesive, wet.	SP		18.5	3	5.00 / 5.00	4	SONIC		●	●	
					559.4	4	5.00 / 5.00	5	SONIC		●	●	
		26.4 - 31.8 (OL) ORGANIC SANDY SILT, trace to some clay, trace sand, brown, cohesive, wet, firm.	OL		26.4								
					554.0	5	5.00 / 5.00						
		31.8 - 33.5 (SP) SAND, poorly graded, fine, brown, non-cohesive, wet.	SP		31.8 552.3								
35		Boring completed at 33.5 ft.											

NOTES:
1. Drilled from a barge.
2. Mud line at a depth of 8.5 feet.

Golder Associates

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

LOGGED: MMJ
CHECKED: JRP
DATE: 11/18/2015

DUL_BOREHOLE (BC ASH POND) 1540973 BC COBB ASH POND.GPJ DUL.GOLDER.GDT 6/10/16

[DRAFT - ELECTRONIC REVIEW]

RECORD OF BOREHOLE BCC-G15-BH-02W

SHEET 1 of 1

PROJECT: BC Cobb Ash Pond
PROJECT NUMBER: 1540973
LOCATION: Pond 3
CLIENT: Consumers Energy Company

DRILLING METHOD: Sonic
DRILLING DATE: 10-12-15
DRILL RIG: Sonic

DATUM: NAVD88
AZIMUTH: ---
NAD83 MI PLANE-S COORDS: N 646804.4, E 12622348

GS ELEVATION (ft): 586.7
TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION (VEGETATION:)	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	RUN NUMBER	RUN REC / ATT	SAMPLES NUMBER	SAMPLES TYPE	POCKET PENETROMETER (tons/ft²)	LAB TESTS: ENVIRONMENTAL (SPLP & TOTAL METALS)	LAB TESTS: GRAIN SIZE DISTRIBUTION	NOTES WATER LEVELS
0	Sonic	0.0 - 8.3 WATER.			578.4								
		8.3 - 17.3 (CCR) COAL COMBUSTION RESIDUALS, dark gray, wood debris, wet, soft to firm.			8.3	1	3.80 / 4.00	1	SONIC		●	●	
10						2	2.10 / 5.00						
15					569.4			2	SONIC		●	●	
		17.3 - 18.9 (SP) SAND, poorly graded, fine, brown, wood debris, non-cohesive, wet.	SP		17.3 567.8	3	5.00 / 5.00	3	SONIC		●	●	
		18.9 - 19.7 ORGANICS, decomposing, brown, wood debris, wet.			18.9 567.0								
20		19.7 - 27.3 (SP) SAND, poorly graded, fine, brown, wood debris, non-cohesive, wet.	SP		19.7			4	SONIC		●	●	
25					559.4	4	5.00 / 5.00						
		27.3 - 28.8 ORGANICS, decomposing, brown, peat-like wood debris, wet.			27.3 557.9			5	SONIC		●	●	
30		28.8 - 32.3 (SM) SILTY SAND, some clay, trace organics, brown, cohesive, wet, firm.	SM		28.8 554.4	5	5.00 / 5.00						
		Boring completed at 32.3 ft.											
35													
40													

NOTES:
1. Drilled from a barge.
2. Mud line at a depth of 8.3 feet.

Golder Associates

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

LOGGED: MMJ
CHECKED: JRP
DATE: 11/18/2015

DUL_BOREHOLE (BC ASH POND) 1540973 BC COBB ASH POND.GPJ DUL.GOLDER.GDT 6/10/16

[DRAFT - ELECTRONIC REVIEW]

RECORD OF BOREHOLE BCC-G15-BH-03W

SHEET 1 of 1

PROJECT: BC Cobb Ash Pond
PROJECT NUMBER: 1540973
LOCATION: Pond 2
CLIENT: Consumers Energy Company

DRILLING METHOD: Sonic
DRILLING DATE: 10-12-15
DRILL RIG: Sonic

DATUM: NAVD88
AZIMUTH: ---
NAD83 MI PLANE-S COORDS: N 646952.5, E 12622410

GS ELEVATION (ft): 587.2
TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION / VEGETATION:	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	RUN NUMBER	RUN REC / ATT	SAMPLES NUMBER	SAMPLES TYPE	POCKET PENETROMETER (tons/ft²)	LAB TESTS: ENVIRONMENTAL (SPLP & TOTAL METALS)	LAB TESTS: GRAIN SIZE DISTRIBUTION	NOTES WATER LEVELS
0	Sonic	0.0 - 8.1 WATER.			579.1								
		8.1 - 10.6 (CCR) COAL COMBUSTION RESIDUALS, dark gray, wet, soft to firm.			8.1 576.6	1	3.60 4.00	1A 1 1B 2	SONIC SONIC SONIC SONIC		● ● ●	● ●	
10		10.6 - 17.1 (SP) SAND, poorly graded, fine, brown, non-cohesive, wet.	SP		10.6 570.1	2	2.50 3.00						
15		17.1 - 18.1 ORGANICS, decomposing, brown, wood debris, wet.			17.1 569.1	3	5.00 5.00	3	SONIC		●	●	
		18.1 - 24.8 (SP) SAND, poorly graded, fine, brown, non-cohesive, wet.	SP		18.1 562.4	4	5.00 5.00	4	SONIC		●	●	
20		24.8 - 30.1 (SM) SILTY SAND, fine, trace to some clay, brown to black, cohesive, wet, stiff.	SM		24.8 557.1	5	5.00 5.00	5	SONIC		●	●	
25		Boring completed at 30.1 ft.											
30													
35													
40													

NOTES:
1. Drilled from a barge.
2. Mud line at a depth of 8.1 feet.

Golder Associates

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

LOGGED: MMJ
CHECKED: JRP
DATE: 11/18/2015

DUL_BOREHOLE (BC ASH POND) 1540973 BC COBB ASH POND.GPJ DUL.GOLDER.GDT 6/10/16

[DRAFT - ELECTRONIC REVIEW]

RECORD OF BOREHOLE BCC-G15-BH-04W

SHEET 1 of 1

PROJECT: BC Cobb Ash Pond
PROJECT NUMBER: 1540973
LOCATION: Pond 1
CLIENT: Consumers Energy Company

DRILLING METHOD: Sonic
DRILLING DATE: 10-6-15
DRILL RIG: Sonic

DATUM: NAVD88
AZIMUTH: ---
NAD83 MI PLANE-S COORDS: N 647066.6, E 12622525

GS ELEVATION (ft): 587.3
TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION / VEGETATION:	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	RUN NUMBER	RUN REC / ATT	SAMPLES NUMBER	SAMPLES TYPE	POCKET PENETROMETER (tons/ft²)	LAB TESTS: ENVIRONMENTAL (SPLP & TOTAL METALS)	LAB TESTS: GRAIN SIZE DISTRIBUTION	NOTES WATER LEVELS
0	Sonic	0.0 - 9.6 WATER.			577.7								
10		9.6 - 14.6 (CCR) COAL COMBUSTION RESIDUALS, some silt, dark gray to brown, wood debris, wet, soft to firm.			9.6 572.7	1	4.50 5.00	1 2	SONIC SONIC		● ●	● ●	
15		14.6 - 19.6 No recovery, assumed to be CCR.			14.6 567.7	2	0.00 5.00						
20		19.6 - 22.1 (CCR) COAL COMBUSTION RESIDUALS, some silt, dark gray to brown, wood debris, wet, soft to firm.			19.6 565.2	3	4.20 5.00	3	SONIC		●	●	
25		22.1 - 26.6 (SP) SAND, poorly graded, fine, trace silt, brown, wood debris, non-cohesive, wet.	SP		22.1 560.7								
		26.6 - 28.1 (SP) SAND, poorly graded, coarse, trace gravel, brown, non-cohesive, wet.	SP		26.6 559.2	4	5.00 5.00						
		28.1 - 29.6 (SP) SAND, poorly graded, fine, trace silt, brown, non-cohesive, wet.	SP		28.1 557.7			4 5	SONIC SONIC		● ●	● ●	
30		29.6 - 31.6 (OL) ORGANIC SILTY SAND, brown, wood debris, cohesive, wet.	OL		29.6 555.7								
		31.6 - 34.6 (SP) SAND, poorly graded, fine, brown, non-cohesive, wet.	SP		31.6 552.7	5	5.00 5.00						
35		Boring completed at 34.6 ft.											
40													

NOTES:
1. Drilled from a barge.
2. Mud line at a depth of 9.6 feet.

Golder Associates

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

LOGGED: MMJ
CHECKED: JRP
DATE: 11/18/2015

DUL_BOREHOLE (BC ASH POND) 1540973 BC COBB ASH POND.GPJ DUL.GOLDER.GDT 6/10/16

[DRAFT - ELECTRONIC REVIEW]

RECORD OF BOREHOLE BCC-G15-BH-05W

SHEET 1 of 1

PROJECT: BC Cobb Ash Pond
PROJECT NUMBER: 1540973
LOCATION: Pond 0
CLIENT: Consumers Energy Company

DRILLING METHOD: Sonic
DRILLING DATE: 10-6-15
DRILL RIG: Sonic

DATUM: NAVD88
AZIMUTH: ---
NAD83 MI PLANE-S COORDS: N 647293.5, E 12622650

GS ELEVATION (ft): 587.3
TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION / VEGETATION:	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	RUN: NUMBER	RUN: REC / ATT	SAMPLES: NUMBER	SAMPLES: TYPE	POCKET PENETROMETER (tons/ft²)	LAB TESTS: ENVIRONMENTAL (SPLP & TOTAL METALS)	LAB TESTS: GRAIN SIZE DISTRIBUTION	NOTES WATER LEVELS
0	Sonic	0.0 - 9.8 WATER.			577.5								
10		9.8 - 10.8 (OL) ORGANIC SILT, trace sand, brown, wood debris, cohesive, wet.	OL		9.8 576.5			1	SONIC		●	●	
		10.8 - 17.8 (SP) SAND, poorly graded, medium, brown, non-cohesive, wet.	SP		10.8	1	4.50 / 5.00						
15						2	3.00 / 3.00	2	SONIC		●	●	
					569.5								
		Boring completed at 17.8 ft.											

NOTES:
1. Drilled from a barge.
2. Mud line at a depth of 9.8 feet.

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

LOGGED: MMJ
CHECKED: JRP
DATE: 11/18/2015

Golder Associates

DUL_BOREHOLE (BC ASH POND) 1540973 BC COBB ASH POND.GPJ DUL.GOLDER.GDT 6/10/16

[DRAFT - ELECTRONIC REVIEW]

RECORD OF BOREHOLE BCC-G15-BH-06

SHEET 1 of 1

PROJECT: BC Cobb Ash Pond
PROJECT NUMBER: 1540973
LOCATION: Exterior Berm
CLIENT: Consumers Energy Company

DRILLING METHOD: Sonic
DRILLING DATE: 10-22-15
DRILL RIG: Geo 8140DT

DATUM: NAVD88
AZIMUTH: ---
NAD83 MI PLANE-S COORDS: N 646449.4, E 12622410

GS ELEVATION (ft): 587.6
TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION / VEGETATION:	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	RUN: NUMBER	RUN: REC / ATT	SAMPLES: NUMBER	SAMPLES: TYPE	POCKET PENETROMETER (tons/ft²)	LAB TESTS: ENVIRONMENTAL (SPLP & TOTAL METALS)	LAB TESTS: GRAIN SIZE DISTRIBUTION	NOTES WATER LEVELS
0	Sonic	0.0 - 20.0 (CCR) COAL COMBUSTION RESIDUALS, trace fine sand, dark gray, wood debris, moist to wet, soft to firm.				1	0.00 / 8.00	1	GRAB		●	●	
5													
						2	1.50 / 2.00	2	SONIC		●	●	
10													
15						3	2.00 / 10.00	3	SONIC		●	●	
					567.6								
20		20.0 - 24.5 (SP) SAND, poorly graded, fine, brown, non-cohesive, wet.	SP		20.0	4	5.00 / 5.00	4	SONIC		●	●	
					563.1								
25		24.5 - 25.0 (SM) SILTY SAND, fine, brown, non-cohesive, wet.	SM		562.6								
		25.0 - 28.0 ORGANICS, some fine sand, brown, peat-like wood debris, organic smell, wet.			25.0 / 559.6	5	5.00 / 5.00						
		28.0 - 29.0 (SP) SAND, poorly graded, fine, brown, non-cohesive, wet.	SP		28.0 / 558.6								
		29.0 - 30.0 (OL) ORGANIC SILTY SAND, fine, brown, wet.	OL		29.0 / 557.6								
30		Boring completed at 30.0 ft.											
35													
40													

NOTES:
1. Air vacuumed to 8 feet bgs to confirm no utilities.

Golder Associates

DEPTH SCALE:1 in to 5 ft
DRILLING CONTRACTOR: Mateco
DRILLER: Dan/John

LOGGED: MMJ
CHECKED: JRP
DATE: 11/18/2015

DUL_BOREHOLE (BC ASH POND) 1540973 BC COBB ASH POND.GPJ DUL.GOLDER.GDT 6/10/16

[DRAFT - ELECTRONIC REVIEW]

RECORD OF BOREHOLE BCC-G15-BH-07

SHEET 1 of 1

PROJECT: BC Cobb Ash Pond
PROJECT NUMBER: 1540973
LOCATION: Interior Berm
CLIENT: Consumers Energy Company

DRILLING METHOD: Sonic
DRILLING DATE: 10-22-15
DRILL RIG: Geo 8140DT

DATUM: NAVD88
AZIMUTH: ---
NAD83 MI PLANE-S COORDS: N 646707.3, E 12622618

GS ELEVATION (ft): 589.0
TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION / VEGETATION:	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	RUN: NUMBER	RUN: REC / ATT	SAMPLES: NUMBER	SAMPLES: TYPE	POCKET PENETROMETER (tons/ft²)	LAB TESTS: ENVIRONMENTAL (SPLP & TOTAL METALS)	LAB TESTS: GRAIN SIZE DISTRIBUTION	NOTES WATER LEVELS
0	Hand Auger	0.0 - 3.0 (CCR) COAL COMBUSTION RESIDUALS, medium to coarse, red to brown, partially cemented, moist.			586.0	1	5.00 / 5.00	1	AUGER		●	●	
		3.0 - 9.5 (CCR) COAL COMBUSTION RESIDUALS, fine, dark gray, wet, soft to firm.			3.0								
5	Sonic					2	4.80 / 5.00	2	SONIC		●	●	4-inch-thick layer of poorly graded, fine sand
					579.5								
10		9.5 - 15.0 (CCR) COAL COMBUSTION RESIDUALS, with fine to medium sand, dark gray, wet, soft.			9.5	3	2.50 / 5.00	3	SONIC		●	●	
					574.0								
15		15.0 - 26.0 (SP) SAND, poorly graded, fine, brown to gray, wood debris, non-cohesive, wet.	SP		15.0	4	4.80 / 5.00	4	SONIC		●	●	
20						5	5.00 / 5.00						
25					563.0								
		26.0 - 30.0 (OL) ORGANIC SANDY SILT, fine, brown, wood debris, wet, firm.	OL		26.0	6	5.00 / 5.00						
30					559.0								
		Boring completed at 30.0 ft.											
35													
40													

NOTES:
1. Hand augered to 5 feet bgs to confirm no utilities.

Golder Associates

DEPTH SCALE: 1 in to 5 ft
DRILLING CONTRACTOR: Mateco
DRILLER: Dan M

LOGGED: MMJ
CHECKED: JRP
DATE: 11/18/2015

DUL_BOREHOLE (BC ASH POND) 1540973 BC COBB ASH POND.GPJ DUL.GOLDER.GDT 6/10/16

[DRAFT - ELECTRONIC REVIEW]

RECORD OF BOREHOLE BCC-G15-BH-08

SHEET 1 of 1

PROJECT: BC Cobb Ash Pond
PROJECT NUMBER: 1540973
LOCATION: Interior Berm
CLIENT: Consumers Energy Company

DRILLING METHOD: Sonic
DRILLING DATE: 10-22-15
DRILL RIG: Geo 8140DT

DATUM: NAVD88
AZIMUTH: ---
NAD83 MI PLANE-S COORDS: N 646976.8, E 12622792

GS ELEVATION (ft): 590.1
TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION / VEGETATION:	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	RUN NUMBER	RUN REC / ATT	SAMPLES NUMBER	SAMPLES TYPE	POCKET PENETROMETER (tons/ft²)	LAB TESTS: ENVIRONMENTAL (SPLP & TOTAL METALS)	LAB TESTS: GRAIN SIZE DISTRIBUTION	NOTES WATER LEVELS
0	Hand Auger	0.0 - 5.0 (CCR) COAL COMBUSTION RESIDUALS, fine to medium, black, moist.			585.1	1	5.00 / 5.00	1	AUGER		●	●	
5	Sonic	5.0 - 8.0 (CCR) COAL COMBUSTION RESIDUALS, some fine sand, dark gray, wood debris, wet, soft to firm.			5.0 / 582.1	2	5.00 / 5.00	2	SONIC		●	●	
		8.0 - 9.0 (SP) SAND, poorly graded, fine to medium, mixed with CCR, dark gray, non-cohesive, wet.	SP		8.0 / 581.1			3	SONIC		●	●	
		9.0 - 9.5 (CCR) COAL COMBUSTION RESIDUALS, dark gray, wet, firm.	SP		580.6 / 580.1								
10		9.5 - 10.0 (SP) SAND, poorly graded, fine, brown, wood debris, non-cohesive, wet.			10.0	3	2.00 / 5.00						
		10.0 - 17.0 (CCR) COAL COMBUSTION RESIDUALS, dark gray, wet, soft to firm.											
15		17.0 - 19.0 (SP) SAND, poorly graded, fine to medium, brown, non-cohesive, wet.	SP		573.1 / 17.0 / 571.1	4	5.00 / 5.00	4	SONIC		●	●	Bottom foot of CCR mixed with wood debris
		19.0 - 20.0 ORGANICS, decomposing, brown, wood debris, wet.			19.0 / 570.1								
20		20.0 - 21.5 (SW) SAND, fine to coarse, brown, wood debris, shell pieces, non-cohesive, wet.	SW		20.0 / 568.6	5	5.00 / 5.00						
		21.5 - 30.0 (SP) SAND, poorly graded, fine, brown, wood debris, non-cohesive, wet.	SP		21.5								
25						6	5.00 / 5.00						
30		Boring completed at 30.0 ft.			560.1								Organic silty sand 3 inches thick
35													
40													

NOTES:
1. Hand augered to 5 feet bgs to confirm no utilities.

Golder Associates

DEPTH SCALE:1 in to 5 ft
DRILLING CONTRACTOR: Mateco
DRILLER: Dan M

LOGGED: MMJ
CHECKED: JRP
DATE: 11/18/2015

DUL_BOREHOLE (BC ASH POND) 1540973 BC COBB ASH POND.GPJ DUL.GOLDER.GDT 6/10/16

[DRAFT - ELECTRONIC REVIEW]

RECORD OF BOREHOLE BCC-G15-BH-09W

SHEET 1 of 1

PROJECT: BC Cobb Ash Pond
PROJECT NUMBER: 1540973
LOCATION: Pond 4
CLIENT: Consumers Energy Company

DRILLING METHOD: Sonic
DRILLING DATE: 10-12-15
DRILL RIG: Sonic

DATUM: NAVD88
AZIMUTH: ---
NAD83 MI PLANE-S COORDS: N 646316.5, E 12622812

GS ELEVATION (ft): 585.8
TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION / VEGETATION:	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	RUN NUMBER	RUN REC / ATT	SAMPLES NUMBER	SAMPLES TYPE	POCKET PENETROMETER (tons/ft²)	LAB TESTS: ENVIRONMENTAL (SPLP & TOTAL METALS)	LAB TESTS: GRAIN SIZE DISTRIBUTION	NOTES WATER LEVELS
0	Sonic	0.0 - 8.5 WATER.			577.3								
		8.5 - 11.0 (CCR) COAL COMBUSTION RESIDUALS, dark gray, wet, soft.			8.5 574.8	1	2.50 2.50	1 2	SONIC SONIC		● ●	● ●	
10		11.0 - 22.3 (SP) SAND, poorly graded, fine to medium, trace to some silt, dark gray to brown, wood debris, organic smell, non-cohesive, wet.	SP		11.0	2	5.00 5.00	3 4	SONIC SONIC		● ●	● ●	
15						3	5.00 5.00						
20					563.5			5	SONIC			●	
		22.3 - 23.5 ORGANICS, decomposing, brown, wood debris, wet.			22.3 562.3	4	5.00 5.00						
25		23.5 - 26.0 (SP) SAND, poorly graded, fine, trace organics, brown, non-cohesive, wet.	SP		23.5 559.8								
		Boring completed at 26.0 ft.											

NOTES:
1. Drilled from a barge.
2. Mud line at a depth of 8.5 feet.

Golder Associates

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

LOGGED: MMJ
CHECKED: JRP
DATE: 11/18/2015

DUL_BOREHOLE (BC ASH POND) 1540973 BC COBB ASH POND.GPJ DUL.GOLDER.GDT 6/10/16

[DRAFT - ELECTRONIC REVIEW]

RECORD OF BOREHOLE BCC-G15-BH-10W

SHEET 1 of 1

PROJECT: BC Cobb Ash Pond
PROJECT NUMBER: 1540973
LOCATION: Pond 3
CLIENT: Consumers Energy Company

DRILLING METHOD: Sonic
DRILLING DATE: 10-12-15
DRILL RIG: Sonic

DATUM: NAVD88
AZIMUTH: ---
NAD83 MI PLANE-S COORDS: N 646439.2, E 12622871

GS ELEVATION (ft): 586.7
TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION / VEGETATION:	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	RUN: NUMBER	RUN: REC / ATT	SAMPLES: NUMBER	SAMPLES: TYPE	POCKET PENETROMETER (tons/ft²)	LAB TESTS: ENVIRONMENTAL (SPLP & TOTAL METALS)	LAB TESTS: GRAIN SIZE DISTRIBUTION	NOTES WATER LEVELS
0	Sonic	0.0 - 6.9 WATER.			579.8								
		6.9 - 10.4 (CCR) COAL COMBUSTION RESIDUALS, dark gray, wet, soft.			6.9 576.3	1	3.80 4.00	1 2 3	SONIC SONIC SONIC		● ● ●	● ● ●	
5													
10		10.4 - 23.1 (SP) SAND, poorly graded, fine, brown, organic smell, non-cohesive, wet.	SP		10.4 563.6	2 3 4	4.00 5.00 5.00 5.00						
15													
20													
		23.1 - 26.4 (SP) SAND, poorly graded, fine, some silt and clay, brown, non-cohesive, wet.	SP		23.1 560.3			4	SONIC		●	●	
25		26.4 - 30.9 (SM) SILTY SAND, fine, trace clay, brown, trace wood debris, cohesive, wet, firm to stiff.	SM		26.4 555.8	5	5.00 5.00	5	SONIC		●	●	
30		Boring completed at 30.9 ft.											
35													
40													

NOTES:
1. Drilled from a barge.
2. Mud line at a depth of 6.9 feet.

Golder Associates

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

LOGGED: MMJ
CHECKED: JRP
DATE: 11/18/2015

DUL_BOREHOLE (BC ASH POND) 1540973 BC COBB ASH POND.GPJ DUL.GOLDER.GDT 6/10/16

[DRAFT - ELECTRONIC REVIEW]

RECORD OF BOREHOLE BCC-G15-BH-11W

SHEET 1 of 1

PROJECT: BC Cobb Ash Pond
PROJECT NUMBER: 1540973
LOCATION: Pond 2
CLIENT: Consumers Energy Company

DRILLING METHOD: Sonic
DRILLING DATE: 10-13-15
DRILL RIG: Sonic

DATUM: NAVD88
AZIMUTH: ---
NAD83 MI PLANE-S COORDS: N 646564.7, E 12622964

GS ELEVATION (ft): 587.2
TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION / VEGETATION:	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	RUN: NUMBER	RUN: REC / ATT	SAMPLES: NUMBER	SAMPLES: TYPE	POCKET PENETROMETER (tons/ft²)	LAB TESTS: ENVIRONMENTAL (SPLP & TOTAL METALS)	LAB TESTS: GRAIN SIZE DISTRIBUTION	NOTES WATER LEVELS
0	Sonic	0.0 - 7.3 WATER.			579.9								
		7.3 - 10.1 (CCR) COAL COMBUSTION RESIDUALS, dark gray, wet, soft to firm.			7.3 577.1	1	3.40 3.50	1 2	SONIC SONIC		● ●	● ●	
10		10.1 - 23.8 (SP) SAND, poorly graded, fine, brown, wood debris, wet.	SP		10.1	2	5.00 5.00	3	SONIC		●	●	
15						3	5.00 5.00	4	SONIC		●	●	
20						4	1.50 5.00	5	SONIC		●	●	
		23.8 - 25.8 (CL) CLAY, assumed (see NOTES below).	CL		563.4 23.8 561.4								
25		Boring completed at 25.8 ft.											
30													
35													
40													

NOTES:
1. Drilled from a barge.
2. Mud line at a depth of 7.3 feet.
3. At 23.8 feet, drillers noticed a change in material consistency while sampling (more difficult to drive sampler). The drilelrs suspected organic silt/clay. The sample was lost during recovery.

Golder Associates

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

LOGGED: MMJ
CHECKED: JRP
DATE: 11/18/2015

DUL_BOREHOLE (BC ASH POND) 1540973 BC COBB ASH POND.GPJ DUL.GOLDER.GDT 6/10/16

[DRAFT - ELECTRONIC REVIEW]

RECORD OF BOREHOLE BCC-G15-BH-12W

SHEET 1 of 1

PROJECT: BC Cobb Ash Pond
PROJECT NUMBER: 1540973
LOCATION: Pond 1
CLIENT: Consumers Energy Company

DRILLING METHOD: Sonic
DRILLING DATE: 10-6-15
DRILL RIG: Sonic

DATUM: NAVD88
AZIMUTH: ---
NAD83 MI PLANE-S COORDS: N 646715.7, E 12623058

GS ELEVATION (ft): 587.3
TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION / VEGETATION:	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	RUN NUMBER	RUN REC / ATT	SAMPLES NUMBER	SAMPLES TYPE	POCKET PENETROMETER (tons/ft²)	LAB TESTS: ENVIRONMENTAL (SPLP & TOTAL METALS)	LAB TESTS: GRAIN SIZE DISTRIBUTION	NOTES WATER LEVELS
0	Sonic	0.0 - 6.4 WATER.			580.9								
		6.4 - 15.9 (CCR) COAL COMBUSTION RESIDUALS, some organics, dark gray, wet, soft to firm.			6.4	1	2.00 / 5.00	1	SONIC		●	●	
10						2	5.00 / 5.00	2	SONIC		●	●	
15					571.4								
		15.9 - 27.9 (SP) SAND, poorly graded, fine, trace organics, dark greenish gray, non-cohesive, wet.	SP		15.9	3	4.00 / 5.00	3	SONIC		●	●	
20						4	3.20 / 5.00						
25					559.4								
		27.9 - 31.4 (OL) ORGANIC SILTY SAND, brown, wood debris, cohesive, wet.	OL		27.9	5	5.00 / 5.00	4	SONIC		●	●	
30					555.9								
		Boring completed at 31.4 ft.											
35													
40													

NOTES:
1. Drilled from a barge.
2. Mud line at a depth of 6.4 feet.

Golder Associates

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

LOGGED: MMJ
CHECKED: JRP
DATE: 11/18/2015

DUL_BOREHOLE (BC ASH POND) 1540973 BC COBB ASH POND.GPJ DUL.GOLDER.GDT 6/10/16

[DRAFT - ELECTRONIC REVIEW]

RECORD OF BOREHOLE BCC-G15-BH-13W

SHEET 1 of 1

PROJECT: BC Cobb Ash Pond
PROJECT NUMBER: 1540973
LOCATION: Pond 0
CLIENT: Consumers Energy Company

DRILLING METHOD: Sonic
DRILLING DATE: 10-5-15
DRILL RIG: Sonic

DATUM: NAVD88
AZIMUTH: ---
NAD83 MI PLANE-S COORDS: N 646823.3, E 12623138

GS ELEVATION (ft): 587.3
TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION (VEGETATION:)	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	RUN NUMBER	RUN REC / ATT	SAMPLES NUMBER	SAMPLES TYPE	POCKET PENETROMETER (tons/ft²)	LAB TESTS: ENVIRONMENTAL (SPLP & TOTAL METALS)	LAB TESTS: GRAIN SIZE DISTRIBUTION	NOTES WATER LEVELS
0	Sonic	0.0 - 10.7 WATER.			576.6								
		10.7 - 13.7 (CCR) COAL COMBUSTION RESIDUALS, dark gray, wet, firm.			10.7 573.6	1	4.20 5.00	1	SONIC		●	●	
		13.7 - 15.7 (CCR) COAL COMBUSTION RESIDUALS, mixed with fine sand, dark gray, wood debris, organic smell, wet.			13.7 571.6			1A	SONIC		●		
15		15.7 - 22.7 (SP) SAND, poorly graded, fine, trace silt, dark gray to brown, wood debris, organic smell, non-cohesive, wet.	SP		15.7 564.6	2	5.00 5.00	2	SONIC		●	●	
20		22.7 - 24.7 (OL) ORGANIC SANDY SILT, dark brown, trace wood debris, organic smell, cohesive, wet, soft.	OL		22.7 562.6	3	5.00 5.00	3	SONIC		●	●	
25		24.7 - 25.7 (SP) SAND, poorly graded, fine, brown, non-cohesive, wet.	SP		24.7 561.6								

Boring completed at 25.7 ft.

NOTES:
1. Drilled from a barge.
2. Mud line at a depth of 10.7 feet.

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

LOGGED: JRP
CHECKED: JRP
DATE: 11/18/2015

Golder Associates

DUL_BOREHOLE (BC ASH POND) 1540973 BC COBB ASH POND.GPJ DUL.GOLDER.GDT 6/10/16

[DRAFT - ELECTRONIC REVIEW]

RECORD OF BOREHOLE BCC-G15-BH-14W

SHEET 1 of 1

PROJECT: BC Cobb Ash Pond
PROJECT NUMBER: 1540973
LOCATION: Pond 8
CLIENT: Consumers Energy Company

DRILLING METHOD: Sonic
DRILLING DATE: 10-9-15
DRILL RIG: Sonic

DATUM: NAVD88
AZIMUTH: ---
NAD83 MI PLANE-S COORDS: N 646232.4, E 12623151

GS ELEVATION (ft): 592.0
TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION / VEGETATION:	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	RUN: NUMBER	RUN: REC / ATT	SAMPLES: NUMBER	SAMPLES: TYPE	POCKET PENETROMETER (tons/ft²)	LAB TESTS: ENVIRONMENTAL (SPLP & TOTAL METALS)	LAB TESTS: GRAIN SIZE DISTRIBUTION	NOTES WATER LEVELS
0	Sonic	0.0 - 5.8 WATER.			586.2								
		5.8 - 14.7 (CCR) COAL COMBUSTION RESIDUALS, some sand, light gray to dark gray, partially cemented, wood debris at bottom, wet. Drillers observed increased difficulty driving sampler into material.			5.8	1	4.50 / 5.00	1 2	SONIC SONIC		● ●	● ●	
10						2	4.70 / 5.00	3	SONIC		●	●	
					577.3			4	SONIC		●	●	
15		14.7 - 25.8 (SP) SAND, poorly graded, fine, brown, wet.	SP		14.7	3	5.00 / 5.00						
20						4	3.00 / 5.00						
25					566.2								
		Boring completed at 25.8 ft.											

NOTES:
1. Auger refusal at 25.8 feet.
2. Drilled from a barge.
3. Mud line at 5.8 feet.

Golder Associates

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

LOGGED: MMJ
CHECKED: JRP
DATE: 11/18/2015

DUL_BOREHOLE (BC ASH POND) 1540973 BC COBB ASH POND.GPJ DUL.GOLDER.GDT 6/10/16

[DRAFT - ELECTRONIC REVIEW]

RECORD OF BOREHOLE BCC-G15-BH-15W

SHEET 1 of 1

PROJECT: BC Cobb Ash Pond
PROJECT NUMBER: 1540973
LOCATION: Pond 7
CLIENT: Consumers Energy Company

DRILLING METHOD: Sonic
DRILLING DATE: 10-8-15
DRILL RIG: Sonic

DATUM: NAVD88
AZIMUTH: ---
NAD83 MI PLANE-S COORDS: N 646401.7, E 12623240

GS ELEVATION (ft): 592.0
TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	RUN: NUMBER	RUN: REC / ATT	SAMPLES: NUMBER	SAMPLES: TYPE	POCKET PENETROMETER (tons/ft²)	LAB TESTS: ENVIRONMENTAL (SPLP & TOTAL METALS)	LAB TESTS: GRAIN SIZE DISTRIBUTION	NOTES WATER LEVELS
0	Sonic	VEGETATION:											
		0.0 - 10.3 WATER.			581.7								
10		10.3 - 17.3 (CCR) COAL COMBUSTION RESIDUALS, dark gray, behaves as a slurry in upper 5 feet, wet, soft.			10.3	1	4.80 / 5.00	1	SONIC		●	●	
								4	SONIC		●	●	
15					574.7								
		17.3 - 30.3 (SP) SAND, poorly graded, fine, brown, wood debris, non-cohesive, wet.	SP		17.3	2	3.00 / 5.00	2	SONIC			●	
20								3	SONIC		●	●	
						3	4.80 / 5.00						
25						4	4.60 / 5.00						
30					561.7								
		Boring completed at 30.3 ft.											
35													
40													

NOTES:
1. Auger refusal at 30.3 feet.
2. Drilled from a barge.
3. Mud line at 10.3 feet.

Golder Associates

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

LOGGED: MMJ
CHECKED: JRP
DATE: 11/18/2015

DUL_BOREHOLE (BC ASH POND) 1540973 BC COBB ASH POND.GPJ DUL.GOLDER.GDT 6/10/16

[DRAFT - ELECTRONIC REVIEW]

RECORD OF BOREHOLE BCC-G15-BH-16W

SHEET 1 of 1

PROJECT: BC Cobb Ash Pond
PROJECT NUMBER: 1540973
LOCATION: Pond 6
CLIENT: Consumers Energy Company

DRILLING METHOD: Sonic
DRILLING DATE: 10-8-15
DRILL RIG: Sonic

DATUM: NAVD88
AZIMUTH: ---
NAD83 MI PLANE-S COORDS: N 646488.6, E 12623269

GS ELEVATION (ft): 588.0
TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION / VEGETATION:	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	RUN: NUMBER	RUN: REC / ATT	SAMPLES: NUMBER	SAMPLES: TYPE	POCKET PENETROMETER (tons/ft²)	LAB TESTS: ENVIRONMENTAL (SPLP & TOTAL METALS)	LAB TESTS: GRAIN SIZE DISTRIBUTION	NOTES WATER LEVELS
0	Sonic	0.0 - 8.1 WATER.			579.9								
		8.1 - 15.2 (CCR) COAL COMBUSTION RESIDUALS, dark gray, behaves as a slurry in upper 5 feet, wet, very soft.			8.1	1	0.00 / 5.00	1	SONIC		●		
								2	SONIC		●	●	
					572.8								
		15.2 - 27.1 (SP) SAND, poorly graded, fine, brown, wood debris, non-cohesive, wet.	SP		15.2	2	4.10 / 5.00	3	SONIC		●	●	
						3	5.00 / 5.00	4	SONIC			●	
						4	5.00 / 5.00						
					560.9								
		27.1 - 28.1 (ML-SM) SANDY SILT, brown, wood debris, organic smell, cohesive, wet, firm.	ML-SM		27.1 559.9								

Boring completed at 28.1 ft.

NOTES:
1. Drilled from a barge.
2. Mud line at 8.1 feet.

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

LOGGED: MMJ
CHECKED: JRP
DATE: 11/18/2015

Golder Associates

DUL_BOREHOLE (BC ASH POND) 1540973 BC COBB ASH POND.GPJ DUL.GOLDER.GDT 6/10/16

[DRAFT - ELECTRONIC REVIEW]

RECORD OF BOREHOLE BCC-G15-BH-17W

SHEET 1 of 1

PROJECT: BC Cobb Ash Pond
PROJECT NUMBER: 1540973
LOCATION: Pond 5
CLIENT: Consumers Energy Company

DRILLING METHOD: Sonic
DRILLING DATE: 10-7-15
DRILL RIG: Sonic

DATUM: NAVD88
AZIMUTH: ---
NAD83 MI PLANE-S COORDS: N 646582, E 12623329

GS ELEVATION (ft): 587.5
TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION / VEGETATION:	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	RUN NUMBER	RUN REC / ATT	SAMPLES NUMBER	SAMPLES TYPE	POCKET PENETROMETER (tons/ft²)	LAB TESTS: ENVIRONMENTAL (SPLP & TOTAL METALS)	LAB TESTS: GRAIN SIZE DISTRIBUTION	NOTES WATER LEVELS
0	Sonic	0.0 - 10.2 WATER.			577.3								
10		10.2 - 13.7 (CCR) COAL COMBUSTION RESIDUALS, dark gray, wet, soft.			10.2 573.8	1	4.50 5.00	1 1A	SONIC SONIC		● ●	●	
		13.7 - 20.2 (SP) SAND, poorly graded, fine, brown, non-cohesive, wet.	SP		13.7 567.3	2	5.00 5.00	4	SONIC			●	
20		20.2 - 23.7 (SM) SILTY SAND, brown, cohesive, wet, stiff.	SM		20.2 563.8	3	5.00 5.00	2	SONIC		●	●	
25		23.7 - 30.2 (SP) SAND, poorly graded, fine, brown, non-cohesive, wet.	SP		23.7 557.3	4	6.00 6.00						
30		30.2 - 31.2 (SM) SILTY SAND, fine, trace clay, brown, cohesive, wet, stiff.	SM		30.2 556.3			3	SONIC		●	●	
35		Boring completed at 31.2 ft.											
40													

NOTES:
1. Drilled from a barge.
2. Mud line at 10.2 feet.

Golder Associates

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

LOGGED: MMJ
CHECKED: JRP
DATE: 11/18/2015

DUL_BOREHOLE (BC ASH POND) 1540973 BC COBB ASH POND.GPJ DUL.GOLDER.GDT 6/10/16

[DRAFT - ELECTRONIC REVIEW]

RECORD OF BOREHOLE BCC-G15-BH-18W

SHEET 1 of 1

PROJECT: BC Cobb Ash Pond
PROJECT NUMBER: 1540973
LOCATION: Pond 7
CLIENT: Consumers Energy Company

DRILLING METHOD: Sonic
DRILLING DATE: 10-9-15
DRILL RIG: Sonic

DATUM: NAVD88
AZIMUTH: ---
NAD83 MI PLANE-S COORDS: N 646227.8, E 12623359

GS ELEVATION (ft): 592.0
TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION / VEGETATION:	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	RUN NUMBER	RUN REC / ATT	SAMPLES NUMBER	SAMPLES TYPE	POCKET PENETROMETER (tons/ft²)	LAB TESTS: ENVIRONMENTAL (SPLP & TOTAL METALS)	LAB TESTS: GRAIN SIZE DISTRIBUTION	NOTES WATER LEVELS
0	Sonic	0.0 - 4.7 WATER.			587.3								
5		4.7 - 16.5 (CCR) COAL COMBUSTION RESIDUALS, some organics, dark gray, layer of wood debris at base, wet, soft.			4.7	1	5.00 / 5.00	1	SONIC		●	●	
10						2	2.90 / 5.00	2	SONIC		●	●	
15								3	SONIC		●	●	
		16.5 - 29.7 (SP) SAND, poorly graded, fine to medium, dark gray to brown, non-cohesive, wet.	SP		575.5 16.5	3	3.90 / 5.00	4	SONIC		●	●	
20						4	2.80 / 5.00	5	SONIC			●	
25						5	0.00 / 5.00						
30		Boring completed at 29.7 ft.			562.3								
35													
40													

NOTES:
1. Drilled from a barge.
2. Mud line at 4.7 feet.

Golder Associates

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

LOGGED: MMJ
CHECKED: JRP
DATE: 11/18/2015

DUL_BOREHOLE (BC ASH POND) 1540973 BC COBB ASH POND.GPJ DUL.GOLDER.GDT 6/10/16

[DRAFT - ELECTRONIC REVIEW]

RECORD OF BOREHOLE BCC-G15-BH-19W

SHEET 1 of 1

PROJECT: BC Cobb Ash Pond
PROJECT NUMBER: 1540973
LOCATION: Pond 6
CLIENT: Consumers Energy Company

DRILLING METHOD: Sonic
DRILLING DATE: 10-8-15
DRILL RIG: Sonic

DATUM: NAVD88
AZIMUTH: ---
NAD83 MI PLANE-S COORDS: N 646210.6, E 12623476

GS ELEVATION (ft): 588.0
TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	RUN: NUMBER	RUN: REC / ATT	SAMPLES: NUMBER	SAMPLES: TYPE	POCKET PENETROMETER (tons/ft²)	LAB TESTS: ENVIRONMENTAL (SPLP & TOTAL METALS)	LAB TESTS: GRAIN SIZE DISTRIBUTION	NOTES WATER LEVELS
0	Sonic	VEGETATION:											
		0.0 - 5.0 WATER.			583.0								
5		5.0 - 10.0 (CCR) COAL COMBUSTION RESIDUALS, dark gray, wet, soft.			5.0	1	4.80 / 5.00	1	SONIC		●	●	
								2	SONIC		●	●	
10		10.0 - 20.0 (SP) SAND, poorly graded, fine, brown, wood debris, non-cohesive, wet, compact to dense.			578.0 / 10.0			3	SONIC			●	
						2	5.00 / 5.00	4	SONIC			●	
15			SP			3	2.50 / 5.00						
20		Boring completed at 20.0 ft.			568.0								
25													
30													
35													
40													

NOTES:
1. Auger refusal at 20.0 feet.
2. Drilled from a barge.
3. Mud line at 5.0 feet.

Golder Associates

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

LOGGED: MMJ
CHECKED: JRP
DATE: 11/18/2015

DUL_BOREHOLE (BC ASH POND) 1540973 BC COBB ASH POND.GPJ DUL.GOLDER.GDT 6/10/16

[DRAFT - ELECTRONIC REVIEW]

RECORD OF BOREHOLE BCC-G15-BH-20W

SHEET 1 of 1

PROJECT: BC Cobb Ash Pond
PROJECT NUMBER: 1540973
LOCATION: Pond 5
CLIENT: Consumers Energy Company

DRILLING METHOD: Sonic
DRILLING DATE: 10-7-15
DRILL RIG: Sonic

DATUM: NAVD88
AZIMUTH: ---
NAD83 MI PLANE-S COORDS: N 646222.6, E 12623590

GS ELEVATION (ft): 587.5
TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION / VEGETATION:	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	RUN: NUMBER	RUN: REC / ATT	SAMPLES: NUMBER	SAMPLES: TYPE	POCKET PENETROMETER (tons/ft²)	LAB TESTS: ENVIRONMENTAL (SPLP & TOTAL METALS)	LAB TESTS: GRAIN SIZE DISTRIBUTION	NOTES WATER LEVELS
0	Sonic	0.0 - 8.6 WATER.			578.9								
		8.6 - 11.6 (CCR) COAL COMBUSTION RESIDUALS, dark gray, wet, soft.			8.6			1	SONIC		●	●	
10					575.9	1	5.00 / 5.00	1A	SONIC		●		
		11.6 - 23.6 (SP) SAND, poorly graded, fine, trace silt, brown, wood debris, non-cohesive, wet, dense.			11.6			2	SONIC		●	●	
15			SP			2	5.00 / 5.00						
20						3	4.50 / 5.00						
								3	SONIC			●	
					563.9								
		Boring completed at 23.6 ft.											

NOTES:
1. Auger refusal at 23.6 feet.
2. Drilled from a barge.
3. Mud line at 8.6 feet.

Golder Associates

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

LOGGED: MMJ
CHECKED: JRP
DATE: 11/18/2015

DUL_BOREHOLE (BC ASH POND) 1540973 BC COBB ASH POND.GPJ DUL.GOLDER.GDT 6/10/16

[DRAFT - ELECTRONIC REVIEW]

RECORD OF BOREHOLE BCC-G15-BH-21W

SHEET 1 of 1

PROJECT: BC Cobb Ash Pond
PROJECT NUMBER: 1540973
LOCATION: EQ Basin
CLIENT: Consumers Energy Company

DRILLING METHOD: Sonic
DRILLING DATE: 10-22-15
DRILL RIG: Geo 8140DT

DATUM: NAVD88
AZIMUTH: ---
NAD83 MI PLANE-S COORDS: N 645691.3, E 12623547

GS ELEVATION (ft): 591.4
TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION / VEGETATION:	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	RUN: NUMBER	RUN: REC / ATT	SAMPLES: NUMBER	SAMPLES: TYPE	POCKET PENETROMETER (tons/ft²)	LAB TESTS: ENVIRONMENTAL (SPLP & TOTAL METALS)	LAB TESTS: GRAIN SIZE DISTRIBUTION	NOTES WATER LEVELS
0	Sonic	0.0 - 4.5 (CCR) COAL COMBUSTION RESIDUALS, medium to coarse, gray to brown, partially cemented, wet.			586.9	1	4.00 / 5.00	1	SONIC		●	●	
5		4.5 - 19.0 (CCR) COAL COMBUSTION RESIDUALS, fine, trace gravel and slag, dark gray, wet, firm.			4.5	2	3.50 / 5.00	2	SONIC		●	●	
10						3	4.50 / 5.00	3	SONIC		●	●	
15						4	1.00 / 5.00						
					572.4								
		19.0 - 19.5 (OL) ORGANIC SILT, brown, peat-like wood debris, wet.	OL		571.9								
20		19.5 - 25.0 (SP) SAND, poorly graded, fine to medium, trace to some organic silt, brown, wood debris, non-cohesive, wet.	SP		19.5	5	5.00 / 5.00	4	SONIC		●	●	
25					566.4								
		Boring completed at 25.0 ft.											
30													
35													
40													

NOTES:
1. Basin drained immediately prior to drilling.

DEPTH SCALE: 1 in to 5 ft
DRILLING CONTRACTOR: Mateco
DRILLER: Dan/John

LOGGED: MMJ
CHECKED: JRP
DATE: 11/18/2015

Golder Associates

DUL_BOREHOLE (BC ASH POND) 1540973 BC COBB ASH POND.GPJ DUL.GOLDER.GDT 6/10/16

[DRAFT - ELECTRONIC REVIEW]

RECORD OF BOREHOLE BCC-G15-BH-22W

SHEET 1 of 1

PROJECT: BC Cobb Ash Pond
PROJECT NUMBER: 1540973
LOCATION: EQ Basin
CLIENT: Consumers Energy Company

DRILLING METHOD: Sonic
DRILLING DATE: 10-22-15
DRILL RIG: Geo 8140DT

DATUM: NAVD88
AZIMUTH: ---
NAD83 MI PLANE-S COORDS: N 645718.3, E 12623643

GS ELEVATION (ft): 590.5
TOC ELEVATION: ---

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION / VEGETATION:	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	RUN: NUMBER	RUN: REC / ATT	SAMPLES: NUMBER	SAMPLES: TYPE	POCKET PENETROMETER (tons/ft²)	LAB TESTS: ENVIRONMENTAL (SPLP & TOTAL METALS)	LAB TESTS: GRAIN SIZE DISTRIBUTION	NOTES WATER LEVELS
0	Sonic	0.0 - 4.5 (CCR) COAL COMBUSTION RESIDUALS, medium to coarse, gray to brown, parially cemented, wet.			586.0	1	2.80 / 5.00	1	SONIC		●	●	
5		4.5 - 7.5 (CCR) COAL COMBUSTION RESIDUALS, medium to fine, trace gravel and slag, reddish brown, wet.			4.5 583.0	2	4.60 / 5.00	2	SONIC		●	●	
10		7.5 - 16.5 (CCR) COAL COMBUSTION RESIDUALS, fine, dark gray, wet, firm to soft.			7.5	3	4.70 / 5.00	3	SONIC		●	●	
15					574.0								
		16.5 - 17.5 ORGANICS, brown, peat-like wood debris, wet.			16.5 573.0	4	4.50 / 5.00						
20		17.5 - 24.5 (SP) SAND, poorly graded, fine, brown, wood debris, wet.	SP		17.5 566.0	5	4.80 / 5.00	4	SONIC		●	●	
25		24.5 - 25.0 (OL) ORGANIC SILT, with peat, brown, wood debris, organic smell, wet.	OL		565.5								
30													
35													
40													

Boring completed at 25.0 ft.

NOTES:
1. Basin drained immediately prior to drilling.

DEPTH SCALE: 1 in to 5 ft
DRILLING CONTRACTOR: Mateco
DRILLER: Dan/John

LOGGED: MMJ
CHECKED: JRP
DATE: 11/18/2015

Golder Associates

DUL_BOREHOLE (BC ASH POND) 1540973 BC COBB ASH POND.GPJ DUL.GOLDER.GDT 6/10/16

[DRAFT - ELECTRONIC REVIEW]

Appendix C

Monitoring Well Boring Logs and Well Construction Logs

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/12/15 **Date Finish:** 10/12/15 **Drilling Company:** Mateco Drilling **Driller's Name:** John Pitsch **Drilling Method:** Hand Auger/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 3.8 **Water Level Finish (ft. btoc.):** 5.96	**Northing:** 645763.32 **Easting:** 12624262.15 **Casing Elevation:** 586.52 **Borehole Depth (ft. bgs.):** 20.0 **Surface Elevation:** 583.6 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15001** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Cloudy, Windy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
0	585									TOC Elevation = 586.52 (ft. above msl)
	580	1	0.0-6.0'	6.0	NA			(0.0 - 0.1') GRASS and TOPSOIL. (0.1 - 1.0') SAND, fine to very fine, subround; little silt; well sorted; dry to moist; dark brown (10YR 3/3). (1.0 - 3.8') ASH, some fine to very fine sand, subround; little silt; poorly sorted; moist to wet; dark grayish brown (10YR 4/2). NOTE: Fill material. (3.8 - 4.0') SAND, fine, little very fine, subround; trace to little silt; well sorted; wet; grayish brown (10YR 5/2). NOTE: trace organic matter, trace ash. (4.0 - 7.0') CLAY, some silt, high plasticity, no dilatancy; trace very fine sand; subround; medium stiff to soft; moist; gray (10YR 5/1) to grayish brown (10YR 5/2). NOTE: very soft, gray (10Yr 5/1) to gray (10YR 6/1) from 6.0-7.0' bgs.		Concrete (0.0-1.0' bgs) 2" PVC Well Casing (-3.0-10.0' bgs) Bentonite Pellets (1.0-8.0' bgs)
5		2	6.0-10.0'	3.0	NA			(7.0 - 7.5') CLAY, some silt, medium plasticity, slow dilatancy; trace very fine sand, subround; soft; moist to wet; very dark gray (10YR 3/1). NOTE: little to some organic matter. (7.5 - 8.0') WOOD, dark gray (10YR 4/1). (8.0 - 9.0') CLAY and SILT, low plasticity, slow dilatancy; little very fine to fine sand, subround; medium stiff; moist to wet; brown (10YR 4/3). NOTE: some organic matter, trace to little wood. (9.0 - 9.1') SAND, very fine, subround; trace silt; well sorted; wet; light gray (10Yr 7/2).		
10	575							(9.1 - 9.6') CLAY and SILT, high plasticity, no dilatancy; little to some very fine sand, subround; medium stiff; moist; brown (10YR 4/3). (9.6 - 20.0') SAND, fine to medium; trace to little very fine sand, subround; trace to little silt; well sorted; wet; light brownish gray (10YR 6/2).		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Hand Auger to 6.0' bgs.
Groundwater encountered at 3.8' bgs during drilling.
Water level at development was 5.96' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.84 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/12/15 **Date Finish:** 10/12/15 **Drilling Company:** Mateco Drilling **Driller's Name:** John Pitsch **Drilling Method:** Hand Auger/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 3.8 **Water Level Finish (ft. btoc.):** 5.96	**Northing:** 645763.32 **Easting:** 12624262.15 **Casing Elevation:** 586.52 **Borehole Depth (ft. bgs.):** 20.0 **Surface Elevation:** 583.6 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15001** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Cloudy, Windy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
	570									
15		3	10.0-20.0'	9.0	NA					Sand Pack K&E WP1 (10.0-20.0' bgs) 2" PVC 10 Slot Well Screen (10.0-20.0' bgs)
	565							NOTE: organic matter, roots, from 18.8 to 18.9' bgs.		
20								End of boring 20.0' bgs.		
	560									
25										

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Hand Auger to 6.0' bgs.
Groundwater encountered at 3.8' bgs during drilling.
Water level at development was 5.96' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.84 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/12/15 **Date Finish:** 10/12/15 **Drilling Company:** Mateco Drilling **Driller's Name:** John Pitsch **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 5.0 **Water Level Finish (ft. btoc.):** 6.45	**Northing:** 645701.73 **Easting:** 12624512.86 **Casing Elevation:** 586.87 **Borehole Depth (ft. bgs.):** 20.0 **Surface Elevation:** 583.8 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15002** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Cloudy, Windy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
	585									TOC Elevation = 586.87 (ft. above msl)
0								(0.0 - 0.1') GRASS and TOPSOIL. (0.1 - 12.0') SAND, fine to medium; trace to little very fine sand, subround; well sorted; moist to wet; dark brown (10YR 3/3).		Concrete (0.0-1.0' bgs)
	580	1	0.0-8.0'	4.0	NA			NOTE: Wet at 5.0' bgs.		
5										Bentonite/Cement Grout (1.0-11.0' bgs) 2" PVC Well Casing (-3.0-15.0' bgs)
	575	2	8.0-10.0'	1.0	NA					
10								(12.0 - 13.0') SAND, fine to medium, subround; trace silt; well sorted; wet; brown (10YR 5/3).		Bentonite Pellets (11.0-13.0' bgs)
	570							(13.0 - 13.5') CLAY and SILT, medium plasticity, no dilatancy; little to some very fine to fine sand, subround; medium stiff; moist; brown (10YR 4/3).		
15		3	10.0-20.0'	7.0	NA			(13.5 - 20.0') SAND, fine to medium; trace to little very fine sand, subround; trace silt; well sorted; wet; light brownish gray (10YR 6/2).		Sand Pack K&E WP1 (13.0-20.0' bgs) 2" PVC 10 Slot Well Screen (15.0-20.0' bgs)
	565									
20								End of boring 20.0' bgs.		

Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 8.0' bgs.
Groundwater encountered at 5.0' bgs during drilling.
Water level at development was 6.45' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.86 feet

ARCADIS Design & Consultancy for natural and built assets

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/12/15 **Date Finish:** 10/12/15 **Drilling Company:** Mateco Drilling **Driller's Name:** John Pitsch **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 11.0 **Water Level Finish (ft. btoc.):** 6.77	**Northing:** 645555.93 **Easting:** 12624726.22 **Casing Elevation:** 587.12 **Borehole Depth (ft. bgs.):** 20.0 **Surface Elevation:** 584.1 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15003** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Cloudy, Windy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
	585									TOC Elevation =587.12 (ft. above msl)
0								(0.0 - 0.1') GRASS and TOPSOIL. (0.1 - 10.0') SAND, fine to medium; trace to little very fine sand, subround; well sorted; moist to wet; dark brown (10YR 3/3).		Concrete (0.0-1.0' bgs)
	580	1	0.0-8.0'	3.5	NA					Bentonite/Cement Grout (1.0-9.0' bgs) 2" PVC Well Casing (-3.0-13.0' bgs)
5										
	575	2	8.0-10.0'	1.0	NA					
10								(10.0 - 11.0') CLAY and SILT, medium plasticity, no dilatancy; little to some very fine to fine sand, subround; medium stiff; moist; brown (10YR 4/3). NOTE: little to some organic matter; roots, wood. (11.0 - 18.0') SAND, fine to medium; trace to little very fine sand, subround; trace silt; well sorted; wet; light brownish gray (10YR 6/2).		Bentonite Pellets (9.0-11.0' bgs)

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Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 8.0' bgs.
Groundwater encountered at 11.0' bgs during drilling.
Water level at development was 6.77' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.84 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/12/15 **Date Finish:** 10/12/15 **Drilling Company:** Mateco Drilling **Driller's Name:** John Pitsch **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 11.0 **Water Level Finish (ft. btoc.):** 6.77	**Northing:** 645555.93 **Easting:** 12624726.22 **Casing Elevation:** 587.12 **Borehole Depth (ft. bgs.):** 20.0 **Surface Elevation:** 584.1 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15003** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Cloudy, Windy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
15	570	3	10.0-20.0'	9.0	NA					Sand Pack K&E WP1 (11.0-20.0' bgs) 2" PVC 10 Slot Well Screen (13.0-18.0' bgs)
20	565							(18.0 - 20.0') SAND, very fine to fine, subround; little to trace silt; well sorted; wet; grayish brown (10YR 5/2) to gray (10YR 6/1). NOTE: Organic matter; roots, leaves, wood from 18.0 to 18.3' bgs and 19.0 to 19.1' bgs.		
25	560							End of boring 20.0' bgs.		

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Remarks: bgs = below ground surface
btoc = below top of casing

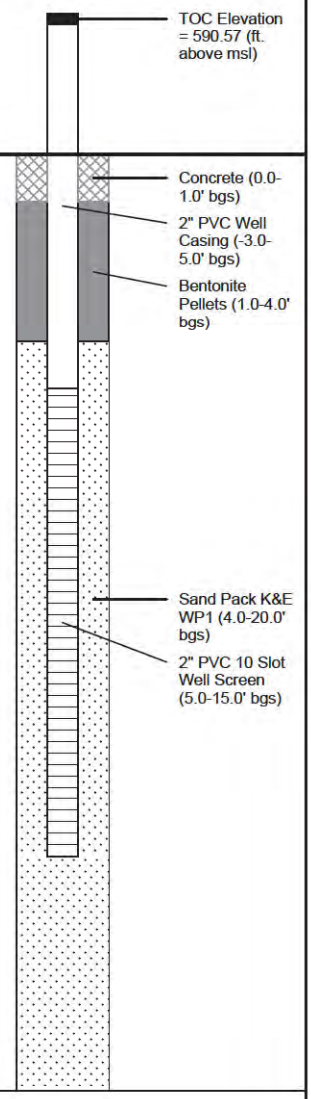
Air Knife to 8.0' bgs.
Groundwater encountered at 11.0' bgs during drilling.
Water level at development was 6.77' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.84 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/13/15 **Date Finish:** 10/13/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 7.0 **Water Level Finish (ft. btoc.):** 10.27	**Northing:** 645491.68 **Easting:** 12624824.48 **Casing Elevation:** 590.57 **Borehole Depth (ft. bgs.):** 20.0 **Surface Elevation:** 587.7 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15004** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 50 F Cloudy, Windy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
	590								
0								(0.0 - 0.1') GRASS and TOPSOIL.	
								(0.1 - 10.0') SAND, fine; little very fine sand, subround; trace granules, subround; trace silt; well sorted; dry to moist; light yellowish brown (10YR 6/4).	
	585	1	0.0-8.0'	3.5	NA				
5									
	580							NOTE: Wet at 7.0' bgs.	
10								(10.0 - 14.0') SAND, fine; little medium, subround; trace to little silt; well sorted; wet; grayish brown (10YR 5/2).	
	575							NOTE: Trace organice material; wood at 13.5' bgs.	
		2	8.0-20.0'	10.0	NA			(14.0 - 17.0') SAND, medium; little coarse sand, subround; trace granules, subround; little silt; well sorted; wet; grayish brown (10YR 5/2).	
15								NOTE: Organic matter, wood; dark brown (10YR 3/3) from 16.5 to 17.0' bgs.	
	570							(17.0 - 20.0') SAND, very fine to fine, subround; little silt; well sorted; wet; grayish brown (10YR 5/2).	
20								End of boring 20.0' bgs.	

Well/Boring Construction



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Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 8.0' bgs.
Groundwater encountered at 7.0' bgs during drilling.
Water level at development was 10.27' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.82 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/13/15 **Date Finish:** 10/13/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 6.0 **Water Level Finish (ft. btoc.):** 7.61	**Northing:** 645166.74 **Easting:** 12624783.15 **Casing Elevation:** 587.77 **Borehole Depth (ft. bgs.):** 20.0 **Surface Elevation:** 584.8 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15005** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 50 F Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
0	585									TOC Elevation = 587.77 (ft. above msl)
		1	0.0-6.0'	6.0	NA			(0.0 - 0.1') GRASS and TOPSOIL. (0.1 - 10.0') SAND, fine; little very fine sand, subround; trace granules, subround; little to trace silt; well sorted; moist to wet; pale brown (10YR 6/3).		Concrete (0.0-1.0' bgs) 2" PVC Well Casing (-3.0-5.0' bgs) Bentonite Pellets (1.0-4.0' bgs)
5	580									
		2	6.0-10.0'	4.0	NA			NOTE: Wet at 6.0' bgs.		
10	575							(10.0 - 10.5') SAND, fine, subround; little silt; well sorted; wet; very dark gray (10YR 3/1). NOTE: trace organic matter, large wood fragments.		Sand Pack K&E WP1 (4.0-20.0' bgs) 2" PVC 10 Slot Well Screen (5.0-15.0' bgs)
								(10.5 - 20.0') SAND, fine to medium; trace coarse sand, subround; little to trace silt; well sorted; wet; grayish brown (10YR 5/2).		
15	570	3	10.0-20.0'	8.0	NA					
20	565							End of boring 20.0' bgs.		

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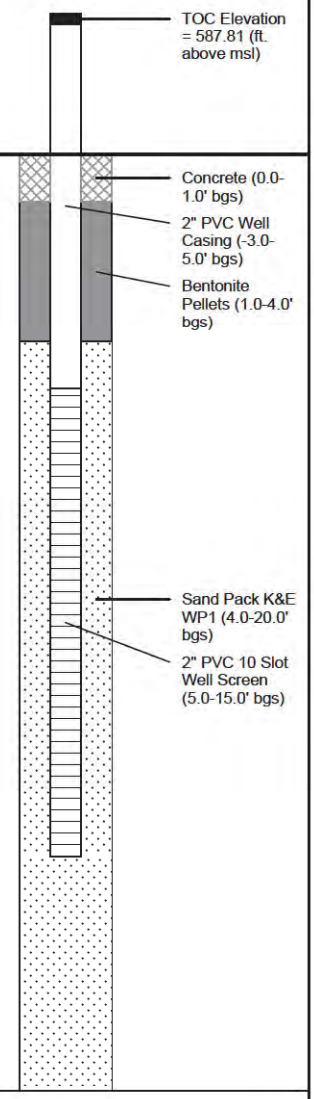
Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 6.0' bgs.
Groundwater encountered at 6.0' bgs during drilling.
Water level at development was 7.61' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.54 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/13/15 **Date Finish:** 10/13/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 5.0 **Water Level Finish (ft. btoc.):** 7.45	**Northing:** 645291.65 **Easting:** 12624610.52 **Casing Elevation:** 587.81 **Borehole Depth (ft. bgs.):** 20.0 **Surface Elevation:** 584.9 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15006** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 50 F Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
0	585							(0.0 - 0.1') LANDSCAPING STONE. (0.1 - 9.0') SAND, fine, subround; trace granules, subround; trace silt; well sorted; moist to wet; light yellowish brown (10YR 6/4).	
5	580	1	0.0-10.0'	4.0	NA			NOTE: Wet at 5.0' bgs.	
10	575							(9.0 - 20.0') SAND, fine to medium, subround; trace granules, subround; well sorted; wet; light brownish gray (10YR 6/2).	
15	570	2	10.0-20.0'	8.0	NA				
20	565							End of boring 20.0' bgs.	



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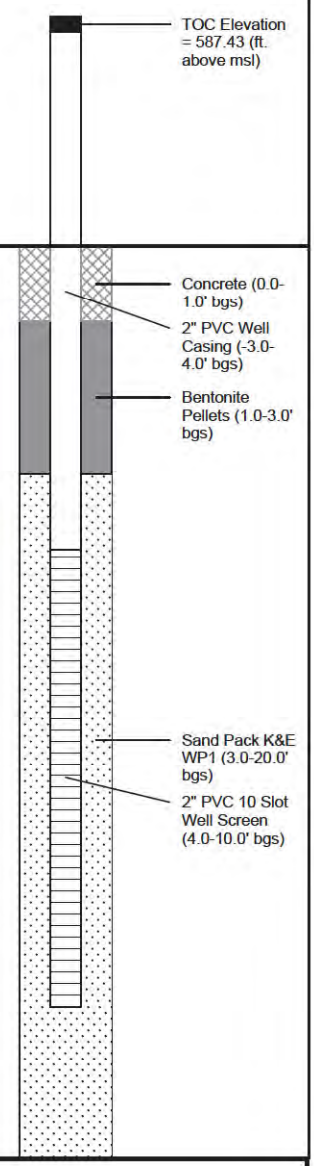
Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 6.0' bgs.
Groundwater encountered at 5.0' bgs during drilling.
Water level at development was 7.45' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 581.14 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/14/15 **Date Finish:** 10/14/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 5.0 **Water Level Finish (ft. btoc.):** 6.78	**Northing:** 645409.39 **Easting:** 12624188.85 **Casing Elevation:** 587.43 **Borehole Depth (ft. bgs.):** 20.0 **Surface Elevation:** 584.5 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15007** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 50 F Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
0	585								
								(0.0 - 0.1') GRASS and TOPSOIL.	
								(0.1 - 10.0') SAND, very fine to fine, subround; trace granules to samll pebble, subround; little to trace silt; well sorted; moist to wet; brown (10YR 5/3).	
5	580	1	0.0-10.0'	2.0	NA			NOTE: Wet at 5.0' bgs.	
10	575							(10.0 - 10.5') CLAY and SILT, medium to high plasticity, no dilatancy; trace very fine sand, subround; soft to very soft; dark brown (10YR 3/3). NOTE: little organic matter; roots.	
								(10.5 - 11.2') SAND, very fine, subround, trace granules, subround, little silt, poorly sorted; wet; grayish brown (10YR 5/2). NOTE: trace to little organic matter; roots and wood (dark brown (10YR 3/3).	
								(11.2 - 11.7') CLAY and SILT, high plasticity, no dilatancy; soft; dark brown (10YR 3/3).	



ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 9.0' bgs.
Groundwater encountered at 5.0' bgs during drilling.
Water level at development was 6.78' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 581.13 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/14/15 **Date Finish:** 10/14/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 5.0 **Water Level Finish (ft. btoc.):** 6.78	**Northing:** 645409.39 **Easting:** 12624188.85 **Casing Elevation:** 587.43 **Borehole Depth (ft. bgs.):** 20.0 **Surface Elevation:** 584.5 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15007** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 50 F Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
								(11.7 - 12.5') SAND, very fine to fine, subround; little silt; poorly sorted; wet; pale brown (10YR 6/3). NOTE: Organic rich matter roots and wood; dark brown (10YR 3/3) from 12.0 to 12.5' bgs.		
								(12.5 - 20.0') SAND, fine to medium; little very fine sand, subround; trace silt; well sorted; wet; light brownish gray (10YR 6/2).		
	570									
15		2	10.0-20.0'	8.0	NA					
								NOTE: Organic matter wood; dark brown (10YR 3/3) from 19.5 to 20.0' bgs.		
	565									
20								End of boring 20.0' bgs.		
	560									
25										

Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 9.0' bgs.
Groundwater encountered at 5.0' bgs during drilling.
Water level at development was 6.78' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 581.13 feet

ARCADIS Design & Consultancy for natural and built assets

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/14/15 **Date Finish:** 10/14/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 4.5 **Water Level Finish (ft. btoc.):** 7.11	**Northing:** 645340.01 **Easting:** 12623510.47 **Casing Elevation:** 587.76 **Borehole Depth (ft. bgs.):** 20.0 **Surface Elevation:** 584.8 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15008** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
0	585									TOC Elevation = 587.76 (ft. above msl)
								(0.0 - 0.1') LANDSCAPING STONE.		Concrete (0.0-1.0' bgs)
								(0.1 - 9.5') SAND, fine to very fine, subround; trace granules to small pebble, subround; little silt; well sorted; moist to wet; brown (10YR 5/3).		2" PVC Well Casing (-3.0-4.0' bgs)
										Bentonite Pellets (1.0-3.0' bgs)
								NOTE: Wet at 4.5' bgs.		
5	580	1	0.0-10.0'	3.0	NA					Sand Pack K&E WP1 (3.0-20.0' bgs)
										2" PVC 10 Slot Well Screen (4.0-9.0' bgs)
10	575							(9.5 - 12.0') SAND, fine, little medium sand, subround; little to trace silt; well sorted; wet; grayish brown (10YR 5/2).		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 8.0' bgs.
Groundwater encountered at 4.5' bgs during drilling.
Water level at development was 7.11' btoc.
No staining observed.
Groundwater elevation measured on November 30, 2015 was 580.99 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/14/15 **Date Finish:** 10/14/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 4.5 **Water Level Finish (ft. btoc.):** 7.11	**Northing:** 645340.01 **Easting:** 12623510.47 **Casing Elevation:** 587.76 **Borehole Depth (ft. bgs.):** 20.0 **Surface Elevation:** 584.8 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15008** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
								(12.0 - 13.0') SAND, fine, little medium sand, subround; little to some silt; poorly sorted; wet; dark grayish brown (10YR 4/2). NOTE: wood fragments; very dark gray (10YR 3/1), slight odor at 12.0' bgs.		
								(13.0 - 13.5') CLAY and SILT, low plasticity, no dilatancy; little to trace very fine to fine sand, subround; soft; dark brown (10YR 3/3). NOTE: little organic matter, roots.		
								(13.5 - 15.5') SAND, fine, subround; some silt; poorly sorted; wet; brown (10YR 4/3). NOTE: trace organics.		
15	570	2	10.0-20.0'	9.0	NA					
								(15.5 - 20.0') SAND, fine to medium; trace silt; well sorted; wet; grayish brown (10YR 5/2).		
20	565							End of boring 20.0' bgs.		
25	560									

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Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 8.0' bgs.
Groundwater encountered at 4.5' bgs during drilling.
Water level at development was 7.11' btoc.
No staining observed.
Groundwater elevation measured on November 30, 2015 was 580.99 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/14/15 **Date Finish:** 10/14/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 0.5 **Water Level Finish (ft. btoc.):** 7.51	**Northing:** 645606.92 **Easting:** 12623622.98 **Casing Elevation:** 589.27 **Borehole Depth (ft. bgs.):** 24.0 **Surface Elevation:** 586.3 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15009** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
	590									TOC Elevation = 589.27 (ft. above msl)
0								(0.0 - 8.0') NO RECOVERY, soils not logged, air knife soil cuttings disposed in CE approved area.		Concrete (0.0-1.0' bgs)
	585									
		1	0.0-8.0'	0.0	NA			NOTE: Wet at 4.5' bgs.		
5										2" PVC Well Casing (-3.0-14.0' bgs)
	580									Bentonite/Cement Grout (1.0-11.0' bgs)
		2	8.0-10.0'	2.0	NA			(8.0 - 10.0') ASH, rapid dilatancy; wet; soft; very dark gray (10YR 3/1). NOTE: Fill material. Little to trace organic matter; roots and wood fragments.		
10								(10.0 - 12.0') CLAY and SILT, low plasticity, no dilatancy; some to little very fine to fine sand, subround; soft; dark brown (10YR 3/3).		

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Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 8.0' bgs.
Groundwater encountered at 0.5' bgs during drilling.
Water level at deveopment was 7.51' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 581.88 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/14/15 **Date Finish:** 10/14/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 0.5 **Water Level Finish (ft. btoc.):** 7.51	**Northing:** 645606.92 **Easting:** 12623622.98 **Casing Elevation:** 589.27 **Borehole Depth (ft. bgs.):** 24.0 **Surface Elevation:** 586.3 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15009** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
	575									
		3	10.0-15.0'	4.0	NA			(12.0 - 17.2') SAND, fine, subround; litle silt; well sorted; wet; brown (10YR 4/3). NOTE: Some clay, low plasticity, no dilatancy; soft; dark brown (10YR 3/3).		Bentonite Pellets (11.0-13.0' bgs)
15										
	570							NOTE: Some organic rich matter, roots and wood; wet; very dark brown (10YR 2/2) from 17.0 to 17.2' bgs.		
		4	15.0-20.0'	5.0	NA			(17.2 - 24.0') CLAY and SILT, low plasticity, no dilatancy; little to trace very fine to fine sand, subround; soft; dark brown (10YR 3/3). NOTE: little organic matter, roots.		Sand Pack K&E WP1 (13.0-24.0' bgs) 2" PVC 10 Slot Well Screen (14.0-24.0' bgs)
20										
	565									
		5	20.0-24.0'	4.0	NA					
								End of boring 24.0' bgs.		
25										

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Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 8.0' bgs.
Groundwater encountered at 0.5' bgs during drilling.
Water level at deveopment was 7.51' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 581.88 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/14/15 **Date Finish:** 10/15/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 0.3 **Water Level Finish (ft. btoc.):** 6.93	**Northing:** 645690.69 **Easting:** 12623979.47 **Casing Elevation:** 588.11 **Borehole Depth (ft. bgs.):** 24.0 **Surface Elevation:** 585.2 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15010** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
0	585							(0.0 - 0.3') STONE, parking lot aggregate. (0.3 - 10.0') ASH, some fine sand, subround; little granules to small pebble subround; wet; soft; very dark gray (10YR 3/1). NOTE: Fill material.		TOC Elevation = 588.11 (ft. above msl) Concrete (0.0-1.0' bgs)
5	580	1	0.0-10.0'	3.0	NA					2" PVC Well Casing (-3.0-12.0' bgs) Bentonite/Cement Grout (1.0-9.0' bgs)
10	575							(10.0 - 24.0') SAND, very fine to fine; trace to little medium sand, subround; trace silt; well sorted; wet; grayish brown (10YR 5/2).		Bentonite Pellets (9.0-11.0' bgs)

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Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 8.0' bgs.
Groundwater encountered at 0.3' bgs during drilling.
Water level at development was 6.93' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 581.42 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/14/15 **Date Finish:** 10/15/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 0.3 **Water Level Finish (ft. btoc.):** 6.93	**Northing:** 645690.69 **Easting:** 12623979.47 **Casing Elevation:** 588.11 **Borehole Depth (ft. bgs.):** 24.0 **Surface Elevation:** 585.2 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15010** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
15	570	2	10.0-20.0'	8.0	NA			NOTE: Little silt and organic matter near 17.0' bgs.		Sand Pack K&E WP1 (11.0-22.0' bgs) 2" PVC 10 Slot Well Screen (12.0-22.0' bgs)
20	565	3	20.0-24.0'	4.0	NA					
25	560							End of boring 24.0' bgs.		

Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 8.0' bgs.
Groundwater encountered at 0.3' bgs during drilling.
Water level at development was 6.93' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 581.42 feet

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[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/15/15 **Date Finish:** 10/15/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 6.5 **Water Level Finish (ft. btoc.):** 13.03	**Northing:** 64578029 **Easting:** 12623765.87 **Casing Elevation:** 595.22 **Borehole Depth (ft. bgs.):** 32.0 **Surface Elevation:** 592.3 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15011** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
	595									TOC Elevation = 595.22 (ft. above msl)
0								(0.0 - 0.1') GRASS, ROOTS and ASH. (0.1 - 18.0') ASH, non-plastic, rapid dilatancy, little fine sand, subround; poorly sorted; soft; wet; gray (10YR 5/1) to dark gray (10YR 4/1). NOTE: Fill material.		Concrete (0.0-1.0' bgs)
	590									
5		1	0.0-10.0'	3.0	NA			NOTE: Wet at 6.5' bgs.		
	585									2" PVC Well Casing (-3.0-21.0' bgs) Bentonite/Cement Grout (1.0-18.0' bgs)
10										
	580							NOTE: Laminated from 13.5 to 15.0' bgs.		
15		2	10.0-20.0'	9.0	NA					

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Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 9.0' bgs.
Groundwater encountered at 6.5' bgs during drilling.
Water level at development was 13.03' btoc.
No staining observed.
Groundwater elevation measured on November 30, 2015 was 582.13 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/15/15 **Date Finish:** 10/15/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 6.5 **Water Level Finish (ft. btoc.):** 13.03	**Northing:** 64578029 **Easting:** 12623765.87 **Casing Elevation:** 595.22 **Borehole Depth (ft. bgs.):** 32.0 **Surface Elevation:** 592.3 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15011** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
	575							(18.0 - 19.0') CLAY and SILT, medium to high plasticity, no dilatancy; medium stiff to soft; moist; dark brown (10YR 3/3). NOTE: organic rich, some wood and roots; slight odor.		Bentonite Pellets (18.0-20.0' bgs)
20								(19.0 - 26.0') SAND, fine, subround; some to little silt; well sorted; wet; light brownish gray (10YR 6/2).		
	570									
25										Sand Pack K&E WP1 (20.0-32.0' bgs)
		3	20.0-32.0'	9.0	NA			(26.0 - 27.0') SAND, fine, little medium sand, subround; little silt; poorly sorted; wet; dark grayish brown (10YR 4/2). NOTE: organic rich, some roots and wood.		2" PVC 10 Slot Well Screen (21.0-31.0' bgs)
	565							(27.0 - 32.0') SAND, fine, little very fine sand, subround; trace silt; well sorted; wet; light brownish gray (10YR 6/2).		
30										
	560							End of boring 32.0' bgs.		
35										

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Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 9.0' bgs.
Groundwater encountered at 6.5' bgs during drilling.
Water level at development was 13.03' btoc.
No staining observed.
Groundwater elevation measured on November 30, 2015 was 582.13 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/15/15 **Date Finish:** 10/15/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 8.0 **Water Level Finish (ft. btoc.):** 13.79	**Northing:** 645889.92 **Easting:** 12623545.99 **Casing Elevation:** 597.39 **Borehole Depth (ft. bgs.):** 35.0 **Surface Elevation:** 594.5 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15012** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
	595									TOC Elevation = 597.39 (ft. above msl)
0								(0.0 - 0.1') GRASS, ROOTS and ASH. (0.1 - 9.0') SAND, fine, subround, and ASH; little silt; poorly sorted; wet; soft; dark grayish brown (10YR 4/2).		Concrete (0.0-1.0' bgs)
5	590	1	0.0-10.0'	3.0	NA			NOTE: Wet at 8.0' bgs.		
10	585							(9.0 - 18.0') ASH, little fine sand, subround; non-plastic, rapid dilatancy; poorly sorted, wet, soft, gray (10YR 5/1). NOTE. Fill material.		2" PVC Well Casing (-3.0-21.0' bgs) Bentonite/Cement Grout (1.0-18.0' bgs)
								NOTE: Laminated from 13.0-15.0' bgs.		
15	580	2	10.0-20.0'	9.0	NA					

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Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 9.0' bgs.
Groundwater encountered at 8.0' bgs during drilling.
Water level at development was 13.79' btoc.
No staining observed.
Groundwater elevation measured on November 30, 2015 was 583.46 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/15/15 **Date Finish:** 10/15/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 8.0 **Water Level Finish (ft. btoc.):** 13.79	**Northing:** 645889.92 **Easting:** 12623545.99 **Casing Elevation:** 597.39 **Borehole Depth (ft. bgs.):** 35.0 **Surface Elevation:** 594.5 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15012** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
								(18.0 - 19.0') CLAY and SILT, medium plasticity, no dilatancy; moist; medium stiff to soft; dark brown (10YR 3/3). NOTE: organic rich; some wood and roots; slight odor.		Bentonite Pellets (18.0-20.0' bgs)
	575							(19.0 - 30.0') SAND, fine, subround; little silt; well sorted; wet; light brownish gray (10YR 6/2). NOTE: trace organics; dark brown (10YR 3/3).		
20			20.0-25.0'	5.0	NA					
	570									
25		3	25.0-30.0	5.0	NA					Sand Pack K&E WP1 (20.0-35.0' bgs) 2" PVC 10 Slot Well Screen (21.0-31.0' bgs)
	565									
30			30.0-35.0	5.0	NA			(30.0 - 35.0') SAND, fine, subround; little silt; well sorted; wet; light brownish gray (10YR 6/2).		
	560									
35								End of boring 35.0' bgs.		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 9.0' bgs.
Groundwater encountered at 8.0' bgs during drilling.
Water level at development was 13.79' btoc.
No staining observed.
Groundwater elevation measured on November 30, 2015 was 583.46 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/15/15 **Date Finish:** 10/16/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 9.5 **Water Level Finish (ft. btoc.):** 16.38	**Northing:** 645716.41 **Easting:** 12623389.21 **Casing Elevation:** 598.5 **Borehole Depth (ft. bgs.):** 40.0 **Surface Elevation:** 595.9 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15013** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
0	595	1	0.0-10.0'	5.0	NA			(0.0 - 0.1') GRASS, ROOTS and ASH. (0.1 - 9.5') SAND, fine, subround, and ASH; poorly sorted; moist; yellowish brown (10YR 5/6) to dark yellowish brown (10YR 3/6).		TOC Elevation = 598.50 (ft. above msl) Concrete (0.0-1.0' bgs)
5	590									
10	585	2	10.0-20.0'	9.0	NA			NOTE: Wet at 9.5' bgs. (9.5 - 10.5') ASH, little fine sand, subround; non-plastic, rapid dilatancy; poorly sorted; wet; soft; gray (10YR 5/1) to dark gray (10YR 4/1). NOTE: Fill material. (10.5 - 13.5') SAND, fine to medium, and ASH; trace coarse sand, subround; poorly sorted; moist to wet; dark yellowish brown (10YR 4/4) to brown (10YR 4/3). (13.5 - 28.0') ASH; little fine sand, subround; non-plastic, rapid dilatancy; poorly sorted; wet; very soft; gray (10YR 5/1) to grayish brown (10YR 5/2).		2" PVC Well Casing (-3.0-30.0' bgs) Bentonite/Cement Grout (1.0-27.0' bgs)
15	580									
20	575									

Remarks: bgs = below ground surface

Air Knife to 9.0' bgs.
Groundwater encountered at 9.5' bgs during drilling.
Water level at development was 16.38' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 582.33 feet above mean sea level.

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[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/15/15 **Date Finish:** 10/16/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 9.5 **Water Level Finish (ft. btoc.):** 16.38	**Northing:** 645716.41 **Easting:** 12623389.21 **Casing Elevation:** 598.5 **Borehole Depth (ft. bgs.):** 40.0 **Surface Elevation:** 595.9 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15013** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
			20.0-25.0'	4.0	NA					
25	570	3								
			25.0-30.0	5.0	NA			(28.0 - 36.0') SAND, fine, trace medium sand, subround; trace silt; well sorted; wet; light gray (10YR 7/2) to very pale brown (10YR 7/3).		Bentonite Pellets (27.0-29.0' bgs)
30	565									
			30.0-35.0	5.0	NA					Sand Pack K&E WP1 (29.0-40.0' bgs)
35	560							(36.0 - 36.5') SAND, fine, subround; trace silt and organics; light gray (10YR 7/1) to dark yellowish brown (10YR 4/4). NOTE: some leaves and small sticks.		2" PVC 10 Slot Well Screen (30.0-40.0' bgs)
			35.0-40.0	4.0	NA			(36.5 - 37.5') CLAY and SILT, low plasticity to non-plastic, no dilatancy; moist; medium stiff; dark brown (10YR 3/3). NOTE: some organics, leaves, roots and wood. (37.5 - 40.0') SAND, fine, subround; trace silt; well sorted; wet; light gray (10YR 7/2).		
40	555							End of boring 40.0' bgs.		
45	550									

Remarks: bgs = below ground surface

Air Knife to 9.0' bgs.
Groundwater encountered at 9.5' bgs during drilling.
Water level at development was 16.38' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 582.33 feet above mean sea level.

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[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/16/15 **Date Finish:** 10/16/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 14.0 **Water Level Finish (ft. btoc.):** 15.50	**Northing:** 645925.93 **Easting:** 12623318.73 **Casing Elevation:** 599.04 **Borehole Depth (ft. bgs.):** 40.0 **Surface Elevation:** 596.2 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15014** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
	600									TOC Elevation = 599.04 (ft. above msl)
0								(0.0 - 0.1') GRASS, ROOTS and ASH.		Concrete (0.0-1.0' bgs)
	595							(0.1 - 14.0') SAND, fine to medium, subround, and ASH; poorly sorted; soft; moist to wet; brown (10YR 5/3) to dark grayish brown (10YR 4/2). NOTE: Fill material.		
5		1	0.0-10.0'	3.0	NA					
	590									
10										2" PVC Well Casing (-3.0-23.0' bgs)
	585									Bentonite/Cement Grout (1.0-20.0' bgs)
								(14.0 - 14.5') ASH, little fine sand, subround; non-plastic, rapid dilatancy; poorly sorted; wet; soft; very dark grayish brown (10YR 5/2) to dark gray (10YR 4/1). NOTE: Fill material. Little to trace organics; roots.		
15		2	10.0-20.0'	9.0	NA			(14.5 - 17.5') ASH, non-plastic, rapid dilatancy; poorly sorted; wet; soft; dark gray (10YR 4/1). NOTE: Fill material.		
	580									
								(17.5 - 20.0') ASH, non-plastic, rapid dilatancy; poorly sorted; wet; soft; grayish brown (10YR 5/2) to dark gray (10YR 4/1). NOTE: Fill material, laminated.		
20										
	575							(20.0 - 27.0') SAND, fine, subround; trace silt; well sorted; wet; light brownish gray (10YR 6/2). NOTE: Organic rich matter, roots, leaves; dark brown (10YR 3/3) from 20.0 to 20.5' bgs.		Bentonite Pellets (20.0-22.0' bgs)

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Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 9.25' bgs.
Groundwater encountered at 14.0' bgs during drilling.
Water level at development was 15.50' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 583.19 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/16/15 **Date Finish:** 10/16/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 14.0 **Water Level Finish (ft. btoc.):** 15.50	**Northing:** 645925.93 **Easting:** 12623318.73 **Casing Elevation:** 599.04 **Borehole Depth (ft. bgs.):** 40.0 **Surface Elevation:** 596.2 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15014** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
25	570	3	20.0-30.0'	8.0	NA					
								(27.0 - 31.0') SAND, fine, subround; some silt; little clay; poorly sorted; wet; light brownish gray (10YR 6/2). NOTE: little to some organics, roots and wood from 27.0 to 27.1' bgs and at 30.0' bgs.		Sand Pack K&E WP1 (22.0-40.0' bgs) 2" PVC 10 Slot Well Screen (23.0-31.0' bgs)
30	565							(31.0 - 34.0') SAND and SILT; trace clay; non-plastic, rapid dilatancy; wet; poorly sorted; soft; dark grayish brown (10YR 4/2). NOTE: rich organic layer; some roots and wood.		
								(34.0 - 36.0') SAND, fine, subround; little silt; well sorted; wet; light brownish gray (10YR 6/2).		
35	560	4	30.0-40.0	9.0	NA					
								(36.0 - 37.5') SAND, fine, and ORGANICS; poorly sorted; wet; dark brown (10YR 3/3) to light gray (10YR 7/2).		
								(37.5 - 39.0') SAND, fine, subround; well sorted; wet; light brownish gray (10YR 6/2).		
								(39.0 - 40.0') CLAY and SILT, low plasticity to non-plastic, no dilatancy; moist; medium stiff; dark brown (10YR 3/3).		
40	555							End of boring 40.0' bgs.		
45	550									

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Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 9.25' bgs.
Groundwater encountered at 14.0' bgs during drilling.
Water level at development was 15.50' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 583.19 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/16/15 **Date Finish:** 10/19/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 8.5 **Water Level Finish (ft. btoc.):** 12.16	**Northing:** 646138.93 **Easting:** 12623024.09 **Casing Elevation:** 596.75 **Borehole Depth (ft. bgs.):** 30.0 **Surface Elevation:** 593.9 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15015** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
	595									TOC Elevation = 596.75 (ft. above msl)
0								(0.0 - 8.5') SAND, fine to medium, and ASH, subangular; poorly sorted; moist; dark grayish brown (4/2). NOTE: Fill material.		Concrete (0.0-1.0' bgs)
	590									
5		1	0.0-10.0'	2.0	NA					
	585							(8.5 - 14.0') ASH, non-plastic, rapid dilatancy; wet; soft; very dark grayish brown (10YR 3/2). NOTE: Fill material.		2" PVC Well Casing (-3.0-20.0' bgs) Bentonite/Cement Grout (1.0-17.0' bgs)
10										
	580							NOTE: Wood fragments at 14.0' bgs.		

Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 8.5' bgs.
Groundwater encountered at 8.5' bgs during drilling.
Water level at development was 12.16' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.81 feet

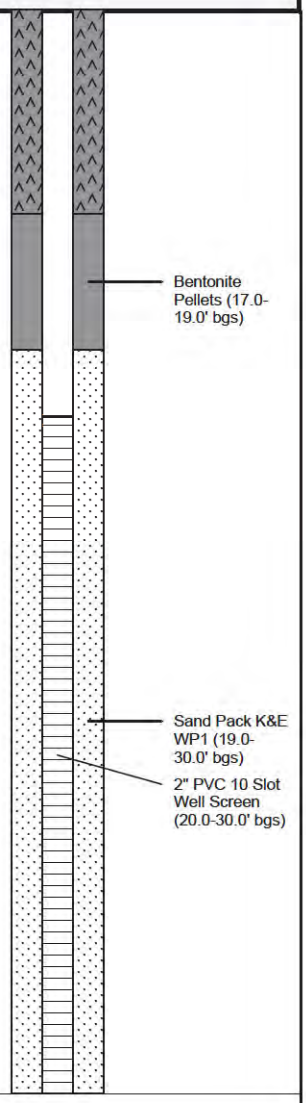
ARCADIS Design & Consultancy for natural and built assets

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/16/15 **Date Finish:** 10/19/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 8.5 **Water Level Finish (ft. btoc.):** 12.16	**Northing:** 646138.93 **Easting:** 12623024.09 **Casing Elevation:** 596.75 **Borehole Depth (ft. bgs.):** 30.0 **Surface Elevation:** 593.9 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15015** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
15		2	10.0-20.0'	9.0	NA			(14.0 - 17.0') SAND, fine, subround; well sorted; wet; light brownish gray (10YR 6/4). NOTE: light yellowish brown (10YR 6/4) from 14.0-16.0' bgs; pale brown (10YR 6/3) from 16.-17.0' bgs.	
	575							(17.0 - 19.0') FILL material, wood fragments; brown (10YR 4/3) to very dark brown (10YR 2/2).	
20								(19.0 - 29.0') SAND, fine, subround; trace silt; well sorted; wet; light brownish gray (10YR 6/4).	
	570								
25		3	20.0-30.0'	10.0	NA			NOTE: Little clay and silt at 27.0' bgs.	
	565							(29.0 - 29.5') CLAY and SILT, low to medium plasticity, no dilatancy; little fine sand, subround; moist; medium stiff; brown (10YR 4/3). NOTE: organic rich, wood near 29.5' bgs.	
30								(29.5 - 30.0') SAND, fine, subround; trace silt; well sorted; wet; light brownish gray (10YR 6/4).	
								End of boring 30.0' bgs.	

Well/Boring Construction



ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 8.5' bgs.
Groundwater encountered at 8.5' bgs during drilling.
Water level at development was 12.16' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.81 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/19/15 **Date Finish:** 10/19/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 8.5 **Water Level Finish (ft. btoc.):** 8.65	**Northing:** 646227.56 **Easting:** 12622459.26 **Casing Elevation:** 589.05 **Borehole Depth (ft. bgs.):** 45.0 **Surface Elevation:** 586.2 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15016** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
	590									TOC Elevation = 589.05 (ft. above msl)
0										
	585							(0.0 - 15.0') SAND, fine to medium, and ASH; little coarse, subround; poorly sorted; moist to wet, dark grayish brown (10YR 4/2). NOTE: Fill material, trace coal fragments.		Concrete (0.0-1.0' bgs)
5		1	0.0-10.0'	3.0	NA					
	580							NOTE: Wet at 9.0' bgs.		
10										
	575									
15		2	10.0-20.0'	10.0	NA			(15.0 - 17.0') SAND, fine, subround; little silt; well sorted; wet; light brownish gray (10YR 6/4).		
	570									2" PVC Well Casing (-3.0-35.0' bgs)
								(17.0 - 19.0') FILL material, wood fragments; some fine sand, subround; brown (10YR 4/3) to very dark brown (10YR 2/2).		Bentonite/Cement Grout (1.0-32.0' bgs)
20								(19.0 - 25.0') SAND, fine, subround; some clay; some to trace silt, non-plastic, no dilatancy; medium stiff; well sorted; wet; light brownish gray (10YR 6/4).		
	565							NOTE: organic rich matter, leaves, sticks, wood; moist; dark brown (10YR 3/3) from 21.0 to 25.0' bgs.		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 8.5' bgs.
Groundwater encountered at 8.5' bgs during drilling.
Water level at development was 8.65' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.08 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/19/15 **Date Finish:** 10/19/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 8.5 **Water Level Finish (ft. btoc.):** 8.65	**Northing:** 646227.56 **Easting:** 12622459.26 **Casing Elevation:** 589.05 **Borehole Depth (ft. bgs.):** 45.0 **Surface Elevation:** 586.2 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15016** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
25	560	3	20.0-30.0'	10.0	NA			(25.0 - 27.0') SAND, fine, subround; trace silt; well sorted; wet; light brownish gray (10YR 6/4).		
								(27.0 - 28.5') CLAY and SILT, low plasticity to non-plastic, no dilatancy; little fine sand, subround; moist; soft; dark brown (10YR 3/3). NOTE: organic rich, trace roots.		
								(28.5 - 28.8') SAND, fine, subround; trace silt; well sorted; wet; light brownish gray (10YR 6/4).		
30	555							(28.8 - 35.0') CLAY and SILT, low plasticity to non-plastic, no dilatancy; little fine sand, subround; moist; soft; dark brown (10YR 3/3). NOTE: Organic rich; trace roots from 28.8 to 30.0' bgs. NOTE: Trace shell fragments at 34.0' bgs.		Bentonite Pellets (32.0-34.0' bgs)
35	550	4	30.0-40.0'	9.0	NA			(35.0 - 37.0') SAND, fine, subround; little silt; well sorted; wet; yellowish brown (10YR 5/4).		Sand Pack K&E WP1 (34.0-45.0' bgs)
								(37.0 - 40.5') SAND, fine, subround; trace silt; well sorted; wet; pale brown (10YR 6/3). NOTE: Trace small pebble, subround at 39.0' bgs.		2" PVC 10 Slot Well Screen (35.0-40.0' bgs)
40	545	5	40.0-45.0'	5.0	NA			(40.5 - 45.0') CLAY, high plasticity, no dilatancy; trace silt; moist; medium stiff to soft; gray (10YR 7/1).		
45	540							End of boring 45.0' bgs.		
50										

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 8.5' bgs.
Groundwater encountered at 8.5' bgs during drilling.
Water level at development was 8.65' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.08 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/19/15 **Date Finish:** 10/20/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 8.0 **Water Level Finish (ft. btoc.):** 8.53	**Northing:** 646354.69 **Easting:** 12622085.55 **Casing Elevation:** 588.61 **Borehole Depth (ft. bgs.):** 40.0 **Surface Elevation:** 585.7 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15017** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy, Windy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
0	585	1	0.0-10.0'	3.0	NA			(0.0 - 11.0') SAND, fine to medium, subround, and ASH; little coarse sand, subround; poorly sorted; moist to wet; very dark grayish brown (10YR 3/2). NOTE: Fill material.		TOC Elevation = 588.61 (ft. above msl) Concrete (0.0-1.0' bgs)
5	580							NOTE: Wet at 9.0' bgs; trace coal fragments.		
10	575	2	10.0-20.0'	9.0	NA			(11.0 - 14.0') SAND, fine, subround, and SILT; trace clay, non-plastic, no dilatancy; moist to wet; poorly sorted; soft; dark brown (10YR 3/3) to light brownish gray (10YR 6/2). NOTE: little to trace organic matter, sticks, wood, and leaves.		
								(14.0 - 15.0') CLAY and SILT, low plasticity to non-plastic, no dilatancy; little fine sand subround; moist; soft; dark brown (10YR 3/3).		
15	570							(15.0 - 18.5') SAND, fine, subround; little to trace silt; well sorted; wet; light brownish gray (10YR 6/4).		2" PVC Well Casing (-3.0-35.0' bgs) Bentonite/Cement Grout (1.0-32.0' bgs)
								(18.5 - 20.0') FILL material, wood fragments; some fine sand, subround; brown (10YR 4/3) to dark brown (10YR 3/3). NOTE: Trace sticks and leaves.		
20								(20.0 - 20.5') SAND, fine, subround; trace silt; well sorted; wet; pale brown (10YR		

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Remarks: bgs = below ground surface

Air Knife to 8.0' bgs.
Groundwater encountered at 8.0' bgs during drilling.
Water level at development was 8.53' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 579.99 feet above mean sea level.

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/19/15 **Date Finish:** 10/20/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 8.0 **Water Level Finish (ft. btoc.):** 8.53	**Northing:** 646354.69 **Easting:** 12622085.55 **Casing Elevation:** 588.61 **Borehole Depth (ft. bgs.):** 40.0 **Surface Elevation:** 585.7 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15017** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy, Windy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
	565							6/3).		
								(20.5 - 21.5') SAND, fine, subround; trace silt; trace wood; poorly sorted; wet; pale brown (10YR 6/3) to dark brown (10YR 3/3).		
								NOTE: Organic rich matter, wood, sticks; dark brown (10YR 3/3) from 21.0 to 21.5' bgs.		
								(21.5 - 22.0') SAND, fine subround; trace silt; well sorted; wet; pale brown (10YR 6/3).		
								(22.0 - 23.5') CLAY and SILT, non-plastic, no dilatancy; little fine sand, subround; moist; soft; brown (10YR 3/3).		
25	560	3	20.0-30.0'	9.0	NA			(23.5 - 33.0') CLAY and SILT, non-plastic, no dilatancy; some fine sand, subround; moist; soft; brown (10YR 3/3).		
30	555							NOTE: Some wood and sticks; trace shell fragments at 33.0' bgs.		Bentonite Pellets (32.0-34.0' bgs)
								(33.0 - 35.0') SAND, fine, subround; trace silt; well sorted; wet; yellow (10YR 7/6).		
35	550	4	30.0-40.0'	9.0	NA			(35.0 - 40.0') SAND, fine, subround; trace silt; well sorted; wet; pale brown (10YR 6/3).		Sand Pack K&E WP1 (34.0-45.0' bgs) 2" PVC 10 Slot Well Screen (35.0-40.0' bgs)
40	545							End of boring 40.0' bgs.		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface

Air Knife to 8.0' bgs.
Groundwater encountered at 8.0' bgs during drilling.
Water level at development was 8.53' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 579.99 feet above mean sea level.

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/20/15 **Date Finish:** 10/20/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 8.0 **Water Level Finish (ft. btoc.):** 11.78	**Northing:** 646789.54 **Easting:** 12622179.74 **Casing Elevation:** 592.43 **Borehole Depth (ft. bgs.):** 45.0 **Surface Elevation:** 589.4 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15018** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
	590									TOC Elevation = 592.43 (ft. above msl)
0								(0.0 - 0.3') STONE, aggregate for road base.		Concrete (0.0-1.0' bgs)
								(0.3 - 14.0') ASH, trace to little fine sand, subround; non-plastic; slow dilatancy; moist to wet; soft; very dark gray (10YR 3/1). NOTE: Fill material.		
	585									
5		1	0.0-10.0'	3.0	NA					
								NOTE: Wet at 8.0' bgs.		
	580									
10										
	575							(14.0 - 23.0') SAND, fine, subround; some silt; trace granules; trace clay; poorly sorted; wet; light brownish gray (10YR 6/4). NOTE: Some large wood fragments at 17.5' and 20.0' bgs.		
15		2	10.0-20.0'	9.0	NA					2" PVC Well Casing (-3.0-37.5' bgs)
	570									Bentonite/Cement Grout (1.0-34.5' bgs)
20								NOTE: Increase in silt at 20.0' bgs		
								NOTE: Organic Rich Matter, wood, sticks, leaves; dark brown (10YR 3/3) from 22.0 to 23.0' bgs.		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 8.5' bgs.
Groundwater encountered at 8.0' bgs during drilling.
Water level at development was 11.78' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.08 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/20/15 **Date Finish:** 10/20/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 8.0 **Water Level Finish (ft. btoc.):** 11.78	**Northing:** 646789.54 **Easting:** 12622179.74 **Casing Elevation:** 592.43 **Borehole Depth (ft. bgs.):** 45.0 **Surface Elevation:** 589.4 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15018** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
25	565	3	20.0-30.0'	10.0	NA			(23.0 - 25.5') SAND, fine, subround; some silt; poorly sorted; wet; light brownish gray (10YR 6/4). NOTE: wood debris from 24.0 to 24.3' bgs.		
								NOTE: Organic rich matter, wood, sticks, leaves; dark brown (10YR 3/3) from 25.0 to 25.5' bgs.		
								(25.5 - 27.5') SAND, fine, subround; little to some silt; well sorted; wet; light brownish gray (10YR 6/4). NOTE: wood debris, sticks; brown (10YR 3/3) from 26.0 to 26.3' bgs.		
								(27.5 - 28.0') CLAY and SILT, low plasticity to non-plastic, no dilatancy; little fine sand, subround; moist; soft; dark brown (10YR 3/3).		
30	560							(28.0 - 30.0') SAND, fine, subround, and SILT; wet; poorly sorted; soft; light browish gray (10YR 6/4) to dark brown (10YR 3/3). NOTE: little wood debris, organic rich near 29.0' bgs.		
								(30.0 - 37.0') CLAY and SILT, low plasticity to non-plastic, no dilatancy; trace fine sand, subround; moist; medium stiff to soft; dark brown (10YR 3/3) to very dark brown (10YR 2/2). NOTE: organic rich, large sticks at 31.0' bgs; white shell fragments from 35.0 to 37.0' bgs.		
35	555	4	30.0-40.0'	10.0	NA					Bentonite Pellets (34.5-36.5' bgs)
								(37.0 - 42.5') SAND, fine, subround; well sorted; wet; very pale brown (10YR 7/3).		Sand Pack K&E WP1 (36.5-42.5' bgs) 2" PVC 10 Slot Well Screen (37.5-42.5' bgs)
40	550									
		5	40.0-45.0'	5.0	NA			(42.5 - 45.0') CLAY, high plasticity, no dilatancy; trace silt; moist; medium stiff to soft; gray (10YR 7/1).		
45	545							End of boring 45.0' bgs.		
50	540									

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Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 8.5' bgs.
Groundwater encountered at 8.0' bgs during drilling.
Water level at development was 11.78' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.08 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/20/15 **Date Finish:** 10/20/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 7.0 **Water Level Finish (ft. btoc.):** 12.22	**Northing:** 647103.13 **Easting:** 12622369.93 **Casing Elevation:** 592.42 **Borehole Depth (ft. bgs.):** 45.0 **Surface Elevation:** 589.4 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15019** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
	590									TOC Elevation = 592.42 (ft. above msl)
0								(0.0 - 0.3') STONE, aggregate for road base.		Concrete (0.0-1.0' bgs)
								(0.3 - 13.0') ASH, little fine sand, subround; trace granules, subangular; non-plastic, slow to rapid dilatancy; moist to wet; soft; very dark gray (10YR 3/1). NOTE: Fill material.		
	585									
5		1	0.0-10.0'	4.0	NA					
								NOTE: Wet at 7.0' bgs.		
	580									
10										
								(13.0 - 15.0') SAND, fine, subround; little to some silt; well sorted; wet; pale brown (10YR 6/3).		
	575									
15		2	10.0-20.0'	9.0	NA			(15.0 - 18.0') SAND, fine, subround; some silt; well sorted; wet; grayish brown (10YR 5/2).		
								NOTE: Large wood fragments at 17.0' bgs.		2" PVC Well Casing (-3.0-37.0' bgs)
								(18.0 - 18.5') SAND, fine, subround; and SILT; poorly sorted; wet; dark brown (10YR 3/3). NOTE: some organic matter; sticks; wood.		Bentonite/Cement Grout (1.0-34.0' bgs)
	570							(18.5 - 26.0') SAND, fine; little silt; trace medium sand, subround; well sorted; wet; light brownish gray (10YR 6/2).		
20										

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 8.5' bgs.
Groundwater encountered at 7.0' bgs during drilling.
Water level at development was 12.22' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.11 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/20/15 **Date Finish:** 10/20/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 7.0 **Water Level Finish (ft. btoc.):** 12.22	**Northing:** 647103.13 **Easting:** 12622369.93 **Casing Elevation:** 592.42 **Borehole Depth (ft. bgs.):** 45.0 **Surface Elevation:** 589.4 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15019** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
25	565	3	20.0-30.0'	9.0	NA			(26.0 - 27.0') CLAY and SILT, non-plastic, no dilatancy; little fine sand, subround; moist; soft; dark brown (10YR 3/3).		
								(27.0 - 27.5') SAND, fine, subround; little silt; well sorted; wet; light brownish gray (10YR 6/2). NOTE: some organic debris, sticks.		
								(27.5 - 29.0') SAND, fine, subround; and SILT; trace clay, non-plastic, slow dilatancy; poorly sorted; wet; brown (10YR 4/3) to dark brown (10YR 3/3).		
30	560							(29.0 - 30.0') SAND, fine, subround; some silt; trace clay; poorly sorted; wet; light brownish gray (10YR 6/2). NOTE: some roots, sticks and wood.		
								(30.0 - 31.5') CLAY and SILT, low plasticity, no dilatancy; little to trace fine sand, subround; moist; soft to medium stiff; dark brown (10YR 3/3). NOTE: organic rich.		
								(31.5 - 32.5') SAND, fine, subround, and SILT; poorly sorted; wet; grayish brown (10YR 5/2).		
								(32.5 - 37.0') CLAY and SILT, low plasticity, no dilatancy; little fine sand, subround; moist; medium stiff; dark brown (10YR 3/3). NOTE: ganic rich; trace white shell fragments at 32.5 to 36.5' bgs.		
35	555	4	30.0-40.0'	9.0	NA					Bentonite Pellets (34.0-36.0' bgs)
								(37.0 - 42.0') SAND, fine, subround; trace silt; well sorted; wet; pale brown (10YR 6/3).		Sand Pack K&E WP1 (36.0-45.0' bgs) 2" PVC 10 Slot Well Screen (37.0-42.0' bgs)
40	550									
		5	40.0-45.0'	5.0	NA			(42.0 - 45.0') CLAY, high plasticity, no dilatancy; trace silt; moist; medium stiff; gray (10YR 7/1).		
45	545							End of boring 45.0' bgs.		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 8.5' bgs.
Groundwater encountered at 7.0' bgs during drilling.
Water level at development was 12.22' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.11 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/21/15 **Date Finish:** 10/21/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 7.0 **Water Level Finish (ft. btoc.):** 12.19	**Northing:** 647436.97 **Easting:** 12622626.85 **Casing Elevation:** 592.23 **Borehole Depth (ft. bgs.):** 45.0 **Surface Elevation:** 589.5 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15020** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
	590									TOC Elevation = 592.23 (ft. above msl)
0								(0.0 - 10.0') NO RECOVERY; most soil cuttings from air knife were not placed back int the hole.		Concrete (0.0-1.0' bgs)
5	585	1	0.0-10.0'	0.0	NA					
	580									
10								(10.0 - 18.0') SAND, fine, subround; some ash; little medium sand; trace granules to small pebble, subangular; moist to wet; poorly sorted; very dark grayish brown (10YR 3/2). NOTE: little large stones; road base fill material.		
15	575	2	10.0-20.0'	5.0	NA					2" PVC Well Casing (-3.0-35.0' bgs) Bentonite/Cement Grout (1.0-32.5' bgs)
								(18.0 - 20.0') ASH, trace fine sand, subround; non-plastic, rapid dilatancy; wet; soft; very dark gray (10YR 4/1). NOTE: Fill material.		
20	570							(20.0 - 31.0') SAND fine, subround; little silt; well sorted; wet; light brownish gray (10YR 6/2).		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 8.5' bgs.
Groundwater encountered at 7.0' bgs during drilling.
Water level at development was 12.19' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.14 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/21/15 **Date Finish:** 10/21/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 7.0 **Water Level Finish (ft. btoc.):** 12.19	**Northing:** 647436.97 **Easting:** 12622626.85 **Casing Elevation:** 592.23 **Borehole Depth (ft. bgs.):** 45.0 **Surface Elevation:** 589.5 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15020** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
25	565	3	20.0-30.0'	5.0	NA					
30	560							(31.0 - 32.5') CLAY and SILT, medium plasticity, no dilatancy; trace fine sand, subround; moist; medium stiff; dark brown (10YR 3/3). NOTE: trace white shell fragments.		
								(32.5 - 34.0') SAND, fine, subround; some to little silt; well sorted; wet; brown (10YR 5/3).		Bentonite Pellets (32.5-34.5' bgs)
35	555	4	30.0-40.0'	10.0	NA			(34.0 - 35.0') CLAY and SILT, low plasticity to non-plastic; some fine sand, subround; wet; soft to very soft; brown (10YR 4/3).		
								(35.0 - 40.0') SAND, fine, subround; trace silt; well sorted; wet; light gray (10YR 7/2). NOTE: large cobble at 35.0' bgs.		Sand Pack K&E WP1 (34.5-45.0' bgs) 2" PVC 10 Slot Well Screen (35.0-40.0' bgs)
40	550									
		5	40.0-45.0'	4.0	NA			(40.0 - 45.0') CLAY, high plasticity, no dilatancy; trace silt; moist; medium stiff to soft; gray (10YR 5/1).		
45	545							End of boring 45.0' bgs.		
50	540									

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 8.5' bgs.
Groundwater encountered at 7.0' bgs during drilling.
Water level at development was 12.19' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.14 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/21/15 **Date Finish:** 10/21/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 5.0 **Water Level Finish (ft. btoc.):** 14.00	**Northing:** 646654.84 **Easting:** 12623310.03 **Casing Elevation:** 593.73 **Borehole Depth (ft. bgs.):** 50.0 **Surface Elevation:** 590.7 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15021** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
0	590	1	0.0-10.0'	5.5	NA			(0.0 - 20.5') ASH, trace fine sand, subround; non-plastic, rapid dilatancy; well sorted; moist to wet; very soft; dark gray (10YR 4/1). NOTE: Fill material.		TOC Elevation = 593.73 (ft. above msl) Concrete (0.0-1.0' bgs)
5	585									
10	580	2	10.0-20.0'	10.0	NA					
15	575									2" PVC Well Casing (-3.0-39.5' bgs) Bentonite/Cement Grout (1.0-36.5' bgs)
20	570							(20.5 - 22.0') SANd, fine, subround; some silt; trace granules, subround; poorly sorted; wet; gray (10YR 5/1) to pale brown (10YR 6/3). (21.5 - 22.0') NOTE: Organic rich matter, wood, sticks, leaves; dark yellowish brown (10YR 3/6) from 21.5 to 22.0' bgs. (22.0 - 23.5') SAND, fine, subround; some silt; poorly sorted; wet; grayish brown (10YR 5/2). NOTE: Some organic rich debris, wood and sticks; dark brown (10YR 3/3).		
25										

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface

Air Knife to 8.0' bgs.
Groundwater encountered at 5.0' bgs during drilling.
Water level at development was 14.00' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.1 feet above mean sea level.

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/21/15 **Date Finish:** 10/21/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 5.0 **Water Level Finish (ft. btoc.):** 14.00	**Northing:** 646654.84 **Easting:** 12623310.03 **Casing Elevation:** 593.73 **Borehole Depth (ft. bgs.):** 50.0 **Surface Elevation:** 590.7 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15021** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
	565	3	20.0-30.0'	10.0	NA			(23.5 - 25.0') SAND, fine, subround; little silt; well sorted; wet; light gray (10YR 7/2).		
								(25.0 - 27.0') SAND, fine, subround, and SILT; poorly sorted; moist to wet; brown (10YR 4/3) to dark gray (10YR 4/1). NOTE: some organic debris, sticks, wood, leaves.		
								(27.0 - 28.5') SAND, fine, subround; little to some silt; well sorted; wet; light gray (10YR 7/2).		
								(28.5 - 29.5') CLAY and SILT, non-plastic, no dilatancy; little fine sand, subround; medium stiff; moist; dark brown (10YR 3/3). NOTE: some organic debris, wood from 29.0 to 29.5' bgs.		
30	560							(29.5 - 32.5') SAND, fine, subround, and SILT; poorly sorted; moist; dark brown (10YR 3/3). NOTE: wood, sticks and leaves from 29.5 to 30.0' and 32.0 to 32.5' bgs.		
								(32.5 - 35.0') SAND, fine, subround; little silt; well sorted; wet; pale brown (10YR 6/3).		
35	555	4	30.0-40.0'	10.0	NA			(34.5 - 35.0') NOTE: Organics, wood, sticks.		
								(35.0 - 39.5') CLAY, medium to high plasticity, no dilatancy; little to some silt; medium stiff; very dark brown (10YR 2/2). NOTE: White shell fragments at 37.5' and 38.0' bgs.		Bentonite Pellets (36.5-38.5' bgs)
40	550							(39.5 - 42.5') SAND, fine, subround; trace silt; well sorted; wet; light gray (10YR 7/2).		Sand Pack K&E WP1 (38.5-50.0' bgs) 2" PVC 10 Slot Well Screen (39.5-42.5' bgs)
								(42.5 - 50.0') CLAY, high plasticity, no dilatancy; trace silt; moist; medium stiff; gray (10YR 5/1).		
45	545	5	40.0-50.0'	10.0	NA					
50	540							End of boring 50.0' bgs.		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface

Air Knife to 8.0' bgs.
Groundwater encountered at 5.0' bgs during drilling.
Water level at development was 14.00' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.1 feet above mean sea level.

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/23/15 **Date Finish:** 10/23/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 7.0 **Water Level Finish (ft. btoc.):** 12.28	**Northing:** 646263.16 **Easting:** 12623634.96 **Casing Elevation:** 595.82 **Borehole Depth (ft. bgs.):** 45.0 **Surface Elevation:** 592.6 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15022** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 40 F Sunny

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
0	595	1	0.0-10.0'	4.5	NA			(0.0 - 22.0') ASH, trace fine sand, subround; non-plastic, rapid dilatancy; well sorted; moist to wet; gray (10YR 5/1). NOTE: Fill material.		Concrete (0.0-1.0' bgs)
5	590							NOTE: Wet at 7.0' bgs.		
10	585	2	10.0-20.0'	9.0	NA					2" PVC Well Casing (-3.0-24.0' bgs) Bentonite/Cement Grout (1.0-21.0' bgs)
15	580									
20	575							(22.0 - 30.0') SAND, fine, subround; trace silt; well sorted; wet; light brownish gray (10YR 6/2).		Bentonite Pellets (21.0-23.0' bgs)

TOC Elevation = 595.82 (ft. above msl)

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 9.0' bgs.
Groundwater encountered at 7.0' bgs during drilling.
Water level at development was 12.28' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 583.42 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/23/15 **Date Finish:** 10/23/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Air Knife/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 7.0 **Water Level Finish (ft. btoc.):** 12.28	**Northing:** 646263.16 **Easting:** 12623634.96 **Casing Elevation:** 595.82 **Borehole Depth (ft. bgs.):** 45.0 **Surface Elevation:** 592.6 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15022** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 40 F Sunny

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
25	570	3	20.0-30.0'	8.0	NA					Sand Pack K&E WP1 (23.0-45.0' bgs) 2" PVC 10 Slot Well Screen (24.0-30.0' bgs)
30	565							(30.0 - 33.0') SAND, fine, subround, and SILT, non-plastic, no dilatancy to slow dilatancy; moist to wet; poorly sorted; light brownish gray (10YR 6/2) to grayish brown (10YR 5/2). NOTE: little to some organic debris.		
35	560	4	30.0-40.0'	9.0	NA			(33.0 - 37.0') SILT, non-plastic, no dilatancy; some fine sand, subround; little clay; poorly sorted; moist to wet; grayish brown (10YR 5/2) to dark brown (10YR 3/3). NOTE: Organic rich debris, sitcks and wood from 36.0 to 37.0' bgs.		
								(37.0 - 40.5') SAND, fine, subround; little silt; well sorted; wet; light brownish gray (10YR 6/2).		
40	555	5	40.0-45.0'	5.0	NA			(40.5 - 43.0') CLAY and SILT, non-plastic, no dilatancy; some to little fine sand, subround; poorly sorted; moist; dark brown (10YR 3/3). NOTE: white shell fragments at 41.0' bgs; organic rich.		
								(43.0 - 44.0') SAND, fine, subround; well sorted; light grayish brown (10YR 6/2).		
								(44.0 - 45.0') CLAY and SILT, non-plastic to low plasticity, no dilatancy; little to trace fine sand, subround; moist; dark gray (10YR 3/3).		
45	550							End of boring 45.0' bgs.		
50										

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

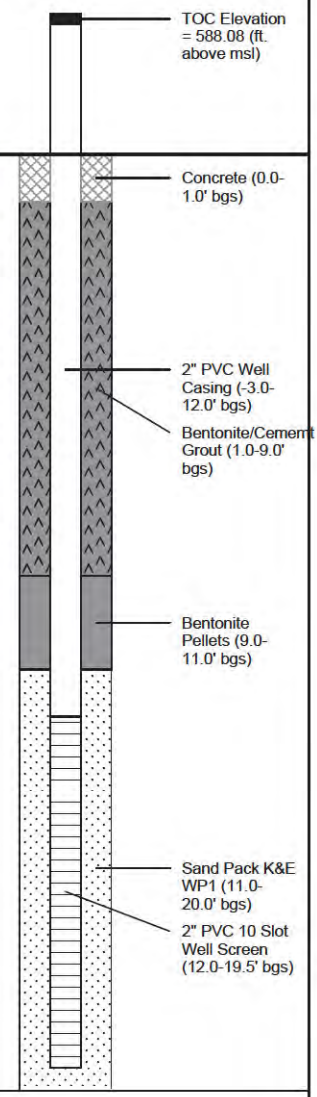
Air Knife to 9.0' bgs.
Groundwater encountered at 7.0' bgs during drilling.
Water level at development was 12.28' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 583.42 feet

[DRAFT - ELECTRONIC REVIEW]

Date Start: 10/23/15 **Date Finish:** 10/23/15 **Drilling Company:** Mateco Drilling **Driller's Name:** Dan Mourer **Drilling Method:** Hand Auger/Sonic **Sampling Method:** Continuous **Rig Type:** Sonic **Water Level Start (ft. bgs.):** 0.0 **Water Level Finish (ft. btoc.):** 3.81	**Northing:** 647125.15 **Easting:** 12622999.24 **Casing Elevation:** 588.08 **Borehole Depth (ft. bgs.):** 20.0 **Surface Elevation:** 585.4 **Descriptions By:** A. Westhuis	**Well/Boring ID:** **BCC MW-15023** **Client:** Consumers Energy **Location:** BC Cobb Facility 151 N Causeway St. Muskegon, MI **Weather Conditions:** 55 F Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
0	585	1	0.0-10.0'	10.0	NA			(0.0 - 10.0') ASH, non-plastic, rapid dilatancy; well sorted; wet; dark gray (10YR 4/1). NOTE: Fill material. Wet at 0.0' bgs.	
5	580							NOTE: Organic debris, leaves, sticks; dark brown (10YR 2/2) from 9.5 to 10.0' bgs; slight odor.	
10	575	2	10.0-20.0'	10.0	NA			(10.0 - 13.0') SAND, fine to medium, subround; trace silt; well sorted; wet; pale brown (10YR 6/3).	
								(13.0 - 16.0') SAND, very fine to fine, subround; some to little silt; well sorted; wet; gayish brown (10YR 5/2).	
15	570							(16.0 - 19.5') SAND, fine, subround; little to trace silt; well sorted; wet; pale brown (10YR 6/3).	
20	565							(19.5 - 20.0') SILT, some clay, non-plastic, no dilatancy; some to little fine sand, subround; poorly sorted; wet; dark brown (10YR 3/3). NOTE: little organic debris, wood.	
								End of boring 20.0' bgs.	

Well/Boring Construction



ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Hand Auger to 7.0' bgs.
Groundwater encountered at 0.0' bgs during drilling.
Water level at development was 3.81' btoc.
No staining observed.
Groundwater elevation measured on November 30, 2015 was 584.06 feet

[DRAFT - ELECTRONIC REVIEW]

SOIL DESCRIPTION

Udden-Wenworth Scale Modified ARCADIS, 2008			
Size Class	Millimeters	Inches	Standard Sieve #
Boulder	256 – 4096	10.08+	
Large cobble	128 - 256	5.04 -10.08	
Small cobble	64 - 128	2.52 – 5.04	
Very large pebble	32 – 64	0.16 - 2.52	
Large pebble	16 – 32	0.63 – 1.26	
Medium pebble	8 – 16	0.31 – 0.63	
Small pebble	4 – 8	0.16 – 0.31	No. 5 +
Granule	2 – 4	0.08 – 0.16	No.5 – No.10
Very coarse sand	1 -2	0.04 – 0.08	No.10 – No.18
Coarse sand	½ - 1	0.02 – 0.04	No.18 - No.35
Medium sand	¼ - ½	0.01 – 0.02	No.35 - No.60
Fine sand	1/8 -¼	0.005 – 0.1	No.60 - No.120
Very fine sand	1/16 – 1/8	0.002 – 0.005	No. 120 – No. 230
Silt (subgroups not included)	1/256 – 1/16	0.0002 – 0.002	Not applicable (analyze by pipette or hydrometer)
Clay (subgroups not included	1/2048 – 1/256	.00002 – 0.0002	

Modifier	Percent of Total Sample (by volume)
and	36 - 50
some	21 - 35
little	10 - 20
trace	<10

Description	Criteria
Nonplastic	A $^{1}/_{8}$ inch (3 mm) thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit

Description	Criteria
Dry	Absence of moisture, dry to touch, dusty.
Moist	Damp but no visible water.
Wet (Saturated)	Visible free water, soil is usually below the water table.

Fine-grained soil – Consistency

Description	Criteria
Very soft	N-value < 2 or easily penetrated several inches by thumb.
Soft	N-value 2-4 or easily penetrated one inch by thumb.
Medium stiff	N-value 9-15 or indented about ¼ inch by thumb with great effort.
Very stiff	N-value 16-30 or readily indented by thumb nail.
Hard	N-value > than 30 or indented by thumbnail with difficulty

Description	Criteria
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces.
Subangular	Particles are similar to angular description but have rounded edges.
Subrounded	Particles have nearly plane sides but have well-rounded corners and edges.
Rounded	Particles have smoothly curved sides and no edges.

Coarse-grained soil – Density

Description	Criteria
Very loose	N-value 1- 4
Loose	N-value 5-10
Medium dense	N-value 11-30
Dense	N-value 31- 50
Very dense	N-value >50

[DRAFT - ELECTRONIC REVIEW]

WELL CONSTRUCTION LOG

WELL NO. BCC-MW-17001

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
CEC: BC Cobb	12/6/17	12/6/17	269767.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns	Sonic	586.1	589.29	20.0	6

Boring Location: 7 feet west of BCC-MW-15016.
N: 646228.0 E: 12622452.1

Personnel
Logged By - T. Hess
Driller - B. Marshal

Drilling Equipment: Geoprobe 8140 LS

Civil Town/City/or Village:	County:	State:
Muskegon	Muskegon	MI

Water Level Observations:
While Drilling: Date/Time 12/6/17 00:00 Depth (ft bgs) 10.0
After Drilling: Date/Time 12/7/17 11:35 Depth (ft bgs) 5.81

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 HA	100		0–5.0	**SANDY COAL ASH** mostly coal ash, some fine to medium sand, dark gray (10YR 4/1), loose, dry.				
			5.0	Change to some woody material at 5.0 feet.				
2 CS	100		5.0–8.0					
			8.0–10.0	**SILTY SAND WITH ASH** mostly fine to medium sand, some silt and ash, few to little woody material, light brownish gray (10YR 6/2), loose, moist.	SM			
			10.0	Change to saturated at 10.0 feet.				
3 CS	100		10.0–14.0	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, moist.	SP			
			14.0–16.0	**PEAT** dark organic woody material (10YR 2/1), brittle, saturated.				
			16.0–18.0	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
			18.0–18.5	**PEAT** dark organic woody material (10YR 2/1), brittle, saturated.				
			18.5–20.0	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
			20.0	End of boring at 20.0 feet below ground surface.				

Signature: For Tanner Hess

Firm: TRC Environmental Corporation
1540 Eisenhower Place Ann Arbor, MI 48108
(734) 971-7080
Fax (734) 971-9022

Checked By: C. Scieszka

[DRAFT - ELECTRONIC REVIEW]

SOIL BORING WELL CONSTRUCTION LOG BCC GSI WELLS.GPJ TRC CORP INCHES.GDT 2/7/18

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC: BC Cobb		WELL ID:	BCC-MW-17001
PROJ. NO: 269767.0000	DATE INSTALLED: 12/6/2017 INSTALLED BY: Tanner Hess		CHECKED BY: CS

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
589.29	3.1	TOP OF CASING
586.1	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL
		BENTONITE SLURRY
		GROUT/BACKFILL METHOD
18.1		TREMIE
	11.0	GROUT
		BENTONITE SEAL MATERIAL
		MEDIUM CHIPS
	13.0	BENTONITE SEAL
571.1	15.0	TOP OF SCREEN
5.00		FILTER PACK MATERIAL
		MEDIUM, WASHED SAND
566.1	20.0	BOTTOM OF SCREEN
	20.0	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL
		NA
566.1	20.0	HOLE BOTTOM

NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 20 FT.
____ IN. FROM ____ TO ____ FT.

SURF. CASING DIAMETER: ____ IN. FROM ____ TO ____ FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.5 HOURS

WATER REMOVED: 9.5 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	23.36	T/PVC	12/6/2017	1653
DTB AFTER DEVELOPING:	23.36	T/PVC	12/6/2017	1727
SWL BEFORE DEVELOPING:	8.99	T/PVC	12/6/2017	1653
SWL AFTER DEVELOPING:	9.59	T/PVC	12/6/2017	1727
OTHER SWL:	8.91	T/PVC	12/7/2017	1135
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

REVISED 11/2013

[DRAFT - ELECTRONIC REVIEW]

WELL CONSTRUCTION LOG

WELL NO. BCC-MW-17002

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
CEC: BC Cobb	12/6/17	12/6/17	269767.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns	Sonic	585.8	588.79	19.0	6

Boring Location: 6 feet southeast of BCC-MW-15017.

N: 646348.8 E: 12622087.2

Personnel
Logged By - T. Hess
Driller - B. Marshal

Drilling Equipment: Geoprobe 8140 LS

Civil Town/City/or Village:	County:	State:
Muskegon	Muskegon	MI

Water Level Observations:
While Drilling: Date/Time 12/6/17 00:00 Depth (ft bgs) 10.0
After Drilling: Date/Time 12/7/17 11:28 Depth (ft bgs) 5.43

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 HA	100		0–5.5	**SANDY COAL ASH** mostly coal ash, some fine to medium sand, trace gravel, dark gray (10YR 4/1), loose, dry.				
2 CS	100		5.5–9	**COAL ASH** mostly coal ash, dark gray (10YR 4/1), loose, dry.				
3 CS	100		9–10	**SAND WITH COAL ASH** mostly fine to medium sand, little coal ash, dark gray (10YR 4/1), loose, dry.	SP			
			10–18	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
			18	**PEAT** mostly organic material, some silt and woody material, black (10YR 2/1), saturated.				
				End of boring at 19.0 feet below ground surface.				

Signature: For Tanner Hess

Firm: TRC Environmental Corporation
1540 Eisenhower Place Ann Arbor, MI 48108
(734) 971-7080
Fax (734) 971-9022

Checked By: C. Scieszka

[DRAFT - ELECTRONIC REVIEW]

SOIL BORING WELL CONSTRUCTION LOG BCC GSI WELLS.GPJ TRC CORP INCHES.GDT 2/7/18

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC: BC Cobb		WELL ID:	BCC-MW-17002
PROJ. NO: 269767.0000	DATE INSTALLED: 12/6/2017 INSTALLED BY: Tanner Hess		CHECKED BY: CS

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
588.79	3.0	TOP OF CASING
585.8	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL
		BENTONITE SLURRY
		GROUT/BACKFILL METHOD
16.5		TREMIE
	9.0	GROUT
		BENTONITE SEAL MATERIAL
		MEDIUM CHIPS
	11.0	BENTONITE SEAL
572.3	13.5	TOP OF SCREEN
5.00		FILTER PACK MATERIAL
		MEDIUM, WASHED SAND
567.3	18.5	BOTTOM OF SCREEN
	18.5	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL
		NATURAL COLLAPSE
566.8	19.0	HOLE BOTTOM

NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 18 FT.
____ IN. FROM ____ TO ____ FT.

SURF. CASING DIAMETER: ____ IN. FROM ____ TO ____ FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.5 HOURS

WATER REMOVED: 9.5 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: LIGHT BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): SLIGHT SULFUR

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	21.49	T/PVC	12/6/2017	1533
DTB AFTER DEVELOPING:	21.49	T/PVC	12/6/2017	1615
SWL BEFORE DEVELOPING:	8.49	T/PVC	12/6/2017	1533
SWL AFTER DEVELOPING:	8.58	T/PVC	12/6/2017	1615
OTHER SWL:	8.43	T/PVC	12/7/2017	1128
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

[DRAFT - ELECTRONIC REVIEW]

WELL CONSTRUCTION LOG

WELL NO. BCC-MW-17003

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
CEC: BC Cobb	12/5/17	12/5/17	269767.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns	Sonic	589.3	592.37	22.0	6

Boring Location: 7.5 feet northeast of BCC-MW-15018.

N: 646794.9 E: 12622184.8

Personnel
Logged By - T. Hess
Driller - B. Marshal

Drilling Equipment: Geoprobe 8140 LS

Civil Town/City/or Village:	County:	State:
Muskegon	Muskegon	MI

Water Level Observations:
While Drilling: Date/Time 12/5/17 00:00 Depth (ft bgs) 11.0
After Drilling: Date/Time 12/7/17 11:24 Depth (ft bgs) 9.07

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 HA	100		0–7.5	**SANDY COAL ASH** mostly coal ash, some fine to medium sand, trace gravel, brown (10YR 4/3), loose, dry.				
2 CS	100		7.5–14	**COAL ASH** mostly coal ash, dark gray (10YR 4/1), loose, dry. Change to saturated at 11.0 feet.				
3 CS	100		14–20	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
4 CS	100		20–22	End of boring at 22.0 feet below ground surface.				

Signature: For Tanner Hess

Firm: TRC Environmental Corporation
1540 Eisenhower Place Ann Arbor, MI 48108
(734) 971-7080
Fax (734) 971-9022

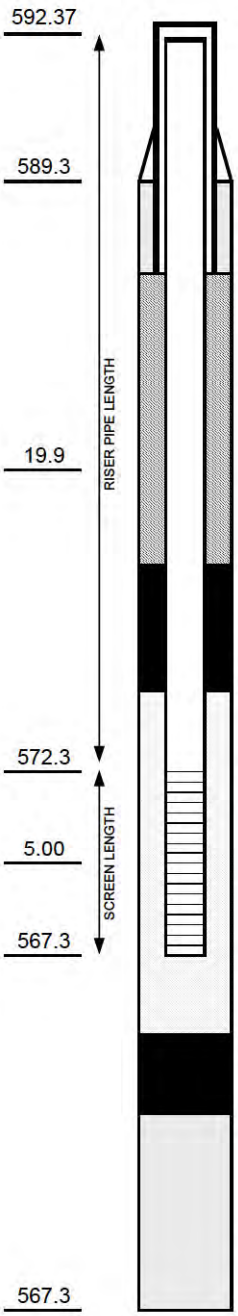
Checked By: C. Scieszka

[DRAFT - ELECTRONIC REVIEW]

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC: BC Cobb		WELL ID:	BCC-MW-17003
PROJ. NO: 269767.0000	DATE INSTALLED: 12/6/2017 INSTALLED BY: Tanner Hess		CHECKED BY: CS

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
592.37	2.9	TOP OF CASING
589.3	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL
		BENTONITE SLURRY
		GROUT/BACKFILL METHOD
19.9		TREMIE
	13.0	GROUT
		BENTONITE SEAL MATERIAL
		MEDIUM CHIPS
	15.0	BENTONITE SEAL
572.3	17.0	TOP OF SCREEN
5.00		FILTER PACK MATERIAL
		MEDIUM, WASHED SAND
567.3	22.0	BOTTOM OF SCREEN
	22.0	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL
		NA
567.3	22.0	HOLE BOTTOM



NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 22 FT.
_____ IN. FROM _____ TO _____ FT.

SURF. CASING DIAMETER: _____ IN. FROM _____ TO _____ FT.
_____ IN. FROM _____ TO _____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.5 HOURS

WATER REMOVED: 9.5 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	25.25	T/PVC	12/6/2017	1258
DTB AFTER DEVELOPING:	25.25	T/PVC	12/6/2017	1337
SWL BEFORE DEVELOPING:	12.05	T/PVC	12/6/2017	1258
SWL AFTER DEVELOPING:	12.10	T/PVC	12/6/2017	1337
OTHER SWL:	11.97	T/PVC	12/7/2017	1124
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

REVISED 11/2013

[DRAFT - ELECTRONIC REVIEW]

WELL CONSTRUCTION LOG

WELL NO. BCC-MW-17004

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
CEC: BC Cobb	12/5/17	12/5/17	269767.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns	Sonic	589.1	591.84	22.5	6

Boring Location: 8 feet northeast of BCC-MW-15019.

N: 647110.1 E: 12622373.4

Personnel
Logged By - T. Hess
Driller - B. Marshal

Drilling Equipment: Geoprobe 8140 LS

Civil Town/City/or Village:	County:	State:
Muskegon	Muskegon	MI

Water Level Observations:
While Drilling: Date/Time 12/5/17 00:00 Depth (ft bgs) 10.0
After Drilling: Date/Time 12/7/17 11:20 Depth (ft bgs) 9.03

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 HA	100		0–5	**SANDY COAL ASH** mostly coal ash, some fine to medium sand, trace gravel, brown (10YR 4/3), loose, dry.				
2 CS	0		5–10	**COAL ASH** mostly coal ash, dark gray (10YR 4/1), loose. Change to saturated at 10.0 feet.				No recovery from 5.0 to 10.0 feet.
3 CS	100		10–20	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
4 CS	80		20–22					

End of boring at 22.5 feet below ground surface.

Signature: For Tanner Hess

Firm: TRC Environmental Corporation
1540 Eisenhower Place Ann Arbor, MI 48108
(734) 971-7080
Fax (734) 971-9022

Checked By: C. Scieszka

[DRAFT - ELECTRONIC REVIEW]

SOIL BORING WELL CONSTRUCTION LOG BCC GSI WELLS.GPJ TRC CORP INCHES.GDT 2/7/18

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC: BC Cobb		WELL ID:	BCC-MW-17004
PROJ. NO: 269767.0000	DATE INSTALLED: 12/5/2017 INSTALLED BY: Tanner Hess		CHECKED BY: CS

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
591.84	2.6	TOP OF CASING
589.1	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL
		BENTONITE SLURRY
		GROUT/BACKFILL METHOD
20.1		TREMIE
	13.0	GROUT
		BENTONITE SEAL MATERIAL
		MEDIUM CHIPS
	15.0	BENTONITE SEAL
571.6	17.5	TOP OF SCREEN
5.00		FILTER PACK MATERIAL
		MEDIUM, WASHED SAND
566.6	22.5	BOTTOM OF SCREEN
	22.5	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL
		NA
566.6	22.5	HOLE BOTTOM

NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 22 FT.
____ IN. FROM ____ TO ____ FT.

SURF. CASING DIAMETER: ____ IN. FROM ____ TO ____ FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.5 HOURS

WATER REMOVED: 9.5 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	25.27	T/PVC	12/5/2017	1544
DTB AFTER DEVELOPING:	25.27	T/PVC	12/5/2017	1625
SWL BEFORE DEVELOPING:	11.20	T/PVC	12/5/2017	1544
SWL AFTER DEVELOPING:	11.30	T/PVC	12/5/2017	1625
OTHER SWL:	11.63	T/PVC	12/7/2017	1120
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

[DRAFT - ELECTRONIC REVIEW]

WELL CONSTRUCTION LOG

TRC

WELL NO. BCC-MW-17005

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
CEC: BC Cobb	12/4/17	12/5/17	269767.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns	Sonic	589.3	592.42	30.0	6

Boring Location: 8 feet southwest of BCC-MW-15020.

N: 647433.9 E: 12622619.7

Personnel
Logged By - T. Hess
Driller - B. Marshal

Drilling Equipment: Geoprobe 8140 LS

Civil Town/City/or Village:	County:	State:
Muskegon	Muskegon	MI

Water Level Observations:
While Drilling: Date/Time 12/4/17 00:00 Depth (ft bgs) 11.5
After Drilling: Date/Time 12/7/17 11:17 Depth (ft bgs) 9.96

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
				GRAVEL mostly gravel, white (10YR 8/1), road base.	GP			
1 HA	100		5	**SANDY COAL ASH** mostly coal ash, some fine to medium sand, trace gravel, brown (10YR 4/3), loose, dry.				
2 CS	50		10	Change to very dark gray (10YR 3/1) at 8.0 feet.				
3 CS	100		15	**COAL ASH** mostly coal ash, dark gray (10YR 4/1), loose, saturated.				
			20	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
4 CS	100		25	**PEAT** mostly organic material, some silt and woody material, black (10YR 2/1), saturated.				
				SAND mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
			30	End of boring at 30.0 feet below ground surface.				

SOIL BORING WELL CONSTRUCTION LOG BCC GSI WELLS.GPJ TRC CORP INCHES.GDT 2/7/18

Signature: For Tanner Hess

Firm: TRC Environmental Corporation
1540 Eisenhower Place Ann Arbor, MI 48108
(734) 971-7080
Fax (734) 971-9022

Checked By: C. Scieszka

[DRAFT - ELECTRONIC REVIEW]

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC: BC Cobb		WELL ID:	BCC-MW-17005
PROJ. NO: 269767.0000	DATE INSTALLED: 12/5/2017 INSTALLED BY: Tanner Hess		CHECKED BY: CS

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
592.42	3.1	TOP OF CASING
589.3	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL
		BENTONITE SLURRY
		GROUT/BACKFILL METHOD
23.1		TREMIE
	15.0	GROUT
		BENTONITE SEAL MATERIAL
		MEDIUM CHIPS
	17.0	BENTONITE SEAL
569.3	20.0	TOP OF SCREEN
5.00		FILTER PACK MATERIAL
		MEDIUM, WASHED SAND
564.3	25.0	BOTTOM OF SCREEN
	25.0	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL
		NATURAL COLLAPSE
559.3	30.0	HOLE BOTTOM

NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 24 FT.
____ IN. FROM ____ TO ____ FT.

SURF. CASING DIAMETER: ____ IN. FROM ____ TO ____ FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.5 HOURS

WATER REMOVED: 9.5 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	27.89	T/PVC	12/5/2017	1400
DTB AFTER DEVELOPING:	27.89	T/PVC	12/5/2017	1445
SWL BEFORE DEVELOPING:	12.73	T/PVC	12/5/2017	1400
SWL AFTER DEVELOPING:	12.80	T/PVC	12/5/2017	1445
OTHER SWL:	13.06	T/PVC	12/7/2017	1117
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

[DRAFT - ELECTRONIC REVIEW]

WELL CONSTRUCTION LOG

WELL NO. BCC-MW-17006

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
CEC: BC Cobb	12/4/17	12/4/17	269767.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns	Sonic	590.5	593.78	30.0	6

Boring Location: 9 feet west of BCC-MW-15021.

N: 646657.7 E: 12623301.3

Personnel
Logged By - T. Hess
Driller - B. Marshal

Drilling Equipment: Geoprobe 8140 LS

Civil Town/City/or Village:	County:	State:
Muskegon	Muskegon	MI

Water Level Observations:
While Drilling: Date/Time 12/4/17 00:00 Depth (ft bgs) 11.5
After Drilling: Date/Time 12/7/17 11:11 Depth (ft bgs) 13.5

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 HA	100		5	**TOPSOIL** black (10YR 2/1). **COAL ASH** mostly coal ash, dark gray (10YR 4/1), fine, soft, loose.				
2 CS	100			Change to moist at 9.0 feet.				
3 CS	100		10	Change to dry at 10.0 feet. Change to saturated at 11.5 feet.				
			15					
			20					
4 CS	100		25	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
				PEAT mostly organic material, some silt and woody material, black (10YR 2/1), saturated.				
				SAND mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
				PEAT mostly organic material, some silt and woody material, black (10YR 2/1), saturated.				
				SAND mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
			30	End of boring at 30.0 feet below ground surface.				

Signature: For Tanner Hess

Firm: TRC Environmental Corporation
1540 Eisenhower Place Ann Arbor, MI 48108
(734) 971-7080
Fax (734) 971-9022

Checked By: C. Scieszka

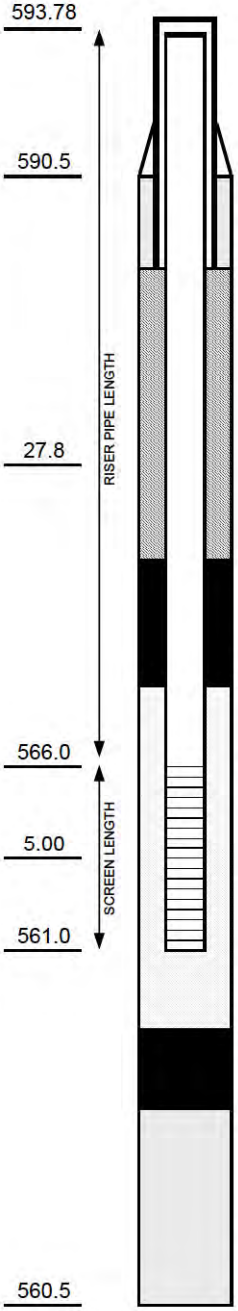
[DRAFT - ELECTRONIC REVIEW]

SOIL BORING WELL CONSTRUCTION LOG BCC GSI WELLS.GPJ TRC CORP INCHES.GDT 2/7/18

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC: BC Cobb		WELL ID:	BCC-MW-17006
PROJ. NO: 269767.0000	DATE INSTALLED: 12/4/2017 INSTALLED BY: Tanner Hess		CHECKED BY: CS

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
593.78	3.3	TOP OF CASING
590.5	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL
		BENTONITE SLURRY
		GROUT/BACKFILL METHOD
27.8		TREMIE
	20.5	GROUT
		BENTONITE SEAL MATERIAL
		MEDIUM CHIPS
	22.5	BENTONITE SEAL
566.0	24.5	TOP OF SCREEN
5.00		FILTER PACK MATERIAL
		MEDIUM, WASHED SAND
561.0	29.5	BOTTOM OF SCREEN
	29.5	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL
		NATURAL COLLAPSE
560.5	30.0	HOLE BOTTOM



NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 30 FT.
____ IN. FROM ____ TO ____ FT.

SURF. CASING DIAMETER: ____ IN. FROM ____ TO ____ FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.75 HOURS

WATER REMOVED: 14.25 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	32.69	T/PVC	12/5/2017	1153
DTB AFTER DEVELOPING:	32.69	T/PVC	12/5/2017	1315
SWL BEFORE DEVELOPING:	16.60	T/PVC	12/5/2017	1153
SWL AFTER DEVELOPING:	16.90	T/PVC	12/5/2017	1315
OTHER SWL:	16.80	T/PVC	12/7/2017	1111
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

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BORING MW-15015R

PROJECT NAME: BC Cobb
PROJECT NUMBER: 083742.02
CLIENT: HDR Michigan Inc
PROJECT LOCATION: Muskegon, Michigan
DATE STARTED: 5/12/20 **COMPLETED:** 5/12/20
BORING METHOD: Hollow-stem Augers
OPERATOR: BG (Stearns Drilling) **RIG NO.:** ATV
LOGGED BY: MLS **CHECKED BY:** CES

SURFACE ELEVATION: 586.8 FT

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY (inches)	PID (ppm)	SOIL ANALYTICAL SAMPLE	REMARKS
585	0	Very Fine SILT with Sand and Some Organics- Dark Gray- Moist (ML)	LS1	24	<1		9-inch diameter flush mounted protective casing set in concrete Filter Sand
	5.0 / 581.8	Fine to Medium SAND with Silt- Dark Gray- Wet (SP-SM)	LS2	16	<1		Hydrated Bentonite Chips
580	10.0 / 576.8	Fine to Medium SAND- Brown and Gray to Dark Gray- Wet (SP)	LS3	12	<1		2-inch diameter PVC with 0.010-inch slot size well screen, 10 feet long
575			LS4	18	<1		
570			LS5	22	<1		
565	24.0 / 562.8	Fine to Medium SAND with Organics- Dark Brown and Black- Moist (SP)					
560	25.0 / 561.8	END OF BORING AT 25.0 FEET.					
	30						

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ **DURING BORING:**	7.0	579.8
▼ **AT END OF BORING:**	4.9	581.9

BACKFILL METHOD: Well

NOTES:
1. Soil samples were classified according to ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) for environmental purposes only. Therefore, the boring logs and associated report(s) should not be used for geotechnical evaluation or design.
2. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.
3. Listed depths under the profile description are rounded to the nearest tenth of a foot (e.g. 5.75 = 5.8). Refer to the report and attachments for actual sample depths and/or intervals (where applicable).
4. No odors noted and no staining observed.

[DRAFT - ELECTRONIC REVIEW]

BORING MW-15016R

PROJECT NAME: BC Cobb
PROJECT NUMBER: 083742.02
CLIENT: HDR Michigan Inc
PROJECT LOCATION: Muskegon, Michigan
DATE STARTED: 5/12/20 **COMPLETED:** 5/12/20
BORING METHOD: Hollow-stem Augers
OPERATOR: BG (Stearns Drilling) **RIG NO.:** ATV
LOGGED BY: MLS **CHECKED BY:** CES

SURFACE ELEVATION: 586.8 FT

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY (inches)	PID (ppm)	SOIL ANALYTICAL SAMPLE	TEMPORARY WELL SCREEN	REMARKS
	0	FILL- Fine to Medium SAND with Silt- Dark Brown- Moist (SP-SM) (1.0 – 585.8)						9-inch diameter flush mounted protective casing set in concrete; Filter Sand; Bentonite Grout
585								
	5	FILL- Fine to Medium Sandy COAL ASH- Silt from 4 to 4.25 Feet- Black and Gray- Moist	LS1	24	<1			
580		(8.0 – 578.8)						
	10	FILL- Fine to Medium SAND- Some Ash, Wood Pieces and Organics- Dark Brown- Wet (SP)	LS2	24	<1			
575			LS3	15	<1			
	15	(15.0 – 571.8)						
570		Fine to Medium SAND- Dark Gray- Wet (SP)	LS4	11	<1			
	20							
565		(23.0 – 563.8)						
		Fine to Medium SAND with Silt- Wood Pieces- Dark Gray- Wet (SP-SM) (24.5 – 562.3)	LS5	18	<1			
	25	Fine to Medium SAND- Wood Pieces from 28 to 28.5 Feet- Gray- Wet (SP)						
560		(28.5 – 558.3)						
		Fine to Medium SANDY SILT- Dark Gray- Wet (ML/SM) (29.5 – 557.3)	LS6	19	<1			
	30							

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ **DURING BORING:**	8.0	578.8
▼ **AT END OF BORING:**	4.8	582.0

BACKFILL METHOD: Well

NOTES:
1. Soil samples were classified according to ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) for environmental purposes only. Therefore, the boring logs and associated report(s) should not be used for geotechnical evaluation or design.
2. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.
3. Listed depths under the profile description are rounded to the nearest tenth of a foot (e.g. 5.75 = 5.8). Refer to the report and attachments for actual sample depths and/or intervals (where applicable).
4. No odors noted and no staining observed.

(Continued Next Page)

[DRAFT - ELECTRONIC REVIEW]

BORING MW-15016R

PROJECT NAME: BC Cobb

PROJECT NUMBER: 083742.02

CLIENT: HDR Michigan Inc

PROJECT LOCATION: Muskegon, Michigan

SURFACE ELEVATION: 586.8 FT

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY (inches)	PID (ppm)	SOIL ANALYTICAL SAMPLE	TEMPORARY WELL SCREEN	REMARKS
	30	Fine to Medium SAND with Wood Pieces and Organics (SP) *(continued)*						
555	33.5 (553.3)							
	34.0 (552.8)	SILTY CLAY- Dark Gray (CL-ML)	LS7	23	<1			
	35.0 (551.8)	Fine to Medium SAND- Wood Chunks at 34 Feet- Dark Gray- Wet (SP)						Bentonite Chip Plug
550	35	Fine to Medium SILTY CLAY with Sand- Gray (CL-ML)						
	39.0 (547.8)		LS8	20	<1			2-inch diameter PVC with 0.010-inch slot size well screen, 5 feet long
545	40	Fine to Medium SAND- Gray Brown- Wet (SP)						
			LS9	10	<1			
	44.8 (542.1)							
	45 (541.8)	LEAN CLAY- Gray (CL)						
		END OF BORING AT 45.0 FEET.						
540	50							
535	55							
530	60							
525	65							
520	70							

[DRAFT - ELECTRONIC REVIEW]

BORING MW-17001R

PROJECT NAME: BC Cobb
PROJECT NUMBER: 083742.02
CLIENT: HDR Michigan Inc
PROJECT LOCATION: Muskegon, Michigan
DATE STARTED: 5/12/20 **COMPLETED:** 5/12/20
BORING METHOD: Hollow-stem Augers
OPERATOR: BG (Stearns Drilling) **RIG NO.:** ATV
LOGGED BY: MLS **CHECKED BY:** CES

SURFACE ELEVATION: 586.8 FT

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY (inches)	PID (ppm)	SOIL ANALYTICAL SAMPLE	REMARKS
	0						9-inch diameter flush mounted protective casing set in concrete
	1.0 (585.8)	FILL- Fine to Medium SAND with Silt- Dark Brown- Moist (SP-SM)					Bentonite Grout
585							
	5	FILL- Fine to Medium Sandy COAL ASH- Black and Gray- Moist	LS1	23	<1		
580							
	8.0 (578.8)						
	10	FILL- Fine to Medium SAND- Some Ash and Wood Pieces- Dark Gray- Wet (SP)	LS2	18	<1		Bentonite Chip Plug
575							
	13.0 (573.8)						2-inch diameter PVC with 0.010-inch slot size well screen, 5 feet long
	15	Fine to Medium SILTY SAND- Woodpieces and Organics- Black- Wet (SM)	LS3	2	<1		
	15.0 (571.8)						Filter Sand
570							
	20	Fine to Medium SAND with Silt- Dark Gray- Wet (SP-SM)	LS4	8	<1		
	21.0 (565.8)						
565		END OF BORING AT 21.0 FEET.					
	25						
560							
	30						

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ **DURING BORING:**	8.0	578.8
▼ **AT END OF BORING:**	4.8	582.0

BACKFILL METHOD: Well

NOTES:
1. Soil samples were classified according to ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) for environmental purposes only. Therefore, the boring logs and associated report(s) should not be used for geotechnical evaluation or design.
2. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.
3. Listed depths under the profile description are rounded to the nearest tenth of a foot (e.g. 5.75 = 5.8). Refer to the report and attachments for actual sample depths and/or intervals (where applicable).
4. No staining observed.
5. Sulfur-type odor noted during drilling.

[DRAFT - ELECTRONIC REVIEW]

Appendix D

Groundwater Sampling Collection Standard Operating Procedure

[DRAFT - ELECTRONIC REVIEW]

Groundwater Sample Collection Standard Operating Procedure

BC Cobb Facility

Muskegon Environmental Redevelopment Group, LLC.

August 14, 2020

[DRAFT - ELECTRONIC REVIEW]

1.0 Introduction

This Standard Operating Procedure (SOP) provides guidance for groundwater sample collection at the B.C. Cobb Facility (BCC or Site) located in Muskegon, Michigan. BCC is the site of a former coal-fired power generation facility. During operations, coal combustion residuals (CCR) were deposited in Ponds 0-8 and the Bottom Ash Pond. Groundwater monitoring will support compliance with Michigan Part 115 Solid Waste Regulations for CCR ash impoundments. This SOP addresses procedures for the groundwater monitoring requirement.

1.1 Method Applicability

The following sections outline the general method for collecting low stress/low flow groundwater samples from monitoring wells. The low flow method is the preferred technique for groundwater monitoring. This technique is appropriate for this Site due to the following characteristics:

- Casing diameter is greater than 1.0 inch
- Screen interval is ten feet or less
- Samples are analyzed for total metals
- Low turbidity is desired in sample containers
- Purge water requiring disposal is minimized, and
- Analytes are repeatable.

The proposed sample collection and safety procedures below are consistent with EPA guidelines and CCR Rule. Muskegon Environmental Redevelopment Group, LLC (MERG) or their Consultant will collect all samples.

1.2 Summary of Method

Depth to water is measured prior to purging. After depth to water is measured, tubing is placed approximately mid-screen in the well. A peristaltic pump is used to purge water from the well at a rate of approximately 100-500 mL/minute. The purged water moves through a flow cell that contains probes to measure stabilization parameters such as pH and conductivity. Once parameters have stabilized, the purged water stream is disconnected from the flow cell and used to fill sample containers for lab analysis. A detailed explanation of this procedure is in Section 5.0.

2.0 Health and Safety

2.1 Safety Documentation

Job Hazard Analyses (JHAs) must be developed prior to arriving on Site. JHAs identify potential hazards that may be present on the Site or while executing the work. JHAs are used to provide methods to minimize hazards.

The site-specific Health and Safety Plan (H&SP) is used to identify actions and precautions to prevent injury. The H&SP also includes essential emergency service contacts in case of incident.

[DRAFT - ELECTRONIC REVIEW]

Each individual is required to have read and understood the Health and Safety Plan (HASP) for the specific project activity and signed the acknowledgement sheet confirming their review.

2.2 Safety Procedures

A safety briefing must be conducted between Site personnel and the sampling team before the start of the work each day. No sampling shall commence until all personnel have completed site specific safety training.

Complete equipment and supply checklists and verify that required documentation and equipment for field activities are on site.

Review locations for planned field activities for hazards. Each sampling site will be characterized by the following factors:

- Location of work
- Weather conditions: rainfall, temperature, and wind direction
- Ongoing activities that may influence or disrupt sampling efforts
- Accessibility to the sampling locations (e.g. road maintenance, rough terrain, fallen trees, flooding, etc.)

View monitoring well locations and confirm the monitoring wells are accessible and well identifications are clearly marked. Select location for disposal of decontamination and purge waters.

3.0 Equipment and Supplies

A complete list of equipment and supplies for groundwater sampling at the BCC site are provided as Appendix A. Primary equipment needs are detailed below:

- YSI water quality meter, or similar, with flow cell and hand-held monitor. In-line probes calibrated to measure dissolved oxygen, oxidation-reduction potential (ORP), conductivity, pH, and temperature are required. Turbidity may be included as an additional probe or a separate turbidity meter may be used.
- Peristaltic pump with pump head and external power source. Bladder pump may be used if water levels are >25 feet below top of casing.
- Water level measurement tape. Must have a minimum of 0.01-foot accuracy.
- Pump head tubing (silicone) and well tubing (polyethylene). Each well is equipped with dedicated tubing; extra tubing on hand is recommended if replacement is deemed necessary.
- Large SUV. An initial safety check should be performed at the start of each shift to confirm the vehicle is in good working condition. The vehicle should then be checked daily for damage or required maintenance.
- Decontamination supplies.
- Sample containers with appropriate preservatives.
- Personal protective equipment.
- Tools and materials as listed in Appendix A.

All equipment must be calibrated according to manufacturer's instructions. Calibration of field equipment is completed by the rental equipment company prior to each rental, and calibration

[DRAFT - ELECTRONIC REVIEW]

records are included with the equipment. Therefore, calibration of field equipment measuring field parameters (YSI or similar) will be calibrated at the beginning of each sample event. The calibration record from the equipment company will be reviewed to ensure accurate calibration. The sample crew will photograph the calibration documentation provided with the equipment.

4.0 Quality Control Documents and Records

The following documentation and records must be taken to the jobsite and maintained for every sampling event:

- Historical documentation, including:
  - Well construction data,
  - Well location map
  - Field data from the previous sampling event
- Material Safety Data Sheets (MSDSs) for any reagents taken to the Site
- Field log book/field worksheet to document:
  - Field instrument calibration data
  - Monitoring well identification number and condition
  - Well depth and depth to water, including date and time of measurement
  - Sample tubing material, diameter, length, placement, and pump type
  - Pumping rate, water level, water quality indicator values, and date and time of measurement
  - Identification and explanation of any unacceptable water quality indicator values
  - Time and date of sample collection
  - Sample ID
  - Field observations
  - Sampler's name or initials

  See Appendix B for the Field Data Sheet to be used to record the above information.
- Chain of Custody (COC) form must include:
  - Analytical parameters requested
  - Sample time and date
  - Sampler's name or initials
  - Site location
  - Sample ID
  - Preservatives added

  See Appendix C for a sample COC form.
- Sample labels must include:
  - Sample ID
  - Sample time and date
  - Sampler's initials
  - Preservatives
  - Analysis requested

Sample bottle labels, COC form data, and information on Field Data Sheets must match *exactly*.

[DRAFT - ELECTRONIC REVIEW]

5.0 Sampling Procedures

5.1 Determination of Depth-to-Groundwater (DTW)

The following initial steps will be followed before purging each monitoring well and collecting groundwater samples in the field.

1. Orient the equipment upwind of the monitoring wells if possible.
2. Begin with the well that has the least contaminated groundwater (if known) and proceed in increasing order of contamination such that the well with the highest contamination is sampled last.
3. Locate the monitoring well to be sampled, confirm monitoring well ID and record the condition of the monitoring well (casing protector, lock, locking cap, and well casing). Record any abnormal observations or evidence of damage or tampering.
4. A sheet of plastic or tarp may be laid around the casing protector to provide a clean area for equipment and minimizing contamination from the ground.
5. Remove the well cap.
6. If the well casing does not have a reference point, make one. The reference point is typically a V-cut or a mark on the top of the PVC well casing.
7. Hold the water level measuring tape against the reference point to measure the DTW to 0.01 feet. Duplicate the reading. Every measurement should be taken from the same reference point. Minimize disturbance of the water column while measuring.
8. Record the DTW on the Field Data Sheet (Appendix B).
9. Decontaminate the water-level indicator and tape prior to each use. The decontamination procedure for the water level indicator is: Hand wash the calibrated tape and probe that contacted groundwater with Alconox solution (or equivalent) and rinse with deionized water.
10. Monitoring well depth can be obtained from monitoring well construction logs. Measuring total depth of monitoring wells prior to sampling should be avoided; measuring to the bottom of the monitoring well casing may cause re-suspension of settled solids.
11. Continue on to purging if sampling is to occur on the same day. Lock well casing and pack up equipment if sampling is to occur at a later date.

5.2 Purging Procedure

The type of pump used for sampling is dependent upon the casing diameter, depth to groundwater, depth of the monitoring well screen, and anticipated volume required for purge. A peristaltic pump is recommended for the BC Cobb Site. A bladder pump may be used if groundwater levels are greater than 25 feet below the top of the casing. Decontamination of portable pumps is required prior to each use.

A peristaltic pump is appropriate for monitoring wells with groundwater depths less than 25 feet below the top of the casing. The sampling protocol will be as follows for the collection of groundwater samples using a peristaltic pump (such as the Geopump-2or similar):

[DRAFT - ELECTRONIC REVIEW]

1. Use historical well data to cut polyethylene tubing to the appropriate length such that the tubing end can be lowered to the middle of the screen, and there is at least three to four feet of tubing at the surface to run through the pump and run into a bucket.
2. Slowly and carefully lower the tubing to the mid-point of the screened interval. In cases where the entire screen is not saturated, place the tubing inlet near the middle of the saturated screen. Take care not to allow the tubing to touch the ground and introduce contamination into the well.
3. Do not place the tubing less than two feet above the bottom of the well, as this may cause the mobilization of bottom sediments. If saturated screen length is two feet or less, collect sample using disposable bailer.
4. Allow at least one foot of water above the inlet so there is little risk of entrainment or air in the sample.
5. Attach an in-line multi-probe flow-through cell. The flow-cell will be used to monitor the indicator parameters so as not to expose the water to the atmosphere prior to measurement. During purging, water quality indicator parameters (pH, ORP, turbidity, specific conductivity, and DO) will be measured every 3-5 minutes until the parameters have stabilized. Measurement should be recorded on Appendix B. A minimum of 5 sets of water quality indicator parameters should be recorded.
6. Begin purging the monitoring well at a rate of approximately 100 mL/minute. Flow rate can range from 100 to 500 mL/min. All purge water will be put in a bucket. The buckets will be disposed of on the ground surface at least 100 feet from the well. Record the pumping rate on the Field Data Sheet (Appendix B).
7. Stabilization is achieved after three successive readings are within ± 0.1 for pH, ± 10 mV for ORP, ± 3% for specific conductance, ± 10% for DO and turbidity. Temperature will also be measured and recorded, but will not be used as a stabilization parameter. Sampling may begin once the well has stabilized.
8. Turbidity and DO usually take the longest to stabilize. Up to 2 hours of purging may be required to reach stabilization. Stabilized purge indicator trends are generally obvious and follow either an exponential or asymptotic change to stable parameter values during purging. If stabilization does not occur or turbidity is >10 NTU after two hours of purging, the ES should be contacted for direction.

5.3 Sample Collection Procedure

Sample bottles will be labeled prior to collecting water in the bottles. Bottle labels will be completed for each sample container collected for analysis, using ink or permanent marker. Each label will include the following:

- Site Location
- Well identification number (MW-#);
- Sample collection date: month, day, year;
- Sample collection time;
- Sample preservation method (e.g. nitric acid); and
- Initials of personnel collecting the sample.

[DRAFT - ELECTRONIC REVIEW]

It is critical that both the sample bottle monitoring well identification and sample times match exactly the sample name and collection time written on both the Field Data Sheet and the Chain of Custody.

Use clean nitrile gloves for each well prior to handling any sample bottles. When collecting a sample:

1. The pump will not be turned off between the purging and sampling processes.
2. Disconnect the flow cell.
3. Samples will be collected in sample containers described in Section 3.5 of the HMP. Remove the sample bottle from the plastic bag and remove the cap.
4. Rinse the bottle with the sample stream, holding the tubing approximately 1/8" outside of the open bottle. Do not place the sample tubing within the bottle or allow it to dip into the collected sample.
5. Collect samples at the same flow rate as the purging rate. Minimize potential contamination by shielding the open bottles as needed. Minimize aeration by allowing the water to flow down the side of the bottle instead of against the bottom.
6. Fill to approximately ¼" below the bottle threads. Cap the bottle and store in a plastic bag. Place the plastic bag(s) in a cooler filled with ice.
7. If recharge is low, the drawdown in the well may approach the pump depth. Purge the well to within one foot of the pump depth, and remove the pump, close the well, and determine the time to let the well recharge prior to returning to collect the sample.
8. Sampling will be performed no less than 24 hours after well development is completed. Observations made during sample collection will be recorded on the water quality sample collection form in Appendix B.
9. After all samples from a monitoring well are collected, remove the tubing unless the tubing is dedicated to the well and remains in place. Tuck any extra length of tubing down into the well casing with care not to permanently pinch the tubing.
10. Cap and lock the monitoring well protective casing.
11. Pour collected purge water on the ground, away from any wells that are to be sampled next.
12. Repeat procedure for remaining monitoring wells.

Samples will be stored in a cooler with ice. The coolers from the field will be delivered back to the lab each day that samples are collected.

5.4 Decontamination Procedure

The purpose of decontamination is: (1) to eliminate the transfer of contaminants from one groundwater monitor well to another, and (2) to protect the health and safety of personnel who may come in contact with contaminated equipment. Decontamination procedures described in this section will be performed at the beginning of each day of field work and between each monitor point, and whenever the equipment is suspected of having been contaminated.

All non-dedicated sampling equipment must be decontaminated before its reuse. All disposable tubing will be properly discarded and new tubing used in its place. The peristaltic pump tubing will be replaced and discarded before each sample location, or dedicated tubing will remain in each well.

[DRAFT - ELECTRONIC REVIEW]

BC Cobb wells are equipped with dedicated tubing; however, if decontamination is required due to insufficient supply or suspected contamination, the steps are as follows:

1. Place the tubing into a bucket containing approximately 5 gallons of an Alconox / tap water solution. Run the pump within the solution for approximately 2 minutes, allowing for the soapy water to run through the tubing. Use a scrub brush if necessary.
2. Place the tubing into a bucket containing approximately 5 gallons of clean tap water. Run the pump within the water for approximately 2 minutes to rinse the pump and tubing.
3. Place the tubing into a bucket containing approximately 5 gallons of distilled water. Run the pump within the water for approximately 2 minutes.
4. Finally place the tubing into a bucket containing approximately 1 gallon (or as little volume as possible to accomplish a quick single rinse) of distilled water. Run the pump within the water for approximately 10 seconds.
5. Wrap the pump and tubing to maintain cleanliness during transport.
6. Replace water and water solutions daily.

The above steps also apply if a bladder pump is required for wells with water levels greater than 25 feet below the top of the casing.

Flow cell shall be rinsed with deionized water if debris is not flushed out during purging. If the probes are not fouled, no further action is necessary since the flow cell does not contact the sample. The cell must be filled with tap water and stored overnight.

5.5 Quality Control

Quality Control (QC) checks of both the field procedures and laboratory analyses will be used to assess and document data quality and to identify discrepancies in the measurement process that need correction. Quality control samples will be used to assess various data quality parameters such as representativeness of the environmental samples, the precision of sample collection and handling procedures, the thoroughness of the field equipment decontamination procedures, and the accuracy of laboratory analyses. In addition, all sample containers, preservation methods, and holding times will be in accordance with QC requirements.

The analytical laboratory will use a series of QC samples, as identified in the laboratory's Quality Assurance Plan and specified in the standard analytical methods. The types of samples include method blanks, surrogate spikes, laboratory control samples, laboratory control sample duplicates, matrix spikes, and matrix spike duplicates. The primary type used for BC Cobb is a sample duplicate. One monitoring well for every 10 will be selected to collect a duplicate sample. It requires an additional sample to be collected in the same manner as the original sample. This sample type is used by the laboratory to determine precision. Sample identification for duplicates will be the same as the sample identification with the addition of a "Duplicate" (e.g. MW-15018 and MW-15018D).

The pump tubing is dedicated in each well; therefore an equipment blank to test decontamination effectiveness is not required.

The precision will be measured through the evaluation of relative percentage differences (RPDs) between sample and duplicate samples and calculated as follows:

[DRAFT - ELECTRONIC REVIEW]

Relative Percentage Difference (%) = $\frac{\text{concentration SA-concentration SB}}{\text{Average concentration of SA+SB}} \times 100$

Where SA denotes Sample A; SB denotes the duplicate, sample B.

Duplicate RPD requirement is 20 percent. Refer to Section 3.7 of the HMP for additional information regarding data quality objectives.

Accuracy is measured by the difference between the measured or observed value and the true or assigned value. Accuracy in the field is assessed through the adherence to all sample handling, preservation, and holding times.

Laboratory data will be reviewed, validated and qualified if necessary prior to use. The laboratory data validation procedure is described in Section 3.7 of the HMP.

5.6 Sample Preservation and Handling

The sample team shall be provided with COC forms prior to sampling. The Chain of Custody (COC) form should be completed in the field as the sampling progresses and signed upon transfer of custody at the laboratory. Chain of custody procedures comprise the following elements: (1) maintaining custody of samples, and (2) documentation of the requested analysis. To document chain of custody, an accurate record must be maintained to trace the possession of each sample from the moment of collection through analysis and reporting. The field chain of custody record is used to record the custody of all samples collected and maintained by investigators. All sample sets will be accompanied by a chain of custody record. It also serves as a sample logging mechanism for the laboratory sample custodian. The following rules apply to chain of custody records:

- All information must be supplied in the indicated spaces to complete the field chain of custody record. It is critical that the proper contact information is provided to the laboratory. This should always be the sampler or ES.
- Every person who maintained custody of the samples must sign in the designated signature block.
- The sample ID, date, and time on the chain of custody must match the sample bottle exactly.
- The total number of sample containers for each sample must be listed in the appropriate column. Total sample bottles need to be counted and double checked. Required analyses should be circled or entered in the appropriate location on the form and double checked.
- If expedited turnaround is requested, this needs to be noted clearly.
- Electronic results are required as EDDs and PDF files of the laboratory report.
- The last person receiving the samples should be the laboratory sample custodian or their designee(s).
- The chain of custody record is an accountability document and should be filled out thoughtfully.
- In cases where the samples leave the sampler's custody into an intermediate carrier, such as shipment, a seal should be placed on the container to detect unauthorized entry to the samples. Containers that arrive at the laboratory with compromised seals must be evaluated to determine if the chain of custody has been invalidated.
- If samples arrive at the laboratory without the COC document, it shall be completed by the laboratory under the supervision of the laboratory project manager. The person completing

[DRAFT - ELECTRONIC REVIEW]

the COC at the lab shall enter the statement "COC completed by the laboratory upon receipt of sample(s)" in the remarks section of the COC and initial the entry.

A sample COC is included as Appendix B.

5.7 Closeout

Upon the completion of groundwater sampling activities, the sampler will perform the following activities:

- Check condition of field equipment.
- Review field documentation.
- Record field data sheet information into electronic project database.
- Make arrangements for shipment of samples (if applicable).
- Confirm logged analyses with the laboratory.

[DRAFT - ELECTRONIC REVIEW]

Appendix A

Groundwater Sampling Equipment Checklist

[DRAFT - ELECTRONIC REVIEW]

Groundwater Sampling Equipment Checklist

- Monitoring well keys
- Map of wells
- List of well names, well construction logs, water level data
- Field data forms
- Field logbook
- YSI (or similar) water quality meter
- Water level indicator tape (check that the depth is in feet and length is adequate for the site conditions)
- Nitrile gloves
- Trash bags
- Watch/timer
- Camera
- Purge water bucket
- Toolbox/wrenches (for well access)
- Hose or extra tubing (may be useful for purge water for certain submersible pump/reel rental setups)
- Knife/boxcutter for slicing tubing
- Graduated cylinder or graduated bucket (for flow measurement)
- Sample bottles
- Permanent Marker
- Cooler
- Ice/Ice packs
- Black electrical tape
- Decontamination bucket(s)
- Tap water source for decontamination
- Distilled water
- Deionized water
- Alconox
- Scrub brush
    - Peristaltic Pump, such as the Geotech Geopump (groundwater <25 feet below top of casing)

[DRAFT - ELECTRONIC REVIEW]

- Modular battery and clips for vehicle battery and power cord
- Tubing, sufficient footage for disposal after each well or decontamination between wells (polyethylene well tubing, silicone pump head tubing)

[DRAFT - ELECTRONIC REVIEW]

Appendix B

Groundwater Sampling Field Data Sheet

[DRAFT - ELECTRONIC REVIEW]

Water Sample Collection Field Data Sheet

Site Name:_____ Well ID.:_____

Sample I.D.(match bottle and COC form exactly):_____

Personnel:_____

Date: _____ Static Depth to Water (ft, btoc) _____

Date/Time Sample Collected (match bottle and COC form exactly):_____

Sample Method: _____

Water level meter, pump, and tubing decontaminated prior: Yes No

Sample QC: Duplicate Yes No Duplicate Sample ID: _____

Sample QC: Equipment Blank Yes No Equip Blank Sample ID: _____

Well Purging Data (Fill In All Blanks)

Depth of Sample Collection (pump depth) (ft, btoc) _____

Time Completed: _____ Total Purge _____ Units_____

Field Measurements:

Time (24 hour)	Amount purged (ml)	pH	COND (mS/m)	TURB (NTU)	DO (mg/L)	TEMP (C°)	ORP (mV)	Water Depth (ft, btoc)

Flow Rate_____
Pump controller setting_____
General Comments:

_____

_____

_____

[DRAFT - ELECTRONIC REVIEW]

Appendix C

Example Chain of Custody Form

[DRAFT - ELECTRONIC REVIEW]

Pace Analytical
www.pacelabs.com

CHAIN-OF-CUSTODY / Analytical Request

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields r

WO# : 50256085

50256085

Section A
Required Client Information:

Company: HDR, Inc
Address: 3321 Bronson Blvd
Kalamazoo, MI 49008
Email: molly.reeves@hdrinc.com
Phone: 734-751-1790 Fax:
Requested Due Date

Section B
Required Project Information:

Report To: Molly Reeves
Copy To:
Purchase Order #:
Project Name: Muskegon Site
Project #:

Section C
Invoice Information:

Attention:
Company Name:
Address:
Pace Quote:
Pace Project Manager: melanie.booms@pacelabs.com
Pace Profile #: 9219

Regulatory Agency
State / Location: MI

ITEM #	SAMPLE ID (One Character per box. (A-Z, 0-9 / , -) Sample Ids must be unique)	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Analyses Test (Y/N): IN Metals, Total	IN pH	IN TDS/F, Cl, SO4/	IN TSS	IN Rad-226	IN Rad-228	Residual Chlorine (Y/N)
1	MW-15002	WT	G	5-11-20	11:10a				6									X				X		
2	MW-15003				12:00p				6									X						
3	MW-15004				12:40p				6									X						
4	MW-15005				1:40p				6									X						
5	MW-15006				2:40p				6									X						
6	MW-15007				3:25p				6									X						
7	MW-15008				4:10p				6									X						
8	MW-15010				4:55p				6									X				X		
9																								
10																								
11																								
12																								

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
	[signature] / HDR	5/5/20	8:33am	[signature]	5-5-20	0833	

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER:
SIGNATURE of SAMPLER: DATE Signed:

TEMP in C | Received on Ice (Y/N) | Custody Sealed Cooler (Y/N) | Samples Intact (Y/N)

[DRAFT - ELECTRONIC REVIEW]

Appendix E

Statistical Procedures Plan

[DRAFT - ELECTRONIC REVIEW]

Statistical Procedures Plan

[DRAFT - ELECTRONIC REVIEW]

1.0 Project Management

This Statistical Procedures Plan provides the procedures for analysis for the data generated during groundwater monitoring at the former B.C. Cobb Power Plant (Site). The Muskegon Environmental Redevelopment Group, LLC (MERG) must comply with the U.S. Environmental Protection Agency's (USEPA) Coal Combustion Residuals Rule and the Michigan Part 115 Solid Waste Regulations for CCR units. Groundwater monitoring of the CCR unit is an integral part of compliance with the federal CCR Rule and State solid waste permit.

This document addresses the statistical procedures for evaluating data to select statistical method(s) required for evaluating groundwater monitoring data, as required by the CCR Rule and Part 115 Rule 908.

2.0 Statistical Analysis

Monitoring will include analyzing groundwater data and groundwater levels from wells upgradient and downgradient of the CCR unit at the Site. The Groundwater Monitoring System Certification for the facility describes the hydrogeologic characterization and rationale for the upgradient and downgradient sample locations.

This section provides the methodology to statistically evaluate the groundwater data, select appropriate statistical method(s), and develop the appropriate background threshold values (BTVs)[1] for required constituents of interest (COIs) from the federal CCR Rule Title 40 Parts §257 and the Michigan Part 11511a(3) and 11519b(2), referred to herein as the COIs. The 40 CFR §257.93(f) includes a list of statistical methods from which to choose for evaluating the groundwater monitoring data from CCR management areas. The options include:

- A parametric analysis of variance followed by multiple comparison.
- An analysis of variance based on ranks followed by multiple comparison procedures.
- A tolerance interval procedure, in which an interval for each constituent is established from the distribution of the background data and the level of each constituent in each compliance well is compared to the upper tolerance limit.
- A control chart approach that gives control limits for each constituent.
- Another statistical test method that meets the performance of 40 CFR §257.93(g).

[1] The CCR Rule does not include the term "background threshold value" or any specific term to represent the upper tolerance limit, or the control limit other than references to the "background value", "background constituent concentration levels" or "background concentration". The EPA's ProUCL documentation uses the term "background threshold value" with explicit reference to upper tolerance limits throughout the documentation. For ease of reference in our planning document, we chose to use the EPA's terminology. Note that a BTV is not a fixed value. It is a statistical test for determining if there is an SSI from a groundwater sample taken at a downgradient well. Its value may change as background sample sizes change over time or if changes are made to the number of downgradient wells.

[DRAFT - ELECTRONIC REVIEW]

The goal of statistical analysis is to provide a quantified means to evaluate whether a CCR management unit has released contaminants into the groundwater. Following the collection of groundwater monitoring data, detected constituents will be statistically evaluated to identify if a statistically significant increase (SSI) over background has occurred. The EPA's ProUCL software (Singh and Singh 2015) supported with R script from the EPA's Unified Guidance Appendix C.3 (USEPA 2009b), SPSS[2] and NCSS[3] will be used to conduct statistical analysis of groundwater analytical data collected for the Site. However, if during the period of the groundwater monitoring program at the Site an updated or more comprehensive statistical software program is available or may become available, a different software program may be used.

The steps for this process are summarized in Figure 1 and are described in sections 2.1 and 2.2. As groundwater monitoring progresses, the use of the selected statistical method will be subject to ongoing review. Other statistical tests may be used in place of, or in addition to, the methods specified in this Statistical Procedures Plan if such methods are better suited for analysis of future results. If test methods are changed, this Statistical Procedures Plan will be revised, as appropriate, and its certification updated.

When developing the BTVs for the required constituents since there are multiple background wells, the data from the background wells will be evaluated to determine if it is appropriate to pool the background groundwater data from multiple wells to develop a single BTV for each constituent. The assumption for pooling groundwater data is that the constituent concentrations sampled at multiple background wells, when pooled, serve as an estimate of overall well field conditions for constituents at a site.

Section 2.1 describes the statistical analyses used to assess and transform the groundwater data from the background monitoring wells where necessary such that the data can be used to produce appropriate BTVs and conduct statistical tests. This stage is referred to as the preliminary data analysis. Consideration is given to issues related to outliers, serial correlation, seasonality, spatial variability, and trends. It may be necessary to test for differences in group means across sub-groups of samples to verify assumptions or to add new groundwater samples to existing samples. For example, sub-group testing can be used to determine if background groundwater concentrations are changing over time or background groundwater concentrations are different by season. These differences are important since they determine if new background data can be pooled with historical data or if deseasonalization of the data is required.

Section 2.2 contains the steps to estimate statistically significant increases (SSIs) over background or statistically significant levels (SSLs) over a groundwater protection standard (GPS) where relevant for each of the detection, assessment and closure phases of the CCR Rule. A suite of prediction limits, tolerance limits, and confidence limits are used to address the statistical test requirements covered through parts 40 CFR §257.93, §257.94, §257.95, and §257.102.

As recommended by the EPA Unified Guidance (2009b) and pending confirmation as appropriate after evaluation of site specific background water quality data, upper tolerance limits (UTLs) are proposed to be used to establish BTVs for each of the COIs at the Site for the purposes of complying with the detection monitoring requirements to confirm SSIs.

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[2] IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.

[3] NCSS 12 Statistical Software (2018). NCSS, LLC. Kaysville, Utah, USA, ncss.com/software/ncss.

[DRAFT - ELECTRONIC REVIEW]

The Site is in Assessment Monitoring and Corrective Action under the federal CCR Rule compliance program, which requires comparison of COIs from downgradient wells to their groundwater protection standards (GPS) (40 CFR §257.95(g)). Under the federal CCR Rule compliance program, the GPS value is the maximum contaminant levels (MCLs) or the background value (using the 95% upper tolerance limits (UTLs)), whichever is higher, estimated from the background samples as statistically equivalent BTVs. The results of the evaluation as to whether or not an COI is above its GPS based on SSLs determines if the CCR Unit remains in assessment monitoring or moves into corrective action. However, under the State Part 115 compliance program described herein, the GPS value is the lowest of the MCL or the applicable cleanup criteria for that constituent for groundwater as established pursuant to section 20120a of the act. Or for constituents for which the background level (UTL) is higher than the MCL or applicable cleanup criteria for groundwater, the background concentration will be the GPS. Therefore, at this Site, there may be a different GPS value for the State Part 115 compliance program than the federal compliance program.

A decision flow chart which summarizes the logic and statistical methods used to determine which groundwater data are suitable to establish or update background and which types of BTVs can be used to describe background levels is shown in Figure 1 below.

The decision flow diagram allows for updates to the BTVs as samples from the background wells continue to be collected at either the scheduled semi-annual or annual sampling events, depending on the quality or quantity of the samples. While the initial required 8 sampling events in 2020 provide the minimum number of samples from which to estimate BTVs[4], as additional samples are collected, the BTVs be updated at scheduled time intervals. In that way, the BTVs may change periodically.

[4] "The Unified Guidance recommends that a minimum of at least 8 to 10 independent background observations be collected before running most statistical tests. Although still a small sample size by statistical standards, these levels allow for minimally acceptable estimates of variability and evaluation of trend and goodness-of fit. However, this recommendation should be considered a temporary minimum until additional background sampling can be conducted and the background sample size enlarged", page 5-3.

[DRAFT - ELECTRONIC REVIEW]

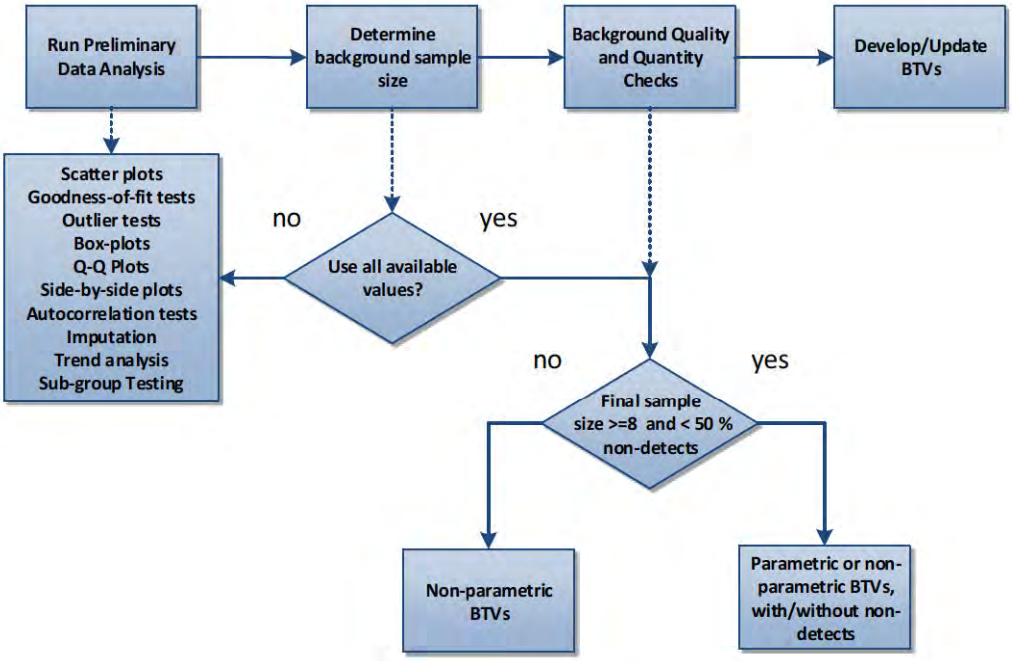

Figure 1: Decision Flow Chart for Preliminary Data Analysis and BTVs

2.1 Preliminary Data Analysis

The CCR Rule references requirements that statistical assumptions and data quality conditions associated with the test procedures are validated as described in 40 CFR §257.93 (g)(5)(6). A preliminary data analysis (PDA) is conducted to confirm such assumptions and bring awareness to the quality of data at the time background concentrations are estimated. A type of statistical analyses to support sub-group testing of differences in population means and medians is given special treatment at the end of this section as different aspects of the PDA will draw from it depending on the purpose of the statistical testing collected from the upgradient and downgradient wells.

a. Descriptive Statistics

Descriptive statistics will be developed per well per constituent and repeated for data pooled across all wells within a location. The purpose of descriptive analysis is to characterize data and assess quality of information. The following statistics will be produced per constituent per well and then pooled over all wells.

- Sample size
- Number of detects
- Percentage of detects
- Number of non-detects
- Percentage of non-detects
- Number of distinct observations
- Number of distinct MDLs
- Mean
- Median
- Minimum
- Maximum
- Standard deviation
- Coefficient of variation

[DRAFT - ELECTRONIC REVIEW]

- Range of collection period in months: Difference between last sampling date and first sampling date
- MAD/0.675[5]
- Skewness
- Kurtosis

b. Graphical Analysis

Scatter plots of observations will be produced as a function of time. Different colors will be used to differentiate detects from non-detects (NDs). The graphs visually provide clues as to whether the period of record is reflective of a steady-state baseline period. The graphs should be evaluated to determine if all data can be incorporated into analysis or if older historical data may need to be dropped (multiple detection limits over time may affect usability of the data). Outliers and seasonality can also be visually detected. Further statistical tests will need to be conducted to confirm assumptions from visual inspections.

c. Identify Outliers

A statistical outlier is defined as a value originating from a different statistical population than the rest of the sample. Outliers or observations not derived from the same population as the rest of the sample violate the basic statistical assumption of identically distributed measurements. If an outlier is suspected, an initial helpful step is to construct a probability plot of the ordered sample data versus the standardized normal distribution.

Two tests will be used to test for possible outliers. Dixon's Outlier Test is appropriate for data series with sample sizes less than 25, and Rosner's Outlier Test is applicable to those with a sample size larger than 25. These outlier tests assume that the rest of the data except for the suspect observation(s) are normally distributed. In conjunction with Dixon's and Rosner's Tests, observations that are greater than 3 standard deviations from the mean will be flagged. Values greater than 3 standard deviations from the mean may be outliers.

If outliers are found from the tests, the anomalous numbers will be investigated. If they are correct values and collected under standard, consistent protocols, they should remain in the data series. Otherwise, they can be dropped before proceeding. Some distributions naturally have anomalously low or high values. The subsequent tests for distribution types should find the best fitting distribution that can explain the anomalous values.

While some literature suggests repeating the statistical procedures with and without the outliers, the risk of this method is that the estimated distributions and statistics tend to be chosen to suit a goal. After a comparison of the estimates is made, a decision needs to be made as to which data set is representative. The decision to use or reject outliers will be done at the data collection and assessment stage. An example would be where a sample was qualified as "J+" (biased high), due to equipment blank contamination. If such a sample was seen as an outlier, it may be possible to

[5] The MAD/0.675 is a robust estimate of variability of the population standard deviation. A robust estimate of variability, which is less likely impacted by outliers in the sample, is derived by dividing the median absolute deviation (MAD) with the constant of 0.675. The MAD is the sum of the differences between each of the observations and the median. Any differences that are less than zero are converted to positive values before a total sum is computed.

[DRAFT - ELECTRONIC REVIEW]

eliminate it from further analysis for this reason. If there is a doubt as to the authenticity and reliability of the measured value, it should not be used. Otherwise, it is a value that was generated by the system regulating the water quality conditions of the tested groundwater well. Groundwater monitoring reports will indicate any outliers that have been rejected from the dataset.

d. Identify Distributions

Since many tests make an explicit assumption concerning the distribution represented by the sample data, the form and exact type of distribution must be checked using a goodness-of-fit test. A goodness-of-fit test assesses how closely the observed sample data resemble a proposed distributional model. The best goodness-of-fit tests attempt to assess whether the sample data closely resemble the tails of the candidate distributional model. The models under consideration for water quality samples are normal, lognormal, or gamma distributions.

The Shapiro-Wilk (sample sizes <= 50) and Lilliefors (sample sizes >50) tests will be used to test for normal distribution. Note that these two tests can be used to test for lognormal distributions after the data are transformed using the natural log function. The empirical distribution function (EDF) based methods, the Kolmogorov-Smirnov (K-S) and Anderson-Darling (A-D) test, are used to test for a gamma distribution. The software package from the USEPA, ProUCL has incorporated these methods to automatically test for either normal, lognormal, or gamma distribution types. If all goodness-of-fit tests fail, a non-parametric estimation method will be used.

e. Test for Spatial Variability

Spatial variability exists when the distribution or pattern of concentration measurements changes from well location to well location, either from natural or anthropogenic factors. Natural spatial variability refers to a pattern of changing mean levels in groundwater associated with normal geochemical conditions unaffected by human activities such as variation in contents of COIs in the soil and variation in geochemical conditions resulting in different solubility of COIs. Natural spatial variability is not an indication of groundwater contamination, even if concentrations at one or more compliance wells exceed (upgradient) background concentrations. Sources of anthropogenic spatial variability can include recent or historic releases from an on-site source or migration of contaminants from off-site sources. In groundwater monitoring, *mean* levels of a given constituent are usually compared from one well to the next to determine if natural or anthropogenic spatial variability is present[6]. Side-by-side box plots will be developed for each constituent at each well where data permit to evaluate the potential for natural spatial variability in the upgradient wells. If sufficient data is available on a per well basis, sub-group testing for differences in population means and medians will be conducted as described in section (i) below.

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[6] Analysis of variance (ANOVA) techniques (see Section 2.1 for details on these techniques) can also be used to establish evidence of spatial variation. If there is evidence of spatial variation, the unified guidance recommends using an intrawell statistical analysis. For an intrawell analysis to be meaningful at the downgradient sites, samples would have had to be taken prior to human activity such the installation of ash basins or ponds. Since the activity has occurred, it is important that the selection of groundwater wells at both upgradient and downgradient sites be done to minimize spatial variability to the extent possible.

[DRAFT - ELECTRONIC REVIEW]

f. Test for Serial Correlation

Sources for serial correlation in water samples can be due to seasonal effects or temporal effects related to the timing of the sample collections. Trend analysis using regression techniques of a water quality constituent sampled over time is confounded if the data exhibits serial correlation. The regression errors from adjacent observations may be correlated. For example, if the residual from a given month's observation is high, then it is likely that the residual from the next month's observation will also be high. The same logic follows for low residuals giving rise to other low residuals. This type of correlation is referred to as serial correlation or autocorrelation. The autocorrelation function test will be run at the 5 percent level of significance (statistical software application SPSS[7] to run this test).

g. Test for Seasonality

As explained in the previous paragraph, there are different reasons why a series of water quality constituent samples exhibit serial correlation. A common reason arises from changes in season as evidenced from varying temperatures and precipitation. These changes impact water quality constituents in a predictable and cyclical manner over the months. The study of water quality changes over time is focused on the ability to discern true trend through regression analysis amidst the cyclical nature of the data or its "seasonality". The correct use of these regression analyses rests on the crucial assumption that regression errors or residuals arising from the model fitting are independent of each other. This is often not the case with data that is seasonal in nature. If seasonality exists, then the autocorrelation function test described in step f will pick up the pattern. To better understand the type of seasonality (monthly, quarterly, bi-annually) which factors into the observed variability of data, a visual inspection of the data as a function of time is recommended.

Box plots of observations on a monthly or quarterly basis will be developed (provided one has at least 8-10 observations per sampling period). These results will be used to determine how to group the data into seasons. If sufficient data is available on a per season basis, sub-group testing for differences in population means and medians will be conducted as described in sub-section (i) below.

h. Test for Trend

The samples from background wells represent water quality conditions exhibiting natural variability and unaffected by anthropogenic activities. As such, the measurements taken at regular intervals over time (3 or more years) are expected to demonstrate a steady or stationary time series. The data from the background wells will be tested to determine whether trends exist (values steadily increasing or steadily decreasing). Depending on the presence of NDs and seasonality, one of the following regression tests will be selected:

- MLE Regression (with or without NDs) with best fitting distribution
- Mann-Kendall (non-parametric, no seasonality, only 1 MDL)

In the circumstances when changes in trend may occur within a constituent's collection of samples over time, the piece-wise polynomial model has proven useful. This approach attempts to find a

[7] IBM®, SPSS®, Statistics ,Version 19

[DRAFT - ELECTRONIC REVIEW]

statistically significant break in the trend direction. The piece-wise models should be applied mainly as a visual guide when interpreting the background linear trend tests.

i. Test for Sub-Group Testing

When assessing if concentration means or medians are statistically different across wells, seasons or between two different background collection periods, various statistical procedures are available. This section describes the tests which may be used depending on the nature of the data and number of tests required. A significance level of 0.05 will be used to decide whether to accept or reject the null hypothesis that there are no differences across the sub-group means. In instances where multiple comparisons are made, adjustments will be incorporated to control for false positive rate (e.g., Bonferroni's adjustment) or statistical tests used with built-in functionality to address the multiple comparison issue (e.g., Tukey-Kramer test).

Before proceeding to test for differences across the sub-group means, one needs a sufficient sample size of at least 8-10 samples per sub-group. Testing for sub-groups can be done in three steps: 1. Graphical analysis, 2. Hypothesis tests for sub-group differences, and 3. Tests to identify which sub-groups are different.

Graphical Analysis

Background groundwater data can be assessed for sub-groups using graphical representation tools such as box-and-whisker and Q-Q plots. Multiple box-and-whisker and Q-Q plots can be constructed for comparing constituent concentrations and variability across potential sub-groups.

Hypothesis Tests for Sub-Group Differences

The following methods can be used to detect for population differences across the sub-groups:

- ANOVA (under normal distribution assumptions)
- Log-ANOVA (under log-normal distribution assumptions)
- Kruskal-Wallis One-Way Analysis on Ranks (distribution free assumptions/non-parametric, presence of non-detects, corrected for ties)
- Kaplan-Meir (non-parametric, useful with heavy censoring).

The decision as to which test to use is predicated on the presence of censorship and whether the distribution follows a parametric distribution of either normal, log-normal, or gamma type or does not have a discernible distribution and hence is non-parametric. Note that the Log-ANOVA is simply the ANOVA approach applied to the natural-logarithm of the time series.

The ANOVA tests require that normality assumptions are valid for each sub-group. In addition, the variances across the groups should be approximately equal.

Testing for potential sub-groups within background groundwater data sets will be performed using a significance level of 0.05.

[DRAFT - ELECTRONIC REVIEW]

Tests to Identify Which Sub-Groups Are Different

Provided any of the tests described above show sub-group differences, further tests will be performed to identify which sub-group(s) is different from the others provided each sub-group has at least 20-30 observations.

- Post-Hoc Test for Multiple Comparisons
  - Tukey-Kramer Test (parametric)
  - Dunn's Test (non-parametric)

2.2 Background Threshold Values

Using the upgradient data from the background well(s) specific to the CCR multiunit system, the appropriate BTVs will be computed for each constituent. Since the site has more than one background well, the upgradient data are defined by data pooled over the wells, as appropriate.

As recommended in the Unified Guidance (2009b), background values should be updated every four to eight measurements (e.g., every two to four years if samples are collected semiannually). New background groundwater data will be evaluated against the existing background dataset, as appropriate. If the new background data does not indicate a statistically significant difference using the approaches described in the sub-group testing section 2.1(i), the new data will be combined with the existing background data to calculate updated BTVs. Increasing the background dataset will increase the power of subsequent statistical tests. If the new background data does indicate a significant difference between the two populations, the data should be reviewed to evaluate the cause of the difference. In the absence of evidence of a release, the combined dataset should be considered more representative of present-day groundwater conditions and used for background.

2.2.1 Detection Monitoring

Under the detection monitoring programs of 40 CFR §257.94 and Michigan Statute 324.11511a(3) COI monitoring results will be statistically compared to BTVs through interwell statistical methods. As recommended by the Unified Guidance (2009b), the statistical test to define the BTV for detection monitoring is the upper tolerance limit. The formulation of the tolerance limit may vary slightly with the particulars of the test to be made and the characteristics of the data involved such as whether the data follow parametric or non-parametric distributions and the percentage of NDs. For example, in the case of log-normally parametrically distributed data, the tolerance limit is described by the mean and standard deviation of the natural log of the observations. The confidence level associated with each upper tolerance limit test is selected such that the site-wide false positive rate does not exceed 10 percent as recommended by the Unified Guidance (2009b). The per-test confidence levels will typically range between 95 and 99 percent. Whatever the formula specification, tolerance limits represent a range where a future result is expected to lie at a given confidence level. Both the upper and lower tolerance limits (LTL) will be produced for pH since lower and higher pH values relative to background are of concern.

Determination of Statistically Significant Increases above Background

If the groundwater concentration of any detection monitoring COI at any downgradient well is greater than the 95 UTL, then that concentration represents an SSI over background. One exception is pH, which can exhibit an SSI if the concentration in a monitoring well is either greater than the UTL or less than the LTL. The CCR Rule, as described in 40 CFR §257.94(e), indicates that if an SSI over

[DRAFT - ELECTRONIC REVIEW]

background is identified at the waste boundary for one or more COI during detection monitoring, then the owner or operator of the CCR unit must, within 90 days: 1) establish an assessment monitoring program, 2) demonstrate that a source other than the CCR unit caused the SSI over background, or 3) demonstrate that the SSI over background resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Written documentation for either demonstration above must be completed and certified by a qualified professional engineer within the 90 day timeframe.

If sources other than the CCR Unit, natural variability or errors have been ruled out as the reason for the SSI, a type of verification sampling method called the one-of-m pass method, as described in the Unified Guidance (2009b), allows for an efficient plan to confirm if an SSI over background identified during detection monitoring resulted from the CCR unit. Resampling of wells where an SSI has occurred can either verify the initial SSI determination or disconfirm it, thereby avoiding false positives. Depending on the number of background samples, the selected site-wide false positive rate, and the available time period in which to do the resampling, either a 1-of-2 or 3 pass method is recommended should verification sampling be considered.

2.2.2 Assessment Monitoring

Under the assessment monitoring program in 40 CFR §257.95 and Michigan Statute 324.11519b(2), monitoring results are compared to BTVs as described in 40 CFR §257.95(e). The UTLs discussed in section 2.2.1 are also used to compare assessment monitoring results to background values.

According to 40 CFR §257.95(e), the CCR unit may return from assessment monitoring to detection monitoring when all COIs are "shown to be at or below background values, using the statistical procedures in paragraph 40 CFR §257.93(g) for two consecutive sampling events." A notification letter stating that detection monitoring is resuming for the CCR unit will be placed in the facility's operating record as required by §257.105(h)(7).

According to 40 CFR §257.95(f), if assessment monitoring concentrations of all COIs are above background concentrations (UTLs) and COIs are below the GPS, then assessment monitoring will continue. MERG will establish GPS for each COI detected in the groundwater.

The Unified Guidance recommends the upper tolerance limit (UTL) to represent the background concentration for this purpose. The limits can be considered as statistically equivalent BTVs to an MCL or other health based numbers. The UTLs are derived from the same background data sourced to produce the UTLs and are used in these situations to represent the GPS. Tolerance intervals represent a range where a proportion of the population is expected at a given confidence level. For the purpose of this certification plan, a 95 percent confidence level is assumed. Specification for tolerance limits vary depending on whether the background data follow parametric or non-parametric distributions and the incidence of NDs. Both the upper and lower tolerance limits will be produced for pH to establish lower and upper GPS.

The GPS shall be defined as the lowest of the following:

- U.S. EPA Maximum Contaminant Level (MCL) for constituents for which an MCL has been established;
- The applicable cleanup criteria for that constituent for groundwater as established pursuant to section 20120a of the act.

[DRAFT - ELECTRONIC REVIEW]

Or for constituents for which the background level (UTL) is higher than the MCL or applicable cleanup criteria for groundwater, the background concentration will be the GPS. Table 1 provides the background level, the MCL, the cleanup criteria, and the GPS values for the Site.

Table 1. Background Values and Groundwater Protection Standards

Parameter		Site-Specific Background Level Upper Tolerance Limit (UTL)	Federal Maximum Contaminant Level	State Non-Residential Drinking Water Cleanup Criteria for Groundwater*	Groundwater Protection Standards for Site
Sb, total	Antimony	1	6	6	6
As, total	Arsenic	10	10	10	10
Ba, total	Barium	340	2000	2000	2000
Be, total	Beryllium	1	4	1	1
B, total	Boron	1320	NV	500	1320
Cd, total	Cadmium	0.2	5	5	5
Cr, total	Chromium	3	100	100	100
Co, total	Cobalt	15	6	100	100
Cu, total	Copper	--	1300	1000	1300 or UTL
Fe, total	Iron	--	300	300	300 or UTL
Pb, total	Lead	2	15	1	15
Li, total	Lithium	28	NV	350	350
Hg, total	Mercury	0.2	2	2	2
Mo, total	Molybdenum	9	NV	210	210
Ni, total	Nickel	--	NV	100	100 or UTL
Se, total	Selenium	3	50	50	50
Ag, total	Silver	--	100	98	100 or UTL
Tl, total	Thallium	2	2	2	2
V, total	Vanadium	--	NV	62	62 or UTL
Zn, total	Zinc	--	5000	5000	5000 or UTL
Ca	Calcium	259	NV	NV	259
F	Fluoride	1000	4	2000	2000
Cl	Chloride	5980	250,000	250,000	250,000
SO_4	Sulfate	200	250,000	250,000	250,000

[DRAFT - ELECTRONIC REVIEW]

TDS	Total Dissolved Solids	5170	500,000	500,000	500,000
TSS	Total Suspended Solids	--	NV	NV	NV
RA226/228	Radium 226 and 228 combined	2.42	NV	NV	NV

* Cleanup Criteria Requirements for Response Activity (Formerly the Part 201 Generic Cleanup Criteria and Screening Levels) found in R 299.44 Generic groundwater cleanup criteria.
NV=no value

Determination of Statistically Significant Levels above GPS

The CCR Rule stipulates in 40 CFR §257.95(g) that if constituents are detected as statistically significant levels (SSLs) above the GPS, the following actions are required to be taken by the owner:

- Place a notification in the operating record identifying the GPS exceedances.
- Characterize the nature and extent of the release and any relevant site conditions that may affect the remedy ultimately selected in accordance with 40 CFR §257.97.
- Notify all persons who own the land or reside on the land that directly overlies any part of the plume of contamination.
- Within 90 days:
    - Prepare an alternative source determination for the exceedance, or
    - Initiate an assessment of corrective measures in accordance with 40 CFR §257.96.

Therefore, if COIs exceed BTVs according to §257.95(e), and COIs exceed GPS per §257.95(f), then constituents will be statistically compared to the GPS to identify SSLs above the GPS per §257.95(g). In order to evaluate if an exceedance of the GPS is statistically significant, the 99 percent lower confidence limit (LCL) concentrations from downgradient monitoring wells are used.

During the statistical analysis of confidence intervals from each constituent, if the LCL exceeds the GPS at the 99 percent confidence level, then the constituent has been detected at a SSL above the GPS at a particular monitoring well. As with the UTLs, the particularities of the LCL are based on whether parametric or non-parametric distributions best fit the data and the incidence of NDs observed in the monitoring data. For example, in the case of normally distributed data, a normal-based parametric confidence interval is used. If the data cannot be explained by parametric distributions, a non-parametric confidence interval on the median is used.

2.3 Criteria for Conducting Closure

Post-ash-removal groundwater concentrations will be reviewed and the closure criteria will be described and approved by EGLE in the Remedial Action Plan once the remedy has been selected.

[DRAFT - ELECTRONIC REVIEW]

3.0 References

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[DRAFT - ELECTRONIC REVIEW]

Attachment 1

2019 and 2017 Groundwater Monitoring Reports for Statistical Evaluations

[DRAFT - ELECTRONIC REVIEW]

2019 Annual Groundwater Monitoring and Corrective Action Report

Former BC Cobb Power Plant
Bottom Ash Pond & Ponds 0-8
Muskegon, Michigan

January 2020

[DRAFT - ELECTRONIC REVIEW]

2019 Annual Groundwater Monitoring and Corrective Action Report

Former BC Cobb Power Plant
Bottom Ash Pond & Ponds 0-8

Muskegon, Michigan

January 2020

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[DRAFT - ELECTRONIC REVIEW]

Table of Contents

Executive Summary iii

Section 1 Introduction 1-1

1.1 Program Summary 1-1
1.2 Site Overview 1-3
1.3 Geology/Hydrogeology 1-3

Section 2 Groundwater Monitoring 2-1

2.1 Monitoring Well Network 2-1
2.2 November 2018 Assessment Groundwater Monitoring 2-1
2.3 2019 Semiannual Assessment Groundwater Monitoring 2-1
2.3.1 Data Summary 2-2
2.3.2 Data Quality Review 2-2
2.3.3 Groundwater Flow Rate and Direction 2-2

Section 3 Statistical Evaluation 3-1

3.1 Establishing Groundwater Protection Standards 3-1
3.2 Data Comparison to Groundwater Protection Standards 3-1

Section 4 Corrective Action 4-1

4.1 Nature and Extent Sampling 4-1
4.2 Assessment of Corrective Measures 4-1
4.3 Remedy Selection 4-2

Section 5 Conclusions and Recommendations 5-1

Section 6 References 6-1

[DRAFT - ELECTRONIC REVIEW]

List of Tables

Table 1	Summary of Groundwater Elevation Data – April to October 2019
Table 2	Summary of Field Parameter Results – April to September 2019
Table 3	Summary of Background Groundwater Sampling Results (Analytical) – April to September 2019
Table 4	Summary of Groundwater Sampling Results (Analytical) – April to September 2019
Table 5	Summary of Groundwater Protection Standard Exceedances – April 2019
Table 6	Summary of Groundwater Protection Standard Exceedances – September 2019

List of Figures

Figure 1	Site Location Map
Figure 2	Site Plan with CCR Monitoring Well Locations
Figure 3	Groundwater Contour Map – April 8, 2019
Figure 4	Groundwater Contour Map – September 24, 2019

List of Appendices

Appendix A	November 2018 Assessment Monitoring Data Summary
Appendix B	Data Quality Review
Appendix C	June 2018 Statistical Evaluation of Initial Assessment Monitoring Sampling Event
Appendix D	April 2019 Assessment Monitoring Statistical Evaluation
Appendix E	September 2019 Assessment Monitoring Statistical Evaluation
Appendix F	ACM Extension Certification
Appendix G	Semiannual Progress Report

[DRAFT - ELECTRONIC REVIEW]

Executive Summary

On behalf of Consumers Energy, TRC has prepared this Annual Groundwater Monitoring Report for the BCC Ponds to cover the period of January 1, 2019 to December 31, 2019. The BCC Ponds were in assessment monitoring at the beginning and the end of the period covered by this report. Data that have been collected and evaluated in 2019, including assessment monitoring data from November 2018, are presented in this report.

Consumers Energy first reported the potential for statistically significant increases (SSIs) for Appendix III constituents in the *"Annual Groundwater Monitoring Report Former BC Cobb Power Plant Bottom Ash Pond & Ponds 0-8 CCR Unit"* (TRC, January 2018). The statistical evaluation of the Appendix III indicator parameters confirming SSIs over background were as follows:

- Boron at BCC-MW-15009, BCC-MW-15010, BCC-MW-15011, and BCC-MW-15014;
- Fluoride at BCC-MW-15012;
- Field pH at BCC-MW-15009, BCC-MW-15011, BCC-MW-15012, BCC-MW-15014, BCC-MW-15015, and BCC-MW-15017.

On April 25, 2018, Consumers Energy entered assessment monitoring upon determining that an Alternate Source Demonstration for the Appendix III constituents was not successful. After subsequent sampling for Appendix IV constituents, Consumers Energy provided notification that lithium was present at statistically significant levels above the Ground Water Protection Standards (GWPS) established at 40 ug/L (TRC, 2019) in two out of fifteen downgradient monitoring wells at the BCC Ponds as follows:

- Lithium at BCC-MW-17001 and BCC-MW-17002.

The notification was followed up with a Response Action Plan submitted to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) on March 15, 2019 laying out the preliminary understanding of water quality and actions that were underway to mitigate or eliminate unacceptable risk associated with the identified release from the CCR unit. The *Assessment of Corrective Measures* (ACM) was initiated on April 15, 2019 and was certified and submitted to the EGLE on September 11, 2019 in accordance with the schedule in §257.96 and provided in the Response Action Plan. The certification for a 60-day time extension to the 90-day completion period of the ACM required per §257.96(a) is included in this report.

The ACM documents that the groundwater nature and extent has been defined, as required in §257.95(g)(1). The property containing the site is owned and operated by Consumers Energy and on-site groundwater is not used for drinking water. The nearest off-site drinking water well is more than 2,000 feet away on the other side of the North Branch of the Muskegon River.

[DRAFT - ELECTRONIC REVIEW]

Per §257.96(b), Consumers Energy is continuing to monitor groundwater in accordance with the assessment monitoring program as specified in §257.95. Overall, the statistical assessments have confirmed that lithium is the only Appendix IV constituent present at statistically significant levels above the GWPS and groundwater chemistry already appears to be improving as a result of discontinuing the hydraulic loading to the BCC Ponds and is expected to further improve following the completed source removal of CCR.

Consumers Energy has not selected a remedy pursuant to §257.97. The semiannual progress report describing the progress in selecting and designing the remedy required pursuant to §257.97(a) is included in this report. As documented in the March 30, 2018 *Notification of Intent to Initiate Closure* letter submitted in accordance with §257.102(g), Consumers Energy intends to close the BCC Ponds under the CCR Rule's closure by removal provisions in §257.102(c). Consumers Energy has also submitted a closure work plan to EGLE. The closure work plan was reviewed and approved by EGLE on October 16, 2018. Field activities are scheduled to begin in 2020.

In 2020, evaluation of corrective measures in accordance with §257.96 and §257.97 as outlined in the ACM will continue according to the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98, which includes semiannual assessment monitoring in accordance with §257.95 to monitor site groundwater conditions and inform the remedy selection. The next semiannual assessment monitoring events are scheduled to occur in the second and fourth calendar quarters of 2020.

[DRAFT - ELECTRONIC REVIEW]

Section 1
Introduction

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule) (USEPA, April 2015), as amended (USEPA, July 2018). Standards for groundwater monitoring and corrective action codified in the CCR Rule apply to the Consumers Energy Company (Consumers Energy) Bottom Ash Pond and Ponds 0-8 (BCC Ponds) at the former BC Cobb Power Plant Site (the Site) located in Muskegon, Michigan. Pursuant to the CCR Rule, no later than January 31, 2018, and annually thereafter, the owner or operator of a CCR unit must prepare an annual groundwater monitoring and corrective action report for the CCR unit documenting the status of groundwater monitoring and corrective action for the preceding year in accordance with §257.90(e).

On behalf of Consumers Energy, TRC has prepared this report for calendar year 2019 activities at the BCC Ponds. The BCC Ponds were in assessment monitoring at the beginning and the end of the period covered by this report. Data that have been collected and evaluated in 2019, including assessment monitoring data from November 2018, are presented in this report.

1.1 Program Summary

Consumers Energy first reported the potential for statistically significant increases (SSIs) for Appendix III constituents in the "*Annual Groundwater Monitoring Report Former BC Cobb Power Plant Bottom Ash Pond & Ponds 0-8 CCR Unit*" (TRC, January 2018). The statistical evaluation of the Appendix III indicator parameters confirming SSIs over background were as follows:

- Boron at BCC-MW-15009, BCC-MW-15010, BCC-MW-15011, and BCC-MW-15014;
- Fluoride at BCC-MW-15012;
- Field pH at BCC-MW-15009, BCC-MW-15011, BCC-MW-15012, BCC-MW-15014, BCC-MW-15015, and BCC-MW-15017.

As discussed in the *2018 Annual Groundwater Monitoring Report* (2018 Annual Report) for the former BC Cobb Plant Bottom Ash Pond and Ponds 0-8 (TRC, January 2019), Consumers Energy initiated an Assessment Monitoring Program for the BCC Ponds pursuant to §257.95 of the CCR Rule that included sampling and analyzing groundwater within the groundwater monitoring system for all constituents listed in Appendix III and Appendix IV. On April 25, 2018, Consumers Energy entered assessment monitoring upon determining that an Alternate Source Demonstration for the Appendix III constituents was not successful. After subsequent sampling for Appendix IV constituents, Consumers Energy provided notification that lithium was

[DRAFT - ELECTRONIC REVIEW]

present at statistically significant levels above the Ground Water Protection Standards (GWPS) established at 40 ug/L (TRC, 2019) in two out of fifteen downgradient monitoring wells at the BCC Ponds as follows:

- Lithium at BCC-MW-17001 and BCC-MW-17002.

On January 14, 2019, Consumers Energy provided notification that lithium was present at statistically significant levels above the federal GWPS in one or more downgradient monitoring wells at the BCC Ponds. The notification was followed by a Response Action Plan submitted to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) on March 15, 2019 laying out the preliminary understanding of water quality and actions that were underway to mitigate or eliminate unacceptable risk associated with the identified release from the CCR unit. The CCR Rule 40 CFR §257.96(a) requires that an owner or operator initiate an assessment of corrective measures (ACM) to prevent further release, to remediate any releases, and to restore impacted areas to original conditions if any Appendix IV constituent has been detected at a statistically significant level exceeding a GWPS. The *Assessment of Corrective Measures* (ACM) (TRC, September 2019) was initiated on April 15, 2019 and was certified and submitted to EGLE on September 11, 2019 in accordance with the schedule in §257.96 and presented in the Response Action Plan.

The ACM documents that the groundwater nature and extent has been defined, as required in §257.95(g)(1), based on the site-specific hydrogeology and the presence of surrounding surface water features. Although lithium concentrations exceed the GWPS in on-site groundwater, the property containing the site is owned and operated by Consumers Energy and on-site groundwater is not used for drinking water. Off-site migration potential and risk to off-site drinking water in the deeper sand is very low given that groundwater in the deeper sand has a very low flow rate and at times flows southeast, away from the North Branch of the Muskegon River (away from the nearest residential drinking water wells located more than 2,000 feet away on the opposite side of the North Branch of the Muskegon River), and if groundwater were to flow toward the northwest for an extended period of time, flow would likely be upward toward the regional surface water discharge features that are present between the Site and the nearest residential wells. In addition, the underlying clay unit prevents the downward vertical migration of groundwater.

To further mitigate potential risk associated with groundwater at the site, CCR removal is planned as documented in the March 30, 2018 *Notification of Intent to Initiate Closure* letter submitted in accordance with §257.102(g). Consumers Energy also submitted the *B.C. Cobb Generating Facility Bottom Ash Pond and Ponds 0-8 Closure Work Plan,* (Golder, 2018) to EGLE for agreement on Consumers Energy's plan to remove CCR on May 31, 2018 and clarified on August 13, 2018 (Golder, 2018b). EGLE provided written concurrence with the plan on October 16, 2018. Field activities are scheduled to begin in 2020.

[DRAFT - ELECTRONIC REVIEW]

Consumers Energy will continue to evaluate corrective measures in accordance with §257.96 and §257.97, as outlined in the ACM, and will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98, which includes semiannual assessment monitoring in accordance with §257.95 as presented in this report.

1.2 Site Overview

The former BC Cobb coal-fired power generation facility is located east of Muskegon Lake, south of Cedar Creek, northwest of the CSX rail line, and west of the Muskegon River marsh in Muskegon, Michigan (Figure 1). The plant began generating electricity in 1948, and plant operations ceased in April 2016. From 1984 through plant closure in 2016, CCR have been deposited in the BCC Ponds by utilizing sluicing methods, allowing CCR particles to settle through a series of ponds and then discharged to a National Pollutant Discharge Elimination System (NPDES) outfall located on the Discharge Channel. CCR was periodically removed from the ponds and disposed or beneficially reused.

During operation of the CCR units, the pond surface water elevations were at 588 feet. Since plant closure in 2016, the pond water elevation has been decreased through dewatering to the groundwater level of approximately 580 feet. Site features are shown on Figure 2.

1.3 Geology/Hydrogeology

The majority of the BCC Ponds are comprised of surficial CCR and sand fill. USGS topographic maps and aerial photographs dating back to 1929, in addition to field descriptions of subsurface soil at the site, indicate that the area currently occupied by the ash ponds was originally marsh land. The subsurface materials encountered in the pond area generally consist of CCR ranging from 3 to 28 feet below ground surface (ft bgs) overlying 10 to 20 feet of poorly graded, fine-grained sand. Discontinuous layers of organic materials (i.e., humus) and peat (on the order of 0.5 to 1.0 feet thick), and organic-rich zones or sand and silt are present within the fine-grained sand. Organic-rich silt was also encountered at depths ranging from 20 to 30 ft bgs, beneath the fine-grained sand, ranging in thickness from approximately 1 to 13 feet. The organic-rich silt deposits are thickest in the perimeter berms along the southernmost edge of the pond area (toward Muskegon Lake). Thinner deposits of the organic-rich silt were encountered toward the northernmost edge of the pond area. Silty clay and/or poorly graded, fine- to medium-grained sand is generally observed within 30 to 40 ft bgs, beneath the organic-rich silt. An underlying gray clay was encountered throughout the pond area at approximately 40 ft bgs, beneath the fine to medium-grained sand.

Bedrock and quaternary geologic maps of Michigan and local water well records indicate that 120 to 190 feet of glacio-lacustrine sand, gravel, moraine and lacustrine clay deposits are present throughout Muskegon County. These lacustrine deposits are situated on top of the sandstone

[DRAFT - ELECTRONIC REVIEW]

bedrock that is part of the Marshall Formation, typically encountered at approximately 200 to 250 ft bgs throughout Muskegon County. Glacial moraine deposits are more prevalent in the northern and eastern portions of the County, while glacio-lacustrine sands dominate in the western and southern areas surrounding Muskegon Lake, and the area approaching Lake Michigan. The BCC ponds are located in the central area of the County.

The BCC Ponds are bound by several surface water features (Figure 2): The North Branch of the Muskegon River and former plant-associated discharge channel adjoin the northwestern and southernmost boundaries of the pond area, and Veterans Memorial Pond is located northeast of the pond area, approximately 100 feet northeast of Michigan Highway 120.

Significant changes occurred in the ash management area during the CCR Rule baseline period that caused variations in groundwater flow at the Site. The monitoring well system was installed in October 2015 while the plant and the pond system were in operation. The plant shut down in April 2016 and ceased sluicing ash to the BCC Ponds and the ponds began dewatering. Veterans Memorial Pond to the north of the BCC Ponds was dewatered for maintenance activities sometime during the period between August and December 2017. These changes have had a profound effect on groundwater flow rates and directions at both the upgradient and downgradient monitoring wells.

While the ponds were in operation, groundwater mounded within the pond area and flowed radially toward the surrounding water bodies. Starting with the July 2016 groundwater sampling round, groundwater continued to flow radially to the surrounding water bodies, but with a much lower gradient. When Veterans Memorial Pond was drained, a stronger gradient was established along the eastern side of the peninsula toward the Veterans Memorial Pond area. Veterans Memorial Pond is no longer drained and hydraulic loading of the BCC Ponds was discontinued back in 2016. Although the overall gradient has diminished compared to pre-2018 monitoring events due to the discontinued hydraulic loading and Veterans Memorial Pond dewatering, groundwater is typically encountered at a similar elevation relative to the surrounding surface water features.

[DRAFT - ELECTRONIC REVIEW]

Section 2
Groundwater Monitoring

2.1 Monitoring Well Network

In accordance with 40 CFR 257.91, Consumers Energy established a groundwater monitoring system for the BCC Ponds, which had initially consisted of 22 monitoring wells (seven background monitoring wells and 15 downgradient monitoring wells) that are screened in the uppermost aquifer. Six additional downgradient monitoring wells were installed in late 2017 and incorporated into the groundwater monitoring system in 2018 (BCC-MW-17001 through BCC-MW-17006). Seven monitoring wells located southwest of the BCC Ponds provide data on background groundwater quality that has not been affected by the CCR unit (BCC-MW-15002 through BCC-MW-15008). The monitoring well locations are shown on Figure 2.

Monitoring wells BCC-MW-15009 through BCC-MW-15014 encircle the BAP, while BCC-MW-15015 through BCC-MW-15023 and BCC-MW-17001 through BCC-MW-17006 are located at the outer edge of the peninsula formed by the bottom ash pond system. Because the perimeter and interior berms within the ash management area were constructed in part with ash and bodies of water surround the ash management area, wells could not be installed entirely beyond the CCR material boundary.

2.2 November 2018 Assessment Groundwater Monitoring

As discussed in the 2018 Annual Report, the second 2018 semiannual monitoring event was conducted in November 2018, but laboratory analysis and data quality review were ongoing as of writing the 2018 Annual Report. A summary of the November 2018 assessment monitoring event was prepared under a separate cover, submitted to the EGLE on March 15, 2019 as part of the Response Action Plan, and is included in Appendix A.

2.3 2019 Semiannual Assessment Groundwater Monitoring

Per §257.95, all wells in the CCR unit monitoring program must be sampled at least semiannually. One semiannual event must include analysis for all constituents from Appendix III and Appendix IV constituents and one semiannual event may include analysis for those constituents in Appendix IV of the CCR Rule that were detected during prior sampling. In addition to the Appendix III and IV constituents, field parameters including dissolved oxygen, oxidation reduction potential, specific conductivity, temperature, and turbidity were collected at each well during each sampling event. Samples were collected and analyzed according to the *BC Cobb Monitoring Program Sample and Analysis Plan* (SAP) (ARCADIS, 2016).

[DRAFT - ELECTRONIC REVIEW]

2.3.1 Data Summary

The first semiannual groundwater assessment monitoring event for 2019 was performed on April 8 through April 12, 2019 and the second semiannual groundwater assessment monitoring event for 2019 was performed on September 24 through September 26, 2019. Both events were performed by TRC personnel, and samples were analyzed by TestAmerica in accordance with the SAP. Static water elevation data were collected at all monitoring well locations during each event. Groundwater samples and field parameters were collected from the 7 background monitoring wells and 21 downgradient monitoring wells and analyzed for the full list of Appendix III and Appendix IV constituents during the April 2019 event, and the full list of Appendix III and Appendix IV constituents detected in the first semiannual event during the September 2019 event.

A summary of the groundwater data collected during the April 2019 and September 2019 events is provided on Table 1 (static groundwater elevation data), Table 2 (field data), Table 3 (background well analytical results), and Table 4 (downgradient well analytical results).

2.3.2 Data Quality Review

Data from each round were evaluated for completeness, overall quality and usability, method-specified sample holding times, precision and accuracy, and potential sample contamination. The data were found to be complete and usable for the purposes of the CCR monitoring program. The data quality reviews are summarized in Appendix B.

2.3.3 Groundwater Flow Rate and Direction

Groundwater elevation data collected during the April 2019 and September 2019 assessment monitoring events are provided in Table 1. The April 2019 and September 2019 groundwater elevation data were used to construct groundwater contour maps (Figure 3 and Figure 4, respectively).

Groundwater elevation data collected during the April 2019 assessment monitoring sampling event showed slight groundwater flow radially outward toward the bounding surface water features from the BCC Ponds. The average gradient observed on April 8, 2019, using well pairs BCC-MW-15012/BCC-MW-15013, BCC-MW-15012/BCC-MW-17004, and BCC-MW-15012/BCC-MW-15022, showed a horizontal gradient of approximately 0.00036 ft/ft with minimal discernible overall flow direction across the BCC Ponds. Using the average hydraulic conductivity measured at the Ponds 0-8 monitoring wells of 58 feet/day (ARCADIS, 2016), and an assumed effective porosity of

[DRAFT - ELECTRONIC REVIEW]

0.3, this results in groundwater flow rate of approximately 0.070 feet/day (approximately 26 feet/year).

Groundwater elevation data collected during the September 2019 assessment monitoring sampling event showed slight groundwater flow across the BCC Ponds area to the north-northeast toward the Veterans Memorial. The average gradient observed on September 24, 2019, using well pairs BCC-MW-17001/BCC-MW-15023, BCC-MW-15014/BCC-MW-15022, and BCC-MW-15015/BCC-MW-17006, showed a horizontal gradient of approximately 0.00093 ft/ft with minimal flow towards the northeast across the BCC Ponds. Using the average hydraulic conductivity measured at the Ponds 0-8 monitoring wells of 58 feet/day (ARCADIS, 2016), and an assumed effective porosity of 0.3, this results in groundwater flow rate of approximately 0.18 feet/day (approximately 66 feet/year).

The low hydraulic gradient and lack of general flow direction is similar to that identified in recent sampling events, although the September 2019 event shows surface water as being slightly higher than the groundwater table in the BCC Ponds area and exhibits a slight gradient inward toward the site, which can be attributed to precipitation prior to the monitoring event and/or continued rise in Great Lakes water levels. In the past, groundwater was typically encountered at a similar or slightly higher elevation relative to the surrounding surface water features, generally flowing outward toward the bounding surface water features and has undergone several changes over time due to permanent discontinuation of hydraulic loading in the BCC Ponds area and the dewatering of Veterans Memorial Pond in 2017 (as discussed in the 2017 Annual Report). Although slight variations in flow direction continue to occur, downgradient wells are appropriately positioned to detect the presence of Appendix III/IV constituents that could potentially migrate from the BCC Ponds.

[DRAFT - ELECTRONIC REVIEW]

Section 3
Statistical Evaluation

Assessment monitoring is continuing at the BCC Ponds while corrective measures are further evaluated in accordance with §257.96 and §257.97 as outlined in the ACM. The following section summarizes the statistical approach applied to assess the 2019 groundwater data in accordance with the assessment monitoring program. The statistical evaluation details are provided in Appendix A (*November 2018 Assessment Monitoring Data Summary and Statistical Evaluation),* Appendix C *(June 2018 Statistical Evaluation of Initial Assessment Monitoring Sampling Event),* Appendix D *(April 2019 Assessment Monitoring Data Summary and Statistical Evaluation), and* Appendix E *(September 2019 Assessment Monitoring Data Summary and Statistical Evaluation).*

3.1 Establishing Groundwater Protection Standards

The Groundwater Protection Standards (GWPSs) are used to assess whether Appendix IV constituent concentrations are present in groundwater at unacceptable levels as a result of CCR Unit operations by statistically comparing concentrations in the downgradient wells to the GWPSs for each Appendix IV constituent. In accordance with §257.95(h) and the *Groundwater Statistical Evaluation Plan* (Stats Plan) (TRC, October 2017), GWPSs were established for the Appendix IV constituents following the preliminary assessment monitoring event using nine rounds of data collected from the background monitoring wells BCC-MW-15002 through BCC-MW-15008 (December 2015 through April 2018). The calculation of the GWPSs is documented in the *Groundwater Protection Standards* technical memorandum included as Appendix C of the 2018 Annual Report. The GWPS is established as the higher of the USEPA Maximum Contaminant Level (MCL) or statistically derived background level for constituents with MCLs and the higher of the USEPA Regional Screening Levels (RSLs) or background level for constituents with RSLs.

3.2 Data Comparison to Groundwater Protection Standards

Consistent with the *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (Unified Guidance) (USEPA, 2009), the preferred method for comparisons to a fixed standard are confidence limits. An exceedance of the standard occurs when the 99 percent lower confidence level of the downgradient data exceeds the GWPS. As documented in the January 14, 2019 *Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per* §257.95(g), lithium was present at statistically significant levels above the federal GWPS in two of the downgradient wells at the BCC Ponds based on the statistical data comparison for the first semiannual assessment monitoring event (June 2018) (Appendix C). Therefore, Consumers

[DRAFT - ELECTRONIC REVIEW]

Energy initiated an Assessment of Corrective Measures (ACM). Assessment monitoring is ongoing.

Overall, the statistical assessments have confirmed that lithium is the only Appendix IV constituent present at statistically significant levels above the GWPS. A summary of the confidence intervals for April 2019 and September 2019 are provided in Table 5 and Table 6, respectively.

Groundwater chemistry already appears to be improving as a result of discontinuing the hydraulic loading to the BCC Ponds and is expected to further improve following the completed source removal of CCR. Although the lower confidence limits for lithium continue to be above the GWPS for BCC-MW-17001 and BCC-MW-17002, lithium concentrations show an overall decrease at those locations as shown on time-series charts (Appendix E: Attachment 1). In addition, arsenic concentrations have steadily decreased at downgradient well BCC-MW-15009 and exhibit a statistically significant downward trend (Appendix E), with concentrations below the GWPS for five consecutive sampling events. Also, as detailed in the September 2019 statistical evaluation (Appendix E), no statistically significant increasing trends were observed for any of the Appendix IV constituents for which confidence intervals were calculated. Groundwater conditions will continue to be monitored while corrective measures continue to be evaluated and a remedy is selected. There is still some uncertainty surrounding how changes in redox conditions may affect contaminant transport as a result of changing conditions, including future CCR removal activities.

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Section 4
Corrective Action

Consumers Energy provided notification that lithium was present at statistically significant levels above the Ground Water Protection Standards (GWPS) established at 40 ug/L (TRC, 2019) in two out of fifteen downgradient monitoring wells at the BCC Ponds as follows:

- Lithium at BCC-MW-17001 and BCC-MW-17002.

The CCR Rule 40 CFR §257.96(a) requires that an owner or operator initiate an assessment of corrective measures (ACM) to prevent further release, to remediate any releases, and to restore impacted areas to original conditions if any Appendix IV constituent has been detected at a statistically significant level exceeding a GWPS. The *Assessment of Corrective Measures* (ACM) (TRC, September 2019) was initiated on April 15, 2019 and was certified and submitted to EGLE on September 11, 2019 in accordance with the schedule in §257.96 and presented in the Response Action Plan.

4.1 Nature and Extent Sampling

Per §257.95(g)(1), in the event that the facility determines, pursuant to §257.93(h), that there is a statistical exceedance of the GWPSs for one or more of the Appendix IV constituents, the facility must characterize the nature and extent of the release of CCR as well as any site conditions that may affect the remedy selected. As discussed in the ACM, nature and extent characterization of groundwater was performed using data collected from the existing groundwater monitoring wells presented in this annual report and previously submitted annual reports. Therefore, no additional data associated with the characterization of nature and extent are included in this report.

4.2 Assessment of Corrective Measures

The ACM was completed on September 11, 2019 as a step towards developing a final remedy. The certification for a 60-day time extension to the 90-day completion period of the ACM required per §257.96(a) is included in Appendix F of this report.

Several groundwater remediation alternatives evaluated in the ACM are considered technically feasible to reduce on-site groundwater concentrations. The following corrective measures were retained for further evaluation for the BCC Ponds:

- Source Removal with Groundwater Monitoring and Institutional Controls;
- Source Removal with Post Source Control/Removal Monitoring;

[DRAFT - ELECTRONIC REVIEW]

- Source Removal with Groundwater Capture/Control;
- Source Removal with Impermeable Barrier;
- Source Removal with Active Geochemical Sequestration; and
- Source Removal with Passive Geochemical Sequestration.

Consumers Energy plans to utilize an adaptive management strategy for selecting the final groundwater remedy for the BCC Ponds in coordination with the specified CCR source material management strategies discussed in the ACM. Under this remedy selection strategy, measures that remove source material, reduce infiltration, and/or minimize the potential for future migration during the closure process may be implemented to address existing conditions followed by monitoring and evaluation of the performance after closure. Adjustments will be made to the corrective measure remedy, as needed, to achieve the remedial goals (e.g. GWPS and/or risk/exposure/pathway-based criteria).

4.3 Remedy Selection

Consumers Energy has not selected a remedy pursuant to §257.97. The semiannual progress report describing the progress in selecting and designing the remedy required pursuant to §257.97(a) is included in Appendix G of this report. As documented in the March 30, 2018 *Notification of Intent to Initiate Closure* letter submitted in accordance with §257.102(g), Consumers Energy intends to close the BCC Ponds under the CCR Rule's closure by removal provisions in §257.102(c). Consumers Energy has also submitted a closure work plan to EGLE. The closure work plan was reviewed and approved by EGLE on October 16, 2018. Field activities are scheduled to begin in 2020.

It is anticipated that the remedy selection process for addressing affected groundwater will proceed following the implementation of the CCR source material management strategies. Additionally, Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98, which includes semiannual assessment monitoring in accordance with §257.95 to monitor groundwater conditions and inform the remedy selection. The final remedy will be formally selected per §257.97 once the selected option is reviewed and commented on by EGLE and a public meeting is conducted at least 30days prior to the final selection as required under §257.96(e).

[DRAFT - ELECTRONIC REVIEW]

Section 5
Conclusions and Recommendations

Overall, the statistical assessments have confirmed that lithium is the only Appendix IV constituent present at statistically significant levels above the GWPS. Groundwater chemistry already appears to be improving as a result of discontinuing the hydraulic loading to the BCC Ponds (e.g. lithium and arsenic) and is expected to further improve following the completion of planned source removal of CCR.

The ACM documents that the groundwater nature and extent has been defined, as required in §257.95(g)(1). Although lithium concentrations exceed the GWPS in on-site groundwater, the property containing the site is owned and operated by Consumers Energy and on-site groundwater is not used for drinking water. The nearest off-site drinking water well is more than 2,000 feet away on the other side of the North Branch of the Muskegon River. As documented in the March 30, 2018 *Notification of Intent to Initiate Closure* letter submitted in accordance with §257.102(g), Consumers Energy intends to close the BCC Ponds under the CCR Rule's closure by removal provisions in §257.102(c). Consumers Energy has also submitted a closure work plan to EGLE. The closure work plan was reviewed and approved by EGLE on October 16, 2018. Field activities are scheduled to begin in 2020.

Corrective measures will continue to be evaluated in accordance with §257.96 and §257.97 as outlined in the ACM and the self-implementing groundwater compliance schedule will continue to be implemented in conformance with §257.90 - §257.98, which includes semiannual assessment monitoring in accordance with §257.95 to monitor site groundwater conditions and inform the remedy selection. The next semiannual monitoring events are tentatively scheduled for the second and fourth calendar quarters of 2020.

[DRAFT - ELECTRONIC REVIEW]

Section 6
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[DRAFT - ELECTRONIC REVIEW]

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[DRAFT - ELECTRONIC REVIEW]

Tables

[DRAFT - ELECTRONIC REVIEW]

Table 1
Summary of Groundwater Elevation Data
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Well Location	Ground Surface Elevation (ft)	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Elevation (ft)			Borehole Terminus Depth (ft BGS)	Borehole Terminus Elevation (ft)	April 8, 2019		September 24, 2019		October 16, 2019[2]	
									Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Background														
BCC-MW-15001	583.6	586.52	Sand with organic seam at 18.8 ft bgs	573.6	to	563.6	20.0	563.6	5.08	581.44	NM[1]	NM	4.95	581.57
BCC-MW-15002	583.8	586.87	Sand	568.8	to	563.8	20.0	563.8	5.34	581.53	5.08	581.79	4.77	582.10
BCC-MW-15003	584.1	587.12	Sand	571.1	to	566.1	20.0	564.1	5.54	581.58	4.97	582.15	NM	NM
BCC-MW-15004	587.7	590.57	Sand	582.7	to	572.7	20.0	567.7	9.03	581.54	9.22	581.35	NM	NM
BCC-MW-15005	584.8	587.77	Sand	579.8	to	569.8	20.0	564.8	6.39	581.38	5.42	582.35	NM	NM
BCC-MW-15006	584.9	587.81	Sand	579.9	to	569.9	20.0	564.9	6.80	581.01	5.05	582.76	NM	NM
BCC-MW-15007	584.5	587.43	Sand	580.5	to	574.5	20.0	564.5	5.80	581.63	4.90	582.53	4.50	582.93
BCC-MW-15008	584.8	587.76	Sand	580.8	to	575.8	20.0	564.8	6.45	581.31	5.35	582.41	NM	NM
Downgradient														
BCC-MW-15009	586.3	589.27	Sand (14 - 17.2 ft bgs) and Clay/silt (17.2 - 24 ft bgs)	572.3	to	562.3	24.0	562.3	7.80	581.47	7.00	582.27	NM	NM
BCC-MW-15010	585.2	588.11	Sand with little silt and organic material	573.2	to	563.2	24.0	561.2	6.62	581.49	6.23	581.88	5.95	582.16
BCC-MW-15011	592.3	595.22	Sand with some silt	571.3	to	561.3	32.0	560.3	13.68	581.54	13.29	581.93	NM	NM
BCC-MW-15012	594.5	597.39	Sand	573.5	to	563.5	35.0	559.5	15.86	581.53	15.43	581.96	NM	NM
BCC-MW-15013	595.9	598.50	Sand with clay/silt and organic material from 36.5 - 37.5 ft bgs	565.9	to	555.9	40.0	555.9	17.15	581.35	16.40	582.10	NM	NM
BCC-MW-15014	596.2	599.04	Sand/silty sand	573.2	to	565.2	40.0	556.2	17.63	581.41	17.01	582.03	NM	NM
BCC-MW-15015	593.9	596.75	Sand with clay/silt and organic material from 29 - 29.5 ft bgs	573.9	to	563.9	30.0	563.9	15.51	581.24	14.69	582.06	NM	NM
BCC-MW-15016	586.2	589.05	Sand	551.2	to	546.2	45.0	541.2	7.75	581.30	6.93	582.12	NM	NM
BCC-MW-15017	585.7	588.61	Sand	550.7	to	545.7	40.0	545.7	7.38	581.23	6.47	582.14	NM	NM
BCC-MW-15018	589.4	592.43	Sand	551.9	to	546.9	45.0	544.4	11.23	581.20	10.30	582.13	NM	NM
BCC-MW-15019	589.4	592.42	Sand	552.4	to	547.4	45.0	544.4	11.22	581.20	10.35	582.07	NM	NM
BCC-MW-15020	589.5	592.23	Sand	554.5	to	549.5	45.0	544.5	10.96	581.27	10.20	582.03	NM	NM
BCC-MW-15021	590.7	593.73	Sand	551.2	to	548.2	50.0	540.7	12.34	581.39	11.78	581.95	NM	NM
BCC-MW-15022	592.6	595.82	Sand	568.6	to	562.6	45.0	547.6	14.35	581.47	14.41	581.41	NM	NM
BCC-MW-15023	585.4	588.08	Sand/silty sand	573.4	to	565.9	20.0	565.4	6.42	581.66	6.41	581.67	NM	NM
Shallow 2017 Wells														
BCC-MW-17001	586.1	589.29	Sand with some organic material	571.1	to	566.1	20.0	566.1	8.16	581.13	7.01	582.28	NM	NM
BCC-MW-17002	585.8	588.79	Sand	572.3	to	567.3	19.0	566.8	7.61	581.18	6.62	582.17	NM	NM
BCC-MW-17003	589.3	592.37	Sand	572.3	to	567.3	22.0	567.3	11.18	581.19	10.28	582.09	NM	NM
BCC-MW-17004	589.1	591.84	Sand	571.6	to	566.6	22.5	566.6	10.60	581.24	9.78	582.06	NM	NM
BCC-MW-17005	589.3	592.42	Sand	569.3	to	564.3	30.0	559.3	11.12	581.30	10.38	582.04	NM	NM
BCC-MW-17006	590.5	593.78	Sand	566.0	to	561.0	30.0	560.5	12.17	581.61	12.23	581.55	NM	NM

Notes:
Survey conducted by Williams & Works, November 2015, and Consumers Energy in January 2018.
Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).
TOC: Top of well casing.
ft BTOC: Feet below top of well casing.
ft BGS: Feet below ground surface.
NM = Not measured
(1) - BCC-MW-15001 static water level measurement was inadvertently not measured during the September 2019 event.
(2) - BCC-MW-15001 water level was collected on October 16, 2019, in addition to nearby monitoring wells.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Field Parameter Results – April to September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Background							
BCC-MW-15002	4/8/2019	0.20	-58.6	7.1	1,054	10.90	6.70
	9/25/2019	0.43	-96.0	7.3	1,610	14.90	0.88
BCC-MW-15003	4/8/2019	0.04	-67.5	7.2	1,549	8.60	5.10
	9/25/2019	0.30	-110.5	7.3	2,760	14.30	0.99
BCC-MW-15004	4/9/2019	0.39	-46.4	7.2	342	7.30	7.90
	9/25/2019	0.31	-96.0	7.0	1,321	16.00	0.93
BCC-MW-15005	4/9/2019	0.52	-22.4	7.4	824	7.70	7.20
	9/25/2019	0.27	-149.9	7.4	810	16.00	6.00
BCC-MW-15006	4/9/2019	2.05	-20.7	7.4	286	8.30	2.60
	9/24/2019	0.34	-118.5	7.4	430	19.00	0.37
BCC-MW-15007	4/9/2019	0.00	-86.7	6.8	2,469	6.70	3.70
	9/24/2019	0.38	-114.6	6.8	3,715	19.70	0.52
BCC-MW-15008	4/9/2019	-0.01	-81.7	7.5	953	6.90	3.50
	9/24/2019	0.30	-126.3	7.6	872	19.30	0.90
Downgradient							
BCC-MW-15009	4/9/2019	0.02	-254.3	9.4	349	13.20	2.80
	9/25/2019	0.31	-258.8	8.7	490	15.60	0.29
BCC-MW-15010	4/9/2019	0.02	-140.2	7.6	570	11.90	4.50
	9/24/2019	0.29	-120.3	7.4	798	14.80	1.00
BCC-MW-15011	4/10/2019	0.12	-204.2	8.8	300	13.00	2.50
	9/25/2019	0.38	-179.1	8.4	655	14.90	1.25
BCC-MW-15012	4/10/2019	0.65	-218.4	9.4	420	13.30	4.30
	9/25/2019	0.37	-288.7	10.1	1,123	15.10	1.41

Notes:
mg/L - Milligrams per Liter.
mV - Millivolts.
SU - Standard units.
umhos/cm - Micromhos per centimeter.
°C - Degrees Celcius
NTU - Nephelometric Turbidity Unit.

Table 2
Summary of Field Parameter Results – April to September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Downgradient (Continued)							
BCC-MW-15013	4/11/2019	0.08	-126.9	7.3	304	12.00	3.10
	9/25/2019	0.35	-209.3	8.0	400	14.80	0.76
BCC-MW-15014	4/11/2019	0.04	-263.5	11.3	373	11.80	3.60
	9/25/2019	0.32	-286.5	11.3	524	14.60	0.25
BCC-MW-15015	4/11/2019	0.05	-190.0	7.6	419	10.20	7.50
	9/26/2019	0.40	-239.0	8.4	444	13.50	0.77
BCC-MW-15016	4/11/2019	0.04	-100.6	6.4	1,552	11.20	5.60
	9/26/2019	0.28	-109.8	6.6	2,143	15.00	4.45
BCC-MW-15017	4/11/2019	0.00	-185.8	6.4	1,590	10.70	1.50
	9/26/2019	0.29	-120.8	6.6	2,391	13.80	1.75
BCC-MW-15018	4/11/2019	0.05	-133.5	6.8	628	11.40	8.90
	9/26/2019	0.34	-100.7	6.9	854	14.70	6.90
BCC-MW-15019	4/12/2019	0.06	-142.1	6.7	560	10.90	8.20
	9/26/2019	0.20	-123.7	6.9	1,031	14.20	4.75
BCC-MW-15020	4/12/2019	0.06	-120.7	6.8	487	12.10	3.70
	9/26/2019	0.26	-115.4	6.8	1,380	14.30	1.65
BCC-MW-15021	4/12/2019	0.08	-124.9	6.7	762	11.30	3.40
	9/26/2019	0.32	-125.9	6.9	1,150	13.20	7.95
BCC-MW-15022	4/12/2019	0.08	-204.1	7.7	1,475	12.30	1.40
	9/25/2019	0.15	-279.0	7.5	2,296	15.90	0.20
BCC-MW-15023	4/12/2019	0.41	-30.7	7.0	602	11.10	5.20
	9/26/2019	0.35	-128.7	7.5	770	13.00	0.65

Notes:
mg/L - Milligrams per Liter.
mV - Millivolts.
SU - Standard units.
umhos/cm - Micromhos per centimeter.
°C - Degrees Celcius
NTU - Nephelometric Turbidity Unit.

Table 2
Summary of Field Parameter Results – April to September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Shallow 2017 Wells (Downgradient)							
BCC-MW-17001	4/11/2019	-0.01	-312.2	6.9	661	10.40	4.10
	9/26/2019	0.28	-149.8	7.0	862	15.50	0.55
BCC-MW-17002	4/11/2019	0.00	-339.3	6.6	946	10.30	0.30
	9/26/2019	0.35	-348.5	7.3	1,206	13.80	0.18
BCC-MW-17003	4/12/2019	0.06	-227.0	7.1	410	10.50	5.00
	9/26/2019	0.24	-219.3	7.5	701	13.70	0.23
BCC-MW-17004	4/12/2019	0.05	-191.8	7.5	387	10.70	6.90
	9/26/2019	0.35	-148.9	7.6	519	14.40	0.75
BCC-MW-17005	4/12/2019	0.07	-116.6	7.5	378	10.80	6.40
	9/26/2019	0.31	-126.0	7.3	900	14.40	0.99
BCC-MW-17006	4/12/2019	0.11	-156.7	7.5	732	12.00	1.70
	9/26/2019	0.39	-209.0	7.8	975	13.20	0.95

Notes:
mg/L - Milligrams per Liter.
mV - Millivolts.
SU - Standard units.
umhos/cm - Micromhos per centimeter.
°C - Degrees Celcius
NTU - Nephelometric Turbidity Unit.

Table 3
Summary of Background Well Groundwater Sampling Results (Analytical): April 2019 - September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15002		BCC-MW-15003		BCC-MW-15004		BCC-MW-15005		BCC-MW-15006		BCC-MW-15007		BCC-MW-15008	
					Sample Date:	4/8/2019	9/25/2019	4/8/2019	9/25/2019	4/9/2019	9/25/2019	4/9/2019	9/25/2019	4/9/2019	9/24/2019	4/9/2019	9/24/2019	4/9/2019	9/24/2019
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	Background													
Appendix III																			
Boron	ug/L	NC	500	500	7,200	420	360	390	230	120	270	56	< 50	< 50	50	90	150	230	300
Calcium	mg/L	NC	NC	NC	500	130	120	100	150	59	95	76	58	63	64	130	160	100	87
Chloride	mg/L	**250****	**250**	**250**	**500**	170	**300**	**360**	**670**	20	240	150	89	2.0	10	**790**	**1,100**	200	81
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 5,000(1)	< 2,000	< 1,000	< 1,000
Sulfate	mg/L	**250****	250	250	**500**	< 2.0	< 20	< 2.0	< 20	7.4	< 20	5.4	3.8	9.2	11	< 10	4.4	2.0	2.1
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**790**	**870**	**1,100**	**1,400**	280	**730**	**640**	460	240	310	**1,900**	**2,000**	**710**	470
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	7.1	7.3	7.2	7.3	7.2	7.0	7.4	7.4	7.4	7.4	6.8	6.8	7.5	7.6
Appendix IV																			
Antimony	ug/L	6	6.0	6.0	130	< 1.0	--	< 1.0	--	< 1.0	--	< 1.0	--	< 1.0	--	< 1.0	--	< 1.0	--
Arsenic	ug/L	10	10	10	10	< 1.0	< 1.0	< 1.0	< 1.0	2.2	4.7	< 1.0	3.0	3.1	8.5	1.8	5.0	1.6	1.8
Barium	ug/L	2,000	2,000	2,000	690	100	100	79	110	24	60	160	150	16	25	100	150	130	92
Beryllium	ug/L	4	4.0	4.0	14	< 1.0	--	< 1.0	--	< 1.0	--	< 1.0	--	< 1.0	--	< 1.0	--	< 1.0	--
Cadmium	ug/L	5	5.0	5.0	3.1	< 0.20	--	< 0.20	--	< 0.20	--	< 0.20	--	< 0.20	--	< 0.20	--	< 0.20	--
Chromium	ug/L	100	100	100	11	< 1.0	< 1.0	1.0	< 1.0	1.0	1.0	1.1	1.3	1.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	40	100	100	< 6.0	--	< 6.0	--	< 6.0	--	< 6.0	--	< 6.0	--	< 6.0	--	< 6.0	--
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 5,000(1)	< 2,000	< 1,000	< 1,000
Lead	ug/L	NC	4.0	4.0	35	< 1.0	--	< 1.0	--	< 1.0	--	< 1.0	--	< 1.0	--	< 1.0	--	< 1.0	--
Lithium	ug/L	NC	170	350	440	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	14	17
Mercury	ug/L	2	2.0	2.0	0.20#	< 0.20	--	< 0.20	--	< 0.20	--	< 0.20	--	< 0.20	--	< 0.20	--	< 0.20	--
Molybdenum	ug/L	NC	**73**	210	3,200	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	6.0	5.8	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC	0.391	0.380	0.194	< 0.267	0.149	0.383	0.131	< 0.273	< 0.173	< 0.157	< 0.177	0.198	0.217	< 0.138
Radium-228	pCi/L	NC	NC	NC	NC	< 0.481	0.760	< 0.696	1.33	< 0.588	0.705	< 0.585	< 0.461	< 0.681	< 0.533	< 0.718	< 0.569	< 0.478	< 0.546
Radium-226/228	pCi/L	5	NC	NC	NC	0.499	1.14	< 0.696	1.58	< 0.588	1.09	< 0.585	< 0.461	< 0.681	< 0.533	< 0.718	< 0.569	0.532	< 0.546
Selenium	ug/L	50	50	50	5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	2.0	2.0	3.7	< 2.0	--	< 2.0	--	< 2.0	--	< 2.0	--	< 2.0	--	< 2.0	--	< 2.0	--

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
NC - no criteria.
-- - not analyzed
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 154 mg CaCO3/L as measured at surface water sample SW-01 collected on February 22, 2018 from the North Channel Muskegon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.
(1) Laboratory reporting limits exceeds one or more criteria due to sample dilutions performed as a result of the nature of the sample matix.

[DRAFT - ELECTRONIC REVIEW]

Table 4
Summary of Groundwater Sampling Results (Analytical): April 2019 - September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15009		BCC-MW-15010		BCC-MW-15011		BCC-MW-15012		BCC-MW-15013		BCC-MW-15014		BCC-MW-15015	
					Sample Date:	4/9/2019	9/25/2019	4/9/2019	9/24/2019	4/10/2019	9/25/2019	4/10/2019	9/25/2019	4/11/2019	9/25/2019	4/11/2019	9/25/2019	4/11/2019	9/26/2019
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient													
Appendix III																			
Boron	ug/L	NC	500	500	7,200	**1,600**	**1,500**	**1,700**	**1,100**	**1,600**	**1,600**	**1,300**	**1,300**	**1,200**	**1,300**	**1,500**	**1,400**	**630**	**510**
Calcium	mg/L	NC	NC	NC	500	33	51	110	130	41	63	61	140	50	45	49	50	68	46
Chloride	mg/L	**250****	250	250	500	32	41	22	42	38	37	20	22	21	24	20	23	20	17
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	**250****	250	250	500	49	30	49	2.9	38	97	190	**540**	4.8	53	12	25	88	69
Total Dissolved Solids	mg/L	**500****	500	500	500	300	290	490	450	260	380	380	850	260	250	260	250	360	250
pH, Field	SU	**6.5 - 8.5*'**	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	9.4	8.7	7.6	7.4	8.8	8.4	9.4	10.1	7.3	8.0	11.3	11.3	7.6	8.4
Appendix IV																			
Antimony	ug/L	6	6.0	6.0	130	< 1.0	--	< 1.0	–	< 1.0	–	< 1.0	–	< 1.0	–	< 1.0	–	< 1.0	–
Arsenic	ug/L	10	10	10	10	3.9	2.3	< 1.0	< 1.0	9.3	< 1.0	1.4	2.3	< 1.0	< 1.0	3.8	2.6	4.3	5.7
Barium	ug/L	2,000	2,000	2,000	690	16	27	78	61	31	39	79	190	45	31	620	560	63	44
Beryllium	ug/L	4	4.0	4.0	14	< 1.0	--	< 1.0	–	< 1.0	–	< 1.0	–	< 1.0	–	< 1.0	–	< 1.0	–
Cadmium	ug/L	5	5.0	5.0	3.1	< 0.20	--	< 0.20	–	< 0.20	–	< 0.20	–	< 0.20	–	< 0.20	–	< 0.20	–
Chromium	ug/L	100	100	100	11	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.0	< 1.0	< 1.0	< 1.0	< 2.0
Cobalt	ug/L	NC	40	100	100	< 6.0	--	< 6.0	–	< 6.0	–	< 6.0	–	< 6.0	–	< 6.0	–	< 6.0	–
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4.0	4.0	35	< 1.0	--	< 1.0	–	< 1.0	–	< 1.0	–	< 1.0	–	< 1.0	–	< 1.0	–
Lithium	ug/L	NC	170	350	440	21	32	41	43	18	13	12	< 10	17	13	12	23	11	< 10
Mercury	ug/L	2	2.0	2.0	0.20#	< 0.20	--	< 0.20	–	< 0.20	–	< 0.20	–	< 0.20	–	< 0.20	–	< 0.20	–
Molybdenum	ug/L	NC	**73**	210	3,200	< 5.0	< 5.0	< 5.0	< 5.0	15	< 5.0	26	**75**	5.7	9.9	**120**	**99**	11	< 10
Radium-226	pCi/L	NC	NC	NC	NC	< 0.153	0.370	< 0.185	< 0.140	0.226	0.272	< 0.142	0.241	< 0.232	< 0.201	< 0.192	< 0.185	< 0.224	< 0.165
Radium-228	pCi/L	NC	NC	NC	NC	< 0.583	< 0.551	< 0.516	< 0.578	< 0.532	0.454	< 0.485	< 0.551	< 0.450	< 0.482	< 0.538	< 0.513	< 0.518	< 0.491
Radium-226/228	pCi/L	**5**	NC	NC	NC	< 0.583	0.807	< 0.516	< 0.578	< 0.532	0.726	< 0.485	0.776	< 0.450	0.508	< 0.538	< 0.513	< 0.518	< 0.491
Selenium	ug/L	50	50	50	**5.0**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.2	< 1.0	< 1.0	**5.2**	4.7	< 1.0	< 2.0
Thallium	ug/L	2	2.0	2.0	3.7	< 2.0	--	< 2.0	--	< 2.0	–	< 2.0	–	< 2.0	–	< 2.0	–	< 2.0	–

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
NC - no criteria.
-- - data pending.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 154 mg CaCO3/L as measured at surface water sample SW-01 collected on February 22, 2018 from the North Channel Muskegon River. Chromium GSI criterion based on hexavalent chromium per footnote (H).
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 4
Summary of Groundwater Sampling Results (Analytical): April 2019 - September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15016		BCC-MW-15017		BCC-MW-15018		BCC-MW-15019		BCC-MW-15020		BCC-MW-15021		BCC-MW-15022		BCC-MW-15023	
					Sample Date:	4/11/2019	9/26/2019	4/11/2019	9/26/2019	4/11/2019	9/26/2019	4/12/2019	9/26/2019	4/12/2019	9/26/2019	4/12/2019	9/26/2019	4/12/2019	9/25/2019	4/12/2019	9/26/2019
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient															
Appendix III																					
Boron	ug/L	NC	**500**	**500**	**7,200**	110	100	100	93	**640**	**550**	**1,600**	**1,000**	**700**	**830**	**940**	**930**	**6,800**	**10,000**	**2,600**	**1,000**
Calcium	mg/L	NC	NC	NC	500	170	160	220	220	96	94	97	100	76	110	93	92	310	300	120	100
Chloride	mg/L	**250****	**250**	**250**	**500**	190	230	210	250	59	55	39	68	45	130	110	110	19	24	16	16
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	**250****	**250**	**250**	**500**	< 2.0	< 20	< 2.0	< 20	< 2.0	< 20	< 2.0	< 20	< 2.0	2.9	< 2.0	< 20	**1,100**	**1,200**	140	130
Total Dissolved Solids	mg/L	**500****	500	500	500	**1,000**	980	**1,200**	**1,200**	480	430	430	530	400	660	590	570	**1,900**	**1,900**	600	490
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	**6.4**	6.6	**6.4**	6.6	6.8	6.9	6.7	6.9	6.8	6.8	6.7	6.9	7.7	7.5	7.0	7.5
Appendix IV																					
Antimony	ug/L	6	6.0	6.0	130	< 1.0	--	< 1.0	--	< 1.0	–	< 1.0	–	< 1.0	–	< 1.0	–	< 1.0	–	< 1.0	–
Arsenic	ug/L	10	10	10	10	1.6	1.4	1.9	1.8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.4	4.0	< 1.0	< 1.0
Barium	ug/L	2,000	2,000	2,000	**690**	**700**	630	**960**	**900**	150	140	110	150	120	330	250	240	190	130	100	92
Beryllium	ug/L	4	4.0	4.0	14	< 1.0	--	< 1.0	--	< 1.0	–	< 1.0	–	< 1.0	–	< 1.0	–	< 1.0	–	< 1.0	–
Cadmium	ug/L	5	5.0	5.0	3.1	< 0.20	--	< 0.20	--	< 0.20	–	< 0.20	–	< 0.20	–	< 0.20	–	< 0.20	–	< 0.20	–
Chromium	ug/L	100	100	100	11	2.3	2.4	2.9	3.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.1	1.2	1.2	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	40	100	100	< 6.0	--	< 6.0	--	< 6.0	–	< 6.0	–	< 6.0	–	< 6.0	–	< 6.0	–	< 6.0	–
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4.0	4.0	35	< 1.0	--	< 1.0	--	< 1.0	–	< 1.0	–	< 1.0	–	< 1.0	–	< 1.0	–	< 1.0	–
Lithium	ug/L	NC	170	350	440	< 10	< 10	< 10	< 10	24	20	22	20	15	< 10	< 8.0	< 10	23	22	31	13
Mercury	ug/L	2	2.0	2.0	0.20#	< 0.20	--	< 0.20	--	< 0.20	–	< 0.20	–	< 0.20	–	< 0.20	–	< 0.20	–	< 0.20	–
Molybdenum	ug/L	NC	**73**	210	3,200	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	5.1
Radium-226	pCi/L	NC	NC	NC	NC	1.18	1.31	1.52	1.42	0.316	0.511	0.246	0.443	0.226	0.672	0.531	0.794	< 0.182	0.261	0.181	0.209
Radium-228	pCi/L	NC	NC	NC	NC	1.76	1.97	3.93	2.75	0.598	0.846	0.548	0.651	< 0.558	1.26	0.783	0.738	< 0.470	0.617	0.771	< 0.400
Radium-226/228	pCi/L	**5**	NC	NC	NC	2.94	3.27	**5.46**	4.16	0.915	1.36	0.794	1.09	< 0.558	1.94	1.31	1.53	< 0.470	0.877	0.952	0.527
Selenium	ug/L	50	50	50	**5.0**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	2.0	2.0	3.7	< 2.0	--	< 2.0	--	< 2.0	–	< 2.0	–	< 2.0	–	< 2.0	–	< 2.0	–	< 2.0	–

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
NC - no criteria.
-- - data pending.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 154 mg CaCO3/L as measured at surface water sample SW-01 collected on February 22, 2018 from the North Channel Muskegon River. Chromium GSI criterion based on hexavalent chromium per footnote (H).
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 4
Summary of Groundwater Sampling Results (Analytical): April 2019 - September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-17001		BCC-MW-17002		BCC-MW-17003		BCC-MW-17004		BCC-MW-17005		BCC-MW-17006	
					Sample Date:	4/11/2019	9/26/2019	4/11/2019	9/26/2019	4/12/2019	9/26/2019	4/12/2019	9/26/2019	4/12/2019	9/26/2019	4/12/2019	9/26/2019
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	Shallow 2017 Wells (downgradient)											
Appendix III																	
Boron	ug/L	NC	**500**	**500**	**7,200**	**1,700**	**1,800**	**9,200**	**13,000**	380	350	440	**570**	400	490	**650**	**600**
Calcium	mg/L	NC	NC	NC	500	130	120	220	200	78	82	67	66	69	120	150	130
Chloride	mg/L	**250****	**250**	**250**	**500**	31	28	15	12	17	23	19	16	15	17	19	18
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	**250****	**250**	**250**	**500**	64	17	**690**	**540**	12	37	7.8	3.1	120	65	**290**	220
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**570**	490	**1,000**	**860**	360	380	330	300	380	**550**	**800**	**680**
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	6.9	7.0	6.6	7.3	7.1	7.5	7.5	7.6	7.5	7.3	7.5	7.8
Appendix IV																	
Antimony	ug/L	6	6.0	6.0	130	< 1.0	--	< 1.0	--	< 1.0	--	< 1.0	--	< 1.0	--	< 1.0	--
Arsenic	ug/L	10	10	10	10	< 1.0	< 1.0	1.6	1.8	3.8	9.4	1.7	< 1.0	< 1.0	< 1.0	5.9	4.3
Barium	ug/L	2,000	2,000	2,000	**690**	82	81	130	75	83	93	150	140	84	340	120	98
Beryllium	ug/L	4	4.0	4.0	14	< 1.0	--	< 1.0	--	< 1.0	--	< 1.0	--	< 1.0	--	< 1.0	--
Cadmium	ug/L	5	5.0	5.0	3.1	< 0.20	--	< 0.20	--	< 0.20	--	< 0.20	--	< 0.20	--	< 0.20	--
Chromium	ug/L	100	100	100	11	1.3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.1	< 1.0	1.2
Cobalt	ug/L	NC	40	100	100	< 6.0	--	< 6.0	--	< 6.0	--	< 6.0	--	< 6.0	--	< 6.0	--
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4.0	4.0	35	< 1.0	--	< 1.0	--	< 1.0	--	< 1.0	--	< 1.0	--	< 1.0	--
Lithium	ug/L	NC	170	350	440	43	60	100	140	15	14	< 8.0	< 10	< 8.0	14	35	28
Mercury	ug/L	2	2.0	2.0	0.20#	< 0.20	--	< 0.20	--	< 0.20	--	< 0.20	--	< 0.20	--	< 0.20	--
Molybdenum	ug/L	NC	**73**	210	3,200	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC	0.314	0.260	0.233	0.501	0.205	0.347	0.182	0.271	0.270	0.497	< 0.225	0.497
Radium-228	pCi/L	NC	NC	NC	NC	< 0.413	0.821	< 0.598	< 0.527	< 0.483	< 0.521	0.539	< 0.546	< 0.479	< 0.564	< 0.556	< 0.437
Radium-226/228	pCi/L	**5**	NC	NC	NC	0.721	1.08	0.688	0.702	0.539	0.676	0.721	< 0.546	0.700	0.739	< 0.556	0.819
Selenium	ug/L	50	50	50	**5.0**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	2.0	2.0	3.7	< 2.0	--	< 2.0	--	< 2.0	--	< 2.0	--	< 2.0	--	< 2.0	--

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
NC - no criteria.
-- - data pending.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 154 mg CaCO3/L as measured at surface water sample SW-01 collected on February 22, 2018 from the North Channel Muskegon River. Chromium GSI criterion based on hexavalent chromium per footnote (H).
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 5

Summary of Groundwater Protection Standard Exceedances – April 2019

BC Cobb – RCRA CCR Monitoring Program

Muskegon, Michigan

Constituent	Units	GWPS	BCC-MW-15009		BCC-MW-15010		BCC-MW-15014		BCC-MW-15017		BCC-MW-17001		BCC-MW-17002	
			LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL
Arsenic	ug/L	10	1.9	13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lithium	ug/L	40	NA	NA	21	65	NA	NA	NA	NA	43	80	92	170
Molybdenum	ug/L	100	NA	NA	NA	NA	70	130	NA	NA	NA	NA	NA	NA
Radium 226/228	pCi/L	5	NA	NA	NA	NA	NA	NA	4.7	5.7	NA	NA	NA	NA

Notes:

ug/L - micrograms per Liter.

GWPS - Groundwater Protection Standard as established in TRC's Technical Memorandum dated October 15, 2018.

NA - Not Applicable; well/parameter pair did not directly exceed the GWPS and was not included in further analysis.

UCL - Upper Confidence Limit (α = 0.01) of the downgradient data set.

LCL - Lower Confidence Limit (α = 0.01) of the downgradient data set.

Indicates a statistically significant exceedance of the GWPS. An exceedance occurs when the LCL is greater than the GWPS.

Table 6

Summary of Groundwater Protection Standard Exceedances – September 2019

BC Cobb – RCRA CCR Monitoring Program

Muskegon, Michigan

Constituent	Units	GWPS	BCC-MW-15009		BCC-MW-15010		BCC-MW-15014		BCC-MW-15017		BCC-MW-17001		BCC-MW-17002	
			LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL
Arsenic	ug/L	10	1.6	12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lithium	ug/L	40	NA	NA	27	59	NA	NA	NA	NA	47	75	100	160
Molybdenum	ug/L	100	NA	NA	NA	NA	77	120	NA	NA	NA	NA	NA	NA
Radium 226/228	pCi/L	5	NA	NA	NA	NA	NA	NA	4.3	5.7	NA	NA	NA	NA

Notes:

ug/L - micrograms per Liter.

GWPS - Groundwater Protection Standard as established in TRC's Technical Memorandum dated October 15, 2018.

NA - Not Applicable; well/parameter pair did not directly exceed the GWPS and was not included in further analysis.

UCL - Upper Confidence Limit ($\alpha = 0.01$) of the downgradient data set.

LCL - Lower Confidence Limit ($\alpha = 0.01$) of the downgradient data set.

Indicates a statistically significant exceedance of the GWPS. An exceedance occurs when the LCL is greater than the GWPS.

Figures

[DRAFT - ELECTRONIC REVIEW]

BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

1" = 3,000'
1:36,000

0 3,000 6,000 FEET

TRC

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Phone: 734.971.7080
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PROJECT:

CONSUMERS ENERGY COMPANY
BC COBB BOTTOM ASH POND AND PONDS 0-8 AREA
MUSKEGON, MICHIGAN

TITLE:

SITE LOCATION MAP

DRAWN BY:	M. VAPHIADIS
CHECKED BY:	B. YELEN
APPROVED BY:	S. HOLMSTROM
DATE:	JANUARY 2020
PROJ. NO.:	322176-001
FILE:	322176-001-020slm.mxd

FIGURE 1

E:\ConsumersEnergy\CCR_GW\2017_269767\322176-001-020slm.mxd - Saved By: SMAJOR on 1/17/2020, 13:10:04 PM

[DRAFT - ELECTRONIC REVIEW]

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT MONITORING WELL
- NATURE AND EXTENT WELL
- APPROXIMATE POND BOUNDARY

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 9/22/2018.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.
3. MONITORING WELLS BCC-MW-17001 THROUGH BCC-MW-17006 SURVEYED BY CONSUMERS ENERGY CO. ON 1/16/2018.
4. DEEP SCREENED WELLS (DEEP) ARE CHARACTERIZED BY WELL SCREENS SET BELOW 555 FEET MSL.

N

0 300 600 Feet

1" = 300'

1:3,600

PROJECT:

CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:

SITE PLAN
WITH CCR MONITORING WELL LOCATIONS

DRAWN BY:	S. MAJOR	PROJ NO.:	322176
CHECKED BY:	B. YELEN		
APPROVED BY:	S. HOLMSTROM		**FIGURE 2**
DATE:	JANUARY 2020		

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FILE NO.: 322176-001-011.mxd

Plot Date: 1/17/2020, 13:08:14 PM by SMAJOR – LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\322176-001-011.mxd

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

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[DRAFT - ELECTRONIC REVIEW]

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT MONITORING WELL
- NATURE AND EXTENT WELL
- APPROXIMATE POND BOUNDARY
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)
- GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 9/22/2018.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.
3. MONITORING WELLS BCC-MW-17001 THROUGH BCC-MW-17006 SURVEYED BY CONSUMERS ENERGY CO. ON 1/16/2018.
4. DEEP SCREENED WELLS (DEEP) ARE CHARACTERIZED BY WELL SCREENS SET BELOW 555 FEET MSL.
5. GROUNDWATER ELEVATION DATA RECORDED ON APRIL 8, 2019.

N

0 300 600 Feet

1" = 300'
1:3,600

PROJECT: CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE: SHALLOW GROUNDWATER CONTOUR MAP
APRIL 8, 2019

DRAWN BY:	M. VAPHIADIS	PROJ NO.:	322176
CHECKED BY:	B. YELEN		FIGURE 3
APPROVED BY:	S. HOLMSTROM		
DATE:	JANUARY 2020		

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FILE NO.: 322176-001-016.mxd

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

Plot Date: 1/17/2020, 13:12:24 PM by SMAJOR – LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\322176-001-016.mxd

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[DRAFT - ELECTRONIC REVIEW]

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT MONITORING WELL
- NATURE AND EXTENT WELL
- APPROXIMATE POND BOUNDARY
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 9/22/2018.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.
3. MONITORING WELLS BCC-MW-17001 THROUGH BCC-MW-17006 SURVEYED BY CONSUMERS ENERGY CO. ON 1/16/2018.
4. DEEP SCREENED WELLS (DEEP) ARE CHARACTERIZED BY WELL SCREENS SET BELOW 555 FEET MSL.
5. GROUNDWATER ELEVATION DATA RECORDED ON SEPTEMBER 24, 2019, EXCEPT FOR BCC-MW-15001 RECORDED ON OCTOBER 16, 2019.

N

0 300 600 Feet

1" = 300'
1:3,600

PROJECT: CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE: SHALLOW GROUNDWATER CONTOUR MAP SEPTEMBER 24, 2019

DRAWN BY:	M. VAPHIADIS	PROJ NO.:	322176
CHECKED BY:	B. YELEN		
APPROVED BY:	S. HOLMSTROM		FIGURE 4
DATE:	JANUARY 2020		

TRC
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FILE NO.: 322176-001-017_Figure4.mxd

Plot Date: 1/17/2020, 13:15:36 PM by SMAJOR – LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\322176-001-017_Figure4.mxd
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0
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[DRAFT - ELECTRONIC REVIEW]

Appendix A
November 2018 Assessment Monitoring Data Summary

[DRAFT - ELECTRONIC REVIEW]

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March 14, 2019

Michelle Marion
Environmental Services
Consumers Energy Company
1945 W. Parnall Road
Jackson, MI 49201

Subject: November 2018 Assessment Monitoring Data Summary and Statistical Evaluation, Consumers Energy, BC Cobb Site, Bottom Ash Pond & Ponds 0-8 CCR Unit

Dear Ms. Marion:

Consumers Energy Company (CEC) is continuing semiannual assessment monitoring in accordance with §257.95 of the CCR Rule[1] for the BC Cobb Power Plant (BCC) Bottom Ash Pond and Ponds 0-8 (collectively the BCC Ponds) located in Muskegon, Michigan. During the statistical evaluation of the initial assessment monitoring event, lithium was present in one or more downgradient monitoring wells at statistically significant levels exceeding the Groundwater Protection Standards (GWPSs). Therefore, CEC will initiate an Assessment of Corrective Measures (ACM) within 90 days from when the Appendix IV exceedance was determined (no later than April 14, 2019). As discussed in the *2018 Annual Groundwater Monitoring Report* (2018 Annual Report) (TRC, January 2019), prepared by TRC on behalf of CEC, the second semiannual monitoring event was conducted in November 2018, but laboratory analysis and data quality review were ongoing as of the writing of the 2018 Annual Report. Therefore, the summary of the November 2018 groundwater data would be prepared under separate cover after laboratory analysis is complete and results have been reviewed for usability. This letter report has been prepared to provide the summary of the November 2018 assessment groundwater monitoring results, data quality review, and statistical data evaluation.

Assessment Monitoring Sampling Summary

TRC conducted the second semiannual assessment monitoring event of 2018 for Appendix III and IV constituents at the BCC Ponds, in accordance with the *BC Cobb Monitoring Program Sample and Analysis Plan* (ARCADIS, 2016) (SAP). The semiannual assessment monitoring event was performed

[1] USEPA final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) published April 17, 2015, as amended per Phase One, Part One of the CCR Rule (83 FR 36435).

[DRAFT - ELECTRONIC REVIEW]

on November 27 through November 30, 2018. Downgradient monitoring wells BCC-MW-15009 through BCC-MW-15023, BCC-MW-17001 through BCC-MW-17006, and background monitoring wells BCC-MW-15002 through BCC-MW-15008 were sampled during this monitoring event. The locations of the monitoring wells are depicted on Figure 1.

TRC personnel collected static water level measurements at all monitoring wells in the BCC Ponds well network. Static water elevation data are summarized in Table 1 and groundwater elevation data are shown on Figure 2. Monitoring wells were purged with peristaltic pumps utilizing low-flow sampling methodology. Field parameters were stabilized at each monitoring well prior to collecting groundwater samples. Field parameters for each monitoring well are summarized in Table 2.

The groundwater samples were analyzed by Pace Analytical Services, LLC (Pace) for Appendix III and IV constituents in accordance with the SAP. The analytical results for the background wells are summarized in Table 3, and the analytical results for the downgradient monitoring wells are summarized in Table 4.

Groundwater Flow Rate and Direction

Groundwater elevation data collected during the November 2018 assessment monitoring event is provided in Table 1. The November 2018 groundwater elevation data was used to construct the groundwater contour map (Figure 2).

Groundwater elevation data collected during the November 2018 assessment monitoring sampling event showed slight groundwater flow radially outward toward the bounding surface water features from the BCC Ponds. The average gradient observed on November 27, 2018, using well pairs BCC-MW-15012/BCC-MW-15013, BCC-MW-15012/BCC-MW-17004, and BCC-MW-15012/BCC-MW-15022, showed a horizontal gradient of approximately 0.00069 ft/ft with minimal discernible overall flow direction across the BCC Ponds. Using the average hydraulic conductivity measured at the Ponds 0-8 monitoring wells of 58 feet/day (ARCADIS, 2016), and an assumed effective porosity of 0.3, this results in groundwater flow rate of approximately 0.13 feet/day (approximately 48 feet/year).

The groundwater flow conditions observed in November 2018 were generally consistent with previous conditions where groundwater was typically encountered at a similar or slightly higher elevation relative to the surrounding surface water features, flowing outward toward the bounding surface water features. Groundwater elevation data from November 2018 continued to exhibit a low hydraulic gradient and had a slight, but discernable, flow direction compared to the previous rounds of assessment monitoring in April and June 2018 where no discernable flow direction was observed. Groundwater flow at the BCC Ponds has undergone several changes over time due to permanent discontinuation of hydraulic loading in the BCC Ponds area and the dewatering of Veteran's Pond in 2017 (as discussed in the January 2018 Annual Report). Although the overall gradient has diminished compared to pre-2018 monitoring events due to the discontinued hydraulic loading and Veteran's

[DRAFT - ELECTRONIC REVIEW]

Pond dewatering, general groundwater flow is still slightly outward toward the river, or equal to the river, with groundwater flowing toward the BCC Ponds from the area of the background wells, and continues to demonstrate that the downgradient wells are appropriately positioned to detect the presence of Appendix III/IV constituents that could potentially migrate from the BCC Ponds.

Data Quality

Analytical data were found to be usable for assessment monitoring. The Data Quality Review, including a summary of data non-conformances, is included as Attachment A.

Assessment Monitoring Statistical Evaluation

Following the second semiannual assessment monitoring sampling event, the compliance well groundwater concentrations for Appendix IV constituents were compared to the GWPSs to determine if a statistically significant exceedance had occurred in accordance with §257.95. Consistent with the *Unified Guidance*[2], the preferred method for comparisons to a fixed standard are confidence limits. An exceedance of the standard occurs when the 99 percent lower confidence level of the downgradient data exceeds the GWPSs. GWPSs were established in accordance with §257.95(h), as detailed in the October 15, 2018 *Groundwater Protection Standards* technical memorandum, which was also included in 2018 Annual Report.

Confidence intervals were established per the statistical methods detailed in the *Statistical Evaluation of November 2018 Assessment Monitoring Sampling Event* technical memorandum provided in Attachment B. For each Appendix IV constituent, the concentrations were first compared directly to the GWPSs. Constituent-well combinations that included a direct exceedance of the GWPSs were retained for further statistical analysis using confidence limits.

The statistical evaluation of the assessment monitoring data indicates that the following constituent is present at statistically significant levels exceeding the GWPS in downgradient monitoring wells at the BCC Ponds:

Constituent	GWPS	# Downgradient Wells Observed
Lithium	40 ug/L	2 of 21

These results are consistent with the results of the initial assessment monitoring data statistical evaluation and CEC will continue to initiate an assessment of corrective measures by April 14, 2019, per §257.95(g). CEC will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

[2] USEPA. 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance.* Office of Conservation and Recovery. EPA 530/R-09-007.

[DRAFT - ELECTRONIC REVIEW]

Sincerely,

TRC

Graham Crockford
Program Manager

Sarah B. Holmstrom
Hydrogeologist/Project Manager

Attachments

Table 1.	Summary of Groundwater Elevation Data
Table 2.	Summary of Field Parameter Results
Table 3.	Summary of Groundwater Sampling Results (Analytical)
Table 4.	Summary of Background Well Groundwater Sampling Results (Analytical)
Table 5.	Summary of Groundwater Protection Standard Exceedances – November 2018
Figure 1.	Site Plan with CCR Monitoring Well Locations
Figure 2.	Shallow Groundwater Contour Map – November 27, 2018
Attachment A	Data Quality Reviews
Attachment B	Statistical Evaluation of November 2018 Assessment Monitoring Sampling Event

[DRAFT - ELECTRONIC REVIEW]

Tables

Table 1
Summary of Groundwater Elevation Data
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Well Location	Ground Surface Elevation (ft)	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Elevation (ft)			November 27, 2018	
							Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Background								
BCC-MW-15001	583.6	586.52	Sand with organic seam at 18.8 ft bgs	573.6	to	563.6	5.42	581.10
BCC-MW-15002	583.8	586.87	Sand	568.8	to	563.8	5.67	581.20
BCC-MW-15003	584.1	587.12	Sand	571.1	to	566.1	5.93	581.19
BCC-MW-15004	587.7	590.57	Sand	582.7	to	572.7	9.34	581.23
BCC-MW-15005	584.8	587.77	Sand	579.8	to	569.8	6.75	581.02
BCC-MW-15006	584.9	587.81	Sand	579.9	to	569.9	6.43	581.38
BCC-MW-15007	584.5	587.43	Sand	580.5	to	574.5	6.50	580.93
BCC-MW-15008	584.8	587.76	Sand	580.8	to	575.8	6.62	581.14
Downgradient								
BCC-MW-15009	586.3	589.27	Sand (14 - 17.2 ft bgs) and Clay/silt (17.2 - 24 ft bgs)	572.3	to	562.3	8.03	581.24
BCC-MW-15010	585.2	588.11	Sand with little silt and organic material	573.2	to	563.2	6.91	581.20
BCC-MW-15011	592.3	595.22	Sand with some silt	571.3	to	561.3	14.20	581.02
BCC-MW-15012	594.5	597.39	Sand	573.5	to	563.5	16.06	581.33
BCC-MW-15013	595.9	598.50	Sand with clay/silt and organic material from 36.5 - 37.5 ft bgs	565.9	to	555.9	17.54	580.96
BCC-MW-15014	596.2	599.04	Sand/silty sand	573.2	to	565.2	17.97	581.07
BCC-MW-15015	593.9	596.75	Sand with clay/silt and organic material from 29 - 29.5 ft bgs	573.9	to	563.9	15.97	580.78
BCC-MW-15016	586.2	589.05	Sand	551.2	to	546.2	8.39	580.66
BCC-MW-15017	585.7	588.61	Sand	550.7	to	545.7	7.84	580.77
BCC-MW-15018	589.4	592.43	Sand	551.9	to	546.9	11.68	580.75
BCC-MW-15019	589.4	592.42	Sand	552.4	to	547.4	11.73	580.69
BCC-MW-15020	589.5	592.23	Sand	554.5	to	549.5	11.42	580.81
BCC-MW-15021	590.7	593.73	Sand	551.2	to	548.2	12.75	580.98
BCC-MW-15022	592.6	595.82	Sand	568.6	to	562.6	14.57	581.25
BCC-MW-15023	585.4	588.08	Sand/silty sand	573.4	to	565.9	6.78	581.30
Shallow 2017 Wells								
BCC-MW-17001	586.1	589.29	Sand with some organic material	571.1	to	566.1	8.58	580.71
BCC-MW-17002	585.8	588.79	Sand	572.3	to	567.3	8.07	580.72
BCC-MW-17003	589.3	592.37	Sand	572.3	to	567.3	11.58	580.79
BCC-MW-17004	589.1	591.84	Sand	571.6	to	566.6	10.98	580.86
BCC-MW-17005	589.3	592.42	Sand	569.3	to	564.3	11.47	580.95
BCC-MW-17006	590.5	593.78	Sand	566.0	to	561.0	12.52	581.26

Notes:

Survey conducted by Williams & Works, November 2015, and Consumers Energy Company in January 2018.

Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).

TOC: Top of well casing.

ft BTOC: Feet below top of well casing.

Table 2
Summary of Field Parameter Results – November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Background							
BCC-MW-15002	11/28/2018	0.42	61.4	7.2	1,314	11.64	0.67
BCC-MW-15003	11/28/2018	0.28	60.3	7.2	3,225	11.54	2.16
BCC-MW-15004	11/28/2018	0.40	13.8	6.8	646	11.48	0.84
BCC-MW-15005	11/27/2018	0.71	35.1	7.4	385	8.64	9.80
BCC-MW-15006	11/27/2018	2.48	22.3	7.2	446	7.38	1.62
BCC-MW-15007	11/27/2018	0.23	-12.9	6.8	2,394	10.22	2.26
BCC-MW-15008	11/27/2018	0.38	32.4	7.4	757	10.40	1.14
Downgradient							
BCC-MW-15009	11/28/2018	0.28	-34.6	9.8	516	12.73	0.94
BCC-MW-15010	11/28/2018	0.38	68.1	7.5	1,003	12.15	2.83
BCC-MW-15011	11/28/2018	0.45	55.5	8.9	332	12.22	0.71
BCC-MW-15012	11/28/2018	0.34	6.5	9.8	556	12.04	0.66
BCC-MW-15013	11/29/2018	0.89	70.6	7.0	321	11.85	0.63
BCC-MW-15014	11/29/2018	0.36	-33.7	11.5	391	10.14	2.39
BCC-MW-15015	11/29/2018	0.29	-0.4	7.8	345	10.91	0.81
BCC-MW-15016	11/29/2018	0.37	-15.5	6.6	1,607	11.50	2.41
BCC-MW-15017	11/29/2018	0.42	-55.0	6.7	1,790	11.15	0.65

Notes:

mg/L - Milligrams per Liter.

mV - Millivolts.

SU - Standard units.

umhos/cm - Micromhos per centimeter.

°C - Degrees Celcius.

NTU - Nephelometric Turbidity Unit.

Table 2
Summary of Field Parameter Results – November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Downgradient (Continued)							
BCC-MW-15018	11/29/2018	0.55	-6.3	6.9	648	10.08	0.70
BCC-MW-15019	11/30/2018	1.06	-10.4	6.9	812	11.65	2.48
BCC-MW-15020	11/30/2018	1.29	3.9	6.9	710	12.10	0.54
BCC-MW-15021	11/30/2018	1.96	-16.8	6.7	1,076	12.06	1.20
BCC-MW-15022	11/27/2018	0.21	1.2	7.8	1,605	11.77	0.66
BCC-MW-15023	11/29/2018	0.81	30.9	7.5	655	10.26	0.41
Shallow 2017 Wells (Downgradient)							
BCC-MW-17001	11/29/2018	0.28	-136.2	7.3	731	11.55	0.87
BCC-MW-17002	11/29/2018	0.43	-152.8	7.0	871	12.18	0.56
BCC-MW-17003	11/29/2018	0.62	0.3	7.3	516	11.17	0.70
BCC-MW-17004	11/30/2018	1.22	41.5	7.3	783	12.19	0.41
BCC-MW-17005	11/30/2018	1.23	45.8	7.6	496	12.22	1.69
BCC-MW-17006	11/30/2018	1.35	20.2	7.7	686	11.93	0.43

Notes:
mg/L - Milligrams per Liter.
mV - Millivolts.
SU - Standard units.
umhos/cm - Micromhos per centimeter.
°C - Degrees Celcius
NTU - Nephelometric Turbidity Unit.

Table 3
Summary of Background Well Groundwater Sampling Results (Analytical): November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15002	BCC-MW-15003	BCC-MW-15004	BCC-MW-15005	BCC-MW-15006	BCC-MW-15007	BCC-MW-15008
					Sample Date:	11/28/2018	11/28/2018	11/28/2018	11/27/2018	11/27/2018	11/27/2018	11/27/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	Background						
Appendix III												
Boron	ug/L	NC	500	500	7,200	434	313	158	38.5	42.5	91.0	269
Calcium	mg/L	NC	NC	NC	500	103	129	69.6	55.0	74.7	109	63.1
Chloride	mg/L	**250****	**250**	**250**	**500**	161	**737**	24.0	32.0	24.4	**718**	95.2
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250**	250	250	500	< 2.0	< 2.0	9.1	2.8	11.3	44.6	3.1
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**644**	**1,550**	342	244	298	**1,620**	474
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	7.2	7.2	6.8	7.4	7.2	6.8	7.4
Appendix IV												
Antimony	ug/L	6	6.0	6.0	130	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	10	10	10	< 1.0	< 5.0	2.7	< 1.0	2.3	2.0	2.3
Barium	ug/L	2,000	2,000	2,000	690	76.0	108	26.3	94.4	19.1	81.4	64.1
Beryllium	ug/L	4	4.0	4.0	14	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5.0	5.0	3.1	< 0.20	< 1.0	< 0.20	< 0.20	< 0.20	< 1.0	< 0.20
Chromium	ug/L	100	100	100	11	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	40	100	100	< 6.0	< 30.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4.0	4.0	35	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0
Lithium	ug/L	NC	170	350	440	< 10	11	< 10	< 10	< 10	< 10	19
Mercury	ug/L	2	2.0	2.0	0.20#	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	73	210	3,200	< 5.0	< 25.0	< 5.0	< 5.0	< 5.0	< 25.0	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC	< 0.719	< 0.862	< 0.798	< 0.890	< 0.938	< 0.858	1.12
Radium-228	pCi/L	NC	NC	NC	NC	1.10	1.13	< 0.786	1.01	0.758	1.07	< 0.533
Radium-226/228	pCi/L	5	NC	NC	NC	< 1.58	1.85	< 1.58	< 1.43	< 1.69	< 1.61	1.53
Selenium	ug/L	50	50	50	5.0	< 1.0	< 1.0	< 1.0	< 1.0	1.1	< 1.0	< 1.0
Thallium	ug/L	2	2.0	2.0	3.7	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 10.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 154 mg CaCO3/L as measured at surface water sample SW-01 collected on February 22, 2018 from the North Channel Muskegon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 4
Summary of Groundwater Sampling Results (Analytical): November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15009	BCC-MW-15010	BCC-MW-15011	BCC-MW-15012	BCC-MW-15013	BCC-MW-15014	BCC-MW-15015	BCC-MW-15016
					Sample Date:	11/28/2018	11/28/2018	11/28/2018	11/28/2018	11/29/2018	11/29/2018	11/29/2018	11/29/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	**7,200**	**1,690**	**1,850**	**1,650**	**1,280**	**1,070**	**1,400**	**505**	80.8
Calcium	mg/L	NC	NC	NC	500	27.9	115	29.5	55.7	50.8	51.1	50.8	169
Chloride	mg/L	250**	250	250	500	51.1	39.6	26.3	21.5	21.3	20.5	17.8	201
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	**250****	**250**	**250**	**500**	19.2	48.3	21.9	137	5.9	12.4	13.2	< 2.0
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**454**	**590**	182	302	210	224	238	**968**
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	**9.8**	7.5	**8.9**	**9.8**	7.0	**11.5**	7.8	6.6
Appendix IV													
Antimony	ug/L	6	6.0	6.0	130	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	10	10	10	4.1	< 1.0	7.3	1.3	< 1.0	4.0	4.3	1.3
Barium	ug/L	2,000	2,000	2,000	**690**	10.2	68.1	18.5	51.7	39.5	604	41.0	548
Beryllium	ug/L	4	4.0	4.0	14	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5.0	5.0	3.1	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	100	100	11	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.3
Cobalt	ug/L	NC	40	100	100	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4.0	4.0	35	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440	20	51	18	10	23	21	14	< 10
Mercury	ug/L	2	2.0	2.0	0.20#	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	**73**	210	3,200	5.2	< 5.0	13.9	28.3	5.0	**106**	7.2	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC	< 0.567	< 0.820	< 0.771	0.700	< 0.696	< 1.52	< 0.677	1.75
Radium-228	pCi/L	NC	NC	NC	NC	< 0.903	< 0.805	< 0.747	< 0.992	< 0.728	< 1.73	< 1.07	2.20
Radium-226/228	pCi/L	**5**	NC	NC	NC	< 1.47	< 1.63	< 1.52	1.27	< 1.42	< 3.25	< 1.75	3.95
Selenium	ug/L	50	50	50	5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.6	< 1.0	< 1.0
Thallium	ug/L	2	2.0	2.0	3.7	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 154 mg CaCO3/L as measured at surface water sample SW-01 collected on February 22, 2018 from the North Channel Muskegon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 4
Summary of Groundwater Sampling Results (Analytical): November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15017	BCC-MW-15018	BCC-MW-15019	BCC-MW-15020	BCC-MW-15021	BCC-MW-15022	BCC-MW-15023
					Sample Date:	11/29/2018	11/29/2018	11/30/2018	11/30/2018	11/30/2018	11/27/2018	11/29/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient						
Appendix III												
Boron	ug/L	NC	**500**	**500**	**7,200**	73.2	488	**1,540**	**721**	**798**	**3,840**	**1,350**
Calcium	mg/L	NC	NC	NC	500	242	101	98.2	81.5	96.6	265	116
Chloride	mg/L	250**	250	250	500	193	49.1	42.6	49.6	120	23.1	17.0
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	**250****	**250**	**250**	**500**	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	**953**	156
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**1,110**	426	**556**	428	**534**	**1,670**	**530**
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	6.7	6.9	6.9	6.9	6.7	7.8	7.5
Appendix IV												
Antimony	ug/L	6	6.0	6.0	130	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	10	10	10	1.8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	2,000	2,000	**690**	**824**	127	114	119	224	242	90.4
Beryllium	ug/L	4	4.0	4.0	14	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5.0	5.0	3.1	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	100	100	11	3.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	40	100	100	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4.0	4.0	35	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440	< 10	22	26	20	< 10	25	20
Mercury	ug/L	2	2.0	2.0	0.20#	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	**73**	210	3,200	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	47.6	6.6
Radium-226	pCi/L	NC	NC	NC	NC	1.93	< 0.842	< 0.880	1.14	1.49	< 0.596	< 0.537
Radium-228	pCi/L	NC	NC	NC	NC	3.19	< 0.997	1.16	0.925	1.12	< 0.807	< 1.18
Radium-226/228	pCi/L	**5**	NC	NC	NC	**5.12**	< 1.84	< 1.77	2.07	2.61	< 1.40	< 1.72
Selenium	ug/L	50	50	50	5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	2.0	2.0	3.7	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 154 mg CaCO3/L as measured at surface water sample SW-01 collected on February 22, 2018 from the North Channel Muskegon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 4
Summary of Groundwater Sampling Results (Analytical): November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-17001	BCC-MW-17002	BCC-MW-17003	BCC-MW-17004	BCC-MW-17005	BCC-MW-17006
					Sample Date:	11/29/2018	11/29/2018	11/29/2018	11/30/2018	11/30/2018	11/30/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	Shallow 2017 Wells (downgradient)					
Appendix III											
Boron	ug/L	NC	**500**	**500**	**7,200**	**1,480**	**9,030**	**410**	**601**	350	**630**
Calcium	mg/L	NC	NC	NC	500	135	197	88.7	116	68.1	99.8
Chloride	mg/L	250**	250	250	500	29.0	16.8	19.1	18.7	18.5	20.4
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	**250****	**250**	**250**	**500**	**148**	**402**	49.6	166	42.1	102
Total Dissolved Sclids	mg/L	**500****	**500**	**500**	**500**	**568**	**800**	362	500	318	432
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.3	7.0	7.3	7.3	7.6	7.7
Appendix IV											
Antimony	ug/L	6	6.0	6.0	130	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	10	10	10	< 1.0	2.0	< 1.0	2.1	< 1.0	6.6
Barium	ug/L	2,000	2,000	2,000	**690**	74.4	97.7	92.7	252	131	68.6
Beryllium	ug/L	4	4.0	4.0	14	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5.0	5.0	3.1	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	100	100	11	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	40	100	100	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4.0	4.0	35	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440	64	120	19	14	11	32
Mercury	ug/L	2	2.0	2.0	0.20#	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	73	210	3,200	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC	< 0.942	< 0.968	< 0.685	< 0.766	< 0.592	1.13
Radium-228	pCi/L	NC	NC	NC	NC	0.989	2.01	< 0.695	< 0.790	< 0.656	1.06
Radium-226/228	pCi/L	**5**	NC	NC	NC	< 1.69	2.29	< 1.38	< 1.56	< 1.25	2.19
Selenium	ug/L	50	50	50	5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	2.0	2.0	3.7	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 154 mg CaCO3/L as measured at surface water sample SW-01 collected on February 22, 2018 from the North Channel Muskegon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 5

Summary of Groundwater Protection Standard Exceedances – November 2018

BC Cobb – RCRA CCR Monitoring Program

Muskegon, Michigan

Constituent	Units	GWPS	BCC-MW-15009		BCC-MW-15010		BCC-MW-15014		BCC-MW-15017		BCC-MW-17001		BCC-MW-17002	
			LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL
Arsenic	ug/L	10	1.4	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lithium	ug/L	40	NA	NA	8.9	77	NA	NA	NA	NA	55	77	99	180
Molybdenum	ug/L	100	NA	NA	NA	NA	58	130	NA	NA	NA	NA	NA	NA
Radium 226/228	pCi/L	5	NA	NA	NA	NA	NA	NA	4.4	5.8	NA	NA	NA	NA

Notes:

ug/L - micrograms per Liter.

GWPS - Groundwater Protection Standard as established in TRC's Technical Memorandum dated October 15, 2018.

NA - Not Applicable; well/parameter pair did not directly exceed the GWPS and was not included in further analysis.

UCL - Upper Confidence Limit (α = 0.01) of the downgradient data set.

LCL - Lower Confidence Limit (α = 0.01) of the downgradient data set.

Indicates a statistically significant exceedance of the GWPS. An exceedance occurs when the LCL is greater than the GWPS.

Figures

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- APPROXIMATE POND BOUNDARY

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.
3. MONITORING WELLS BCC-MW-17001 THROUGH BCC-MW-17006 SURVEYED BY CONSUMERS ENERGY CO. ON 1/16/2018.
4. DEEP SCREENED WELLS (DEEP) ARE CHARACTERIZED BY WELL SCREENS SET BELOW 555 FEET MSL.

N

0 300 600 Feet

1" = 300'
1:3,600

PROJECT:
CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:
SITE PLAN
WITH CCR MONITORING WELL LOCATIONS

DRAWN BY:	S. MAJOR	PROJ NO.:	284111-001
CHECKED BY:	C. SCIESZKA		
APPROVED BY:	S. HOLMSTROM		**FIGURE 1**
DATE:	OCTOBER 2018		

TRC

1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 284111-001-011.mxd

Plot Date: 10/16/2018, 11:13:29 AM by SMAJOR – LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\284111-001-011.mxd
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0
TRC - GIS

[DRAFT - ELECTRONIC REVIEW]

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- APPROXIMATE POND BOUNDARY
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)
- GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.
3. MONITORING WELLS BCC-MW-17001 THROUGH BCC-MW-17006 SURVEYED BY CONSUMERS ENERGY CO. ON 1/16/2018.
4. DEEP SCREENED WELLS (DEEP) ARE CHRACTERIZED BY WELL SCREENS SET BELOW 555 FEET MSL, AND WERE NOT USED TO CONSTRUCT CONTOUR MAP.

N

0 300 600 Feet

1" = 300'
1:3,600

PROJECT: CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE: SHALLOW GROUNDWATER CONTOUR MAP NOVEMBER 27, 2018

DRAWN BY:	S. MAJOR	PROJ NO.:	322176-001
CHECKED BY:	K. LOWERY		
APPROVED BY:	S. HOLMSTROM		FIGURE 2
DATE:	MARCH 2019		

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 284111-001-014.mxd

Plot Date: 3/14/2019, 09:37:34 AM by SMAJOR – LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\284111-001-014.mxd

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

TRC - GIS

[DRAFT - ELECTRONIC REVIEW]

Attachment A
Data Quality Reviews

[DRAFT - ELECTRONIC REVIEW]

Laboratory Data Quality Review
Groundwater Monitoring Event November 2018
CEC BC Cobb

Groundwater samples were collected by TRC for the November 2018 sampling event. Samples were analyzed for anions, total dissolved solids, alkalinity, and total metals by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan, and/or for radium by Pace located in Greensburg, Pennsylvania. The antimony and selenium analyses were subcontracted by Pace in Grand Rapids, MI to the Pace facility in Indianapolis, Indiana. The laboratory analytical results are reported in laboratory reports 4620712, 4620713, 4620843, 4620844, 4620845, and 4620846.

During the November 2018 sampling event, a groundwater sample was collected from each of the following wells:

4620712/4620713

- BCC-MW-15002
- BCC-MW-15003
- BCC-MW-15004
- BCC-MW-15005
- BCC-MW-15006
- BCC-MW-15007
- BCC-MW-15008
- BCC-MW-15009
- BCC-MW-15010
- BCC-MW-15011
- BCC-MW-15012
- BCC-MW-15022

4620843/4620844

- BCC-MW-15013
- BCC-MW-15014
- BCC-MW-15015
- BCC-MW-15016
- BCC-MW-15017
- BCC-MW-15018
- BCC-MW-15019
- BCC-MW-15020
- BCC-MW-15021
- BCC-MW-15023

4620845/4620846

- BCC-MW-17001
- BCC-MW-17002
- BCC-MW-17003
- BCC-MW-17004
- BCC-MW-17005
- BCC-MW-17006

[DRAFT - ELECTRONIC REVIEW]

Each sample was analyzed for one or more of the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Alkalinity*	SM 2320B-11
Total Dissolved Solids	SM 2540C-11
Total Metals	SW-846 6020A, SW-846 6010C, SW-846 7470A
Radium (Radium-226, Radium-228, Total Radium)*	EPA 903.1, EPA 904.0

*Note that samples in laboratory reports 4620712 and 4620843 were not analyzed for alkalinity.

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2017) and the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

- Sample receipt;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field blanks are used to assess potential contamination arising from field procedures;
- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Data for laboratory duplicates, when performed on project samples. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Percent recoveries for tracer and carriers, where applicable, for radiochemistry only. Tracers and/or carriers are used to assess the chemical yield for the preparation and/or instrument efficiency;

- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation, are noted below.

- The reviewed Appendix III and IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- Sample receipt:
  - The cooler temperatures for all but one cooler in all reviewed laboratory reports were >6°C (8.2-15.4 °C); the temperature was recorded as <6°C for one of the temperature blanks in laboratory report 4620712. Further, select coolers in all reviewed laboratory reports were noted as having no ice; the laboratory could not verify which samples were in each cooler. Potential low bias exists for the positive and nondetect results for anions, alkalinity, and/or TDS in several samples, as summarized in the attached table. Concentrations were within or above the range of historical results with the following exceptions:
    - Chloride at BCC-MW-17004 was below the range of historical concentrations;
    - Chloride at BCC-MW-17005 was below the range of historical concentrations;
    - TDS and bicarbonate and total alkalinity at BCC-MW-17006 were below the range of historical concentrations; and
    - TDS at BCC-MW-15014 was below the range of historical concentrations.
  - The laboratory performing radium analysis noted that 2.5 mLs of nitric acid were added to sample BCC-MW-15017 upon receipt at the laboratory in order to meet the sample preservation requirement of pH <2. Since the sample pH was adjusted prior to analysis, there was no impact on data usability.

- A method blank was analyzed with each analytical batch. For radium, normalized absolute difference comparisons between blank and sample that are between 1.96 and 2.58 may indicate biased high results and normalized absolute differences <1.96 may indicate a false positive sample result. Target analytes were not detected in the method blanks with the following exception:
  - Radium-228 was detected in the method blank in batch 322937 at 0.758 ± 0.377 pCi/L. The positive results for radium-228 in select samples associated with this method blank were potentially impacted, as summarized in the attached table; however, radium-228 concentrations from batch 322937 samples were within the range of historical radium-228 concentrations, with the exception of BCC-MW-17006 and Dup-04 . Radium-228 at BCC-MW-17006 and DUP-04 (BCC-MW-17001) were above the range of historical results. Normalized absolute difference comparisons between blank and sample that are > 2.58 are not impacted and therefore not discussed.
- Four equipment blanks (EB-01, EB-02, EB-03, EB-04) and three field blanks (FB-01, FB-02, and FB-04) were collected. For radium, normalized absolute difference comparisons between blank and sample that are between 1.96 and 2.58 may indicate biased high results and normalized absolute differences <1.96 may indicate a false positive sample result. Normalized absolute difference comparisons between blank and sample that are > 2.58 are not impacted and therefore not discussed. Target analytes were not detected in equipment blanks and field blanks with the following exceptions:
  - Radium-228 was detected in FB-01 at 0.924 ± 0.508 pCi/L and FB-04 at 0.720 ± 0.380 pCi/L. However, the positive result for radium-228 in these samples were potentially due to method blank contamination, as summarized in the attached table. Therefore, data usability was not further affected.
  - Radium-226 was detected in EB-01 at concentration of 0.516 ± 0.362 pCi/L. The positive results for radium-226 in samples associated with this equipment blank were potentially impacted, as summarized in the attached table; however, radium-226 concentrations were within the range of historical radium-226 concentrations, with the exception of BCC-MW-15016, which was above the range of historical results.
- LCS recoveries were within laboratory control limits for all analytes.
- MS and/or MSDs were performed on the following samples:
  - BCC-MW-15022 and BCC-MW-15009 for anions, mercury, metals, radium;
  - BCC-MW-15013 for mercury;
  - BCC-MW-15015 for select metals; and
  - BCC-MW-17006 for anions, mercury, metals, alkalinity, radium.
- The MS/MSD recoveries and relative percent differences (RPDs), where applicable, were within the acceptance limits with the following exceptions:
  - The recoveries for chloride and fluoride in the MS performed on sample BCC-MW-15022 in batch 39449 were below the laboratory control limits. Potential low bias exists for the results for chloride and fluoride in this sample, as summarized in the

attached table; however, fluoride and chloride concentrations from batch 39449 were within the range of historical fluoride and chloride concentrations.

- The recoveries for sulfate in the MS/MSD performed on sample BCC-MW-15009 in batch 39508 were above the laboratory control limits. Potential high bias exists for the positive results for sulfate in the samples in this batch, as summarized in the attached table; however, sulfate concentrations from batch 39508 were within the range of historical sulfate concentrations, with the exception of BCC-MW-15007, which was above the range of historical results.
- The recoveries for selenium in the MS/MSD performed on sample BCC-MW-15009 were below the lower laboratory control limit in batch 474699. Potential low bias exists for the result for selenium in this sample, as summarized in the attached table; however, selenium concentrations were within the range of historical selenium concentrations. Note that since a second MS/MSD was performed on a project sample in this QC batch with acceptable recoveries for selenium; only the parent sample was associated with the MS/MSD nonconformances.
- The recoveries for selenium in the MS/MSD performed on sample BCC-MW-17006 were below the lower laboratory control limit in batch 474702. Potential low bias exists for the results for selenium in the samples in this batch, as summarized in the attached table; however, selenium concentrations were within the range of historical selenium concentrations.
- The MS/MSD recoveries for calcium and/or boron in the MS/MSDs performed on samples BCC-MW-15022 and BCC-MW-15009 were outside of the acceptance criteria. The calcium and boron concentrations in the parent sample, BCC-MW-15022, and the boron concentration in the parent sample, BCC-MW-15009, were >4x the spike concentration; therefore, the laboratory control limits are not applicable. Data usability is not affected.

- Laboratory duplicates were performed on the following samples:
  - BCC-MW-15022 and BCC-MW-15009 for anions, TDS;
  - BCC-MW-15015 for anions;
  - BCC-MW-15023 for TDS;
  - BCC-MW-17006 for anions, alkalinity, TDS; and
  - Dup-04 for anions.
  - RPDs were within laboratory control limits.
- The field duplicate pair samples submitted with this data set are as follows:
  - Dup-01 corresponds with BCC-MW-15008
  - Dup-02 corresponds with BCC-MW-15004
  - Dup-03 corresponds with BCC-MW-15020
  - Dup-04 corresponds with BCC-MW-17001

    - RPDs between the parent and duplicate samples were within the QC limits for all analytes.
- Carrier and tracer recoveries, where applicable, were within 30-110%.
- Reporting limits for arsenic, cadmium, chromium, cobalt, and molybdenum in BCC-MW-15003 were elevated due to a 5x dilution. These are background wells and elevated reporting limits will be taken into consideration during future statistical evaluations using background data.
- Reporting limits for cadmium, lead, molybdenum, and thallium in BCC-MW-15007 were elevated due to a 5x dilution. These are background wells and elevated reporting limits will be taken into consideration during future statistical evaluations using background data.

[DRAFT - ELECTRONIC REVIEW]

Attachment A

Summary of Data Non-Conformances for Groundwater Analytical Data
BC Cobb - RCRA CCR Detection Monitoring Program
Muskegon, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
BCC-MW-15013_20181129	11/29/2018	Fluoride, Chloride, Sulfate, TDS	Cooler(s) was received with temperature >6°C and no ice in one or more coolers. Sample results may be biased low.
BCC-MW-15014_20181129			
BCC-MW-15015_20181129			
BCC-MW-15016_20181129			
BCC-MW-15017_20181129			
BCC-MW-15018_20181129			
BCC-MW-15023_20181129			
EB-01_20181129			
EB-02_20181129			
FB-01_20181129			
BCC-MW-15019_20181130	11/30/2018		
BCC-MW-15020_20181130			
BCC-MW-15021_20181130			
EB-03_20181130			
FB-02_20181130			
Dup-03_20181130			
BCC-MW-17001_20181129	11/29/2018	Fluoride, Chloride, Sulfate, Total Alkalinity, Bicarbonate Alkalinity, Carbonate Alkalinity, TDS	
BCC-MW-17002_20181129			
BCC-MW-17003_20181129			
Dup-04_20181129			
FB-04_20181129			
BCC-MW-17004_20181130	11/30/2018		
BCC-MW-17005_20181130			
BCC-MW-17006_20181130			
EB-04_20181130			
BCC-MW-15005_20181127	11/27/2018	Fluoride, Chloride, Sulfate, TDS	
BCC-MW-15006_20181127			
BCC-MW-15007_20181127			
BCC-MW-15008_20181127			
BCC-MW-15022_20181127			
Dup-01_20181127			
BCC-MW-15002_20181128	11/28/2018		
BCC-MW-15003_20181128			
BCC-MW-15004_20181128			
BCC-MW-15009_20181128			
BCC-MW-15010_20181128			
BCC-MW-15011_20181128			
BCC-MW-15012_20181128			
Dup-02_20181128			

Attachment A

Summary of Data Non-Conformances for Groundwater Analytical Data
BC Cobb - RCRA CCR Detection Monitoring Program
Muskegon, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
FB-01_20181129	11/29/2018	Radium-228	Detection in the method blank. Normalized absolute difference between blank and samples <1.96; indicates possible false positive results.
BCC-MW-15016_20181129	11/29/2018		
BCC-MW-17001_20181129	11/29/2018		
BCC-MW-17002_20181129	11/29/2018		
BCC-MW-17006_20181130	11/30/2018		
Dup-04_20181129	11/29/2018		
FB-04_20181129	11/29/2018		
BCC-MW-15016_20181129	11/29/2018	Radium-226	Detection in the equipment blank (EB-01). Normalized absolute difference between blank and samples <1.96; indicates possible false positive results.
BCC-MW-15017_20181129	11/29/2018		
BCC-MW-15004_20181128	11/28/2018	Sulfate	MS/MSD recoveries above the upper laboratory control limits. Sample result may be biased high.
BCC-MW-15005_20181127	11/27/2018		
BCC-MW-15006_20181127	11/27/2018		
BCC-MW-15007_20181127	11/27/2018		
BCC-MW-15008_20181127	11/27/2018		
BCC-MW-15009_20181128	11/28/2018		
BCC-MW-15010_20181128	11/28/2018		
BCC-MW-15011_20181128	11/28/2018		
BCC-MW-15012_20181128	11/28/2018		
Dup-01_20181127	11/27/2018		
Dup-02_20181128	11/28/2018		
BCC-MW-17001_20181129	11/29/2018	Selenium	MS/MSD recoveries below the lower laboratory control limits. Sample result may be biased low; however, data were within range of historical concentrations.
BCC-MW-17002_20181129	11/29/2018		
BCC-MW-17003_20181129	11/29/2018		
BCC-MW-17004_20181130	11/30/2018		
BCC-MW-17005_20181130	11/30/2018		
BCC-MW-17006_20181130	11/30/2018		
Dup-04_20181129	11/29/2018		
EB-04_20181130	11/30/2018		
FB-04_20181129	11/29/2018		
BCC-MW-15009_20181128	11/28/2018		
BCC-MW-15022_20181127	11/27/2018	Fluoride, chloride	MS recoveries below the lower laboratory control limits. Sample result may be biased low; however, data were within range of historical concentrations.

Attachment B
Statistical Evaluation of November 2018 Assessment Monitoring Sampling Event

[DRAFT - ELECTRONIC REVIEW]

Technical Memorandum

Date: March 14, 2019

To: Michelle Marion, CEC

cc: Brad Runkel, CEC
JR Register, CEC
Bethany Swanberg, CEC

From: Darby Litz, TRC
Sarah Holmstrom, TRC
Kristin Lowery, TRC

Project No.: 284111.0000.0000

Subject: Statistical Evaluation of November 2018 Assessment Monitoring Sampling Event BC Cobb Bottom Ash Pond & Ponds 0-8 CCR Unit, Consumers Energy Company, Muskegon, Michigan

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During the statistical evaluation of the initial assessment monitoring event, lithium was present in one or more downgradient monitoring wells at statistically significant levels exceeding the Groundwater Protection Standards (GWPSs). Therefore, Consumers Energy Company (CEC) will initiate an Assessment of Corrective Measures (ACM) within 90 days from when the Appendix IV exceedance was determined (no later than April 14, 2019).

Currently, CEC is continuing semiannual assessment monitoring in accordance with §257.95 of the CCR Rule[1] at the BC Cobb Power Plant (BCC) Bottom Ash Pond and Ponds 0-8 (collectively the BCC Ponds). The second semiannual assessment monitoring event for 2018 was conducted on November 27 through November 30, 2018. In accordance with §257.95, the assessment monitoring data must be compared to GWPSs to determine whether or not Appendix IV constituents are detected at statistically significant levels above the GWPSs. GWPSs were established in accordance with §257.95(h), as detailed in the October 15, 2018 *Groundwater Protection Standards* technical memorandum, which was also included in the *2018 Annual Groundwater Monitoring Report* (TRC, January 2019). The following

[1] USEPA final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) published April 17, 2015, as amended per Phase One, Part One of the CCR Rule (83 FR 36435).

[DRAFT - ELECTRONIC REVIEW]

narrative describes the methods employed and the results obtained and the Sanitas™ output files are included as an attachment.

The statistical evaluation of the second semiannual assessment monitoring event data indicates that the following constituent is present at statistically significant levels exceeding the GWPS in downgradient monitoring wells at the BCC Ponds:

Constituent	GWPS	# Downgradient Wells Observed
Lithium	40 ug/L	2 of 21

These results are consistent with the results of the initial assessment monitoring data statistical evaluation and CEC will continue to initiate an assessment of corrective measures per §257.95(g). CEC will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Assessment Monitoring Statistical Evaluation

The compliance monitoring wells BCC-MW-15009 through BCC-MW-15014 encircle the BAP, while BCC-MW-15015 through BCC-MW-15023 and BCC-MW-17001 through BCC-MW-17006 are located at the outer edge of the peninsula formed by the bottom ash pond system. Because the perimeter and interior berms within the ash management area were constructed in part with ash and bodies of water surround the ash management area, wells could not be installed entirely beyond the CCR material boundary.

Following the second semiannual assessment monitoring event, compliance well data for the BCC Ponds were evaluated in accordance with the *Groundwater Statistical Evaluation Plan* (Stats Plan) (TRC, October 2017). An assessment monitoring program was developed to evaluate concentrations of CCR constituents present in the uppermost aquifer relative to acceptable levels (i.e. GWPSs). In order to decide as to whether or not the GWPSs have been exceeded, the change in concentration observed at the downgradient wells during a given assessment monitoring event must be large enough, after accounting for variability in the sample data, that the result is unlikely to have occurred merely by chance. Consistent with the Unified Guidance[2], the preferred method for comparisons to a fixed standard are confidence limits. Based on the number of historical observations in the representative sample population, the population mean, the population standard deviation, and a selected confidence level (*i.e.* 99 percent), an upper and lower confidence limit is calculated. The true concentration, with 99 percent confidence, will fall between and lower and upper confidence limits.

[2] USEPA. 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance.* Office of Conservation and Recovery. EPA 530/R-09-007.

[DRAFT - ELECTRONIC REVIEW]

The concentrations observed in the downgradient wells are deemed to be a statistically significant exceedance when the 99 percent lower confidence limit of the downgradient data exceeds the GWPS. If the confidence interval straddles the GWPS (i.e. the lower confidence level is below the GWPS but the upper confidence level is above), the statistical test results are inconclusive and there is not compelling evidence that the measured concentration is a result of a release from the CCR unit versus the inherent variability of the sample data. This statistical approach is consistent with the statistical methods for assessment monitoring presented in §257.93(f) and (g). Statistical evaluation methodologies built into the CCR Rule, and numerous other federal rules, are key in determining whether or not individually measured data points represent a concentration increase over the baseline or a fixed standard (such as a GWPS in an assessment monitoring program).

For each detected Appendix IV constituent, the concentrations for each well were first compared directly to the GWPS, as shown on Table A1. Due to the significant operational changes that occurred within the ash management area and immediately adjacent to it during the CCR Rule baseline period, where groundwater flow rates and directions were changed drastically over relatively short periods of time, the data set used for statistical evaluation was limited to the four most recent events relative to the timeline of other factors that could be affecting observations of constituents in groundwater that are unrelated to releases from the ponds. Limiting the data set to the four most recent data points is appropriate for the BCC Ponds to allow for evaluation of groundwater quality that is representative of current conditions that excludes variability in the sample data set caused by the observed changes in site conditions that would not be indicative of a release from the BCC Ponds. Those observed changes are attributed to several possibilities including cessation of hydraulic loading in the BCC Ponds in April 2016, changes in the analytical laboratory being used, and pumping from Veteran's Memorial Pond (pumping influence observed from July 2017 through September 2017; construction completed in December 2017). These activities have the potential to influence the results of the statistical analysis by including data that may have different reporting limits or may have been biased low or high due to changing site conditions, introducing additional variability and uncertainty in the results that is inconsistent with the natural groundwater data distribution. Use of the four most recent data points relative to the timeline of other site factors is adequate in providing the minimum density of data for the statistical analysis as recommended per the Unified Guidance; therefore, no less than four data points are used to minimize bias from external influences.

For the BCC-MW-15000-series monitoring wells, the confidence interval tests included data collected between July 2017 and November 2018. For the BCC-MW-17000-series wells, the confidence interval tests included data collected between February 2018 and November 2018 (four out of the five data points accumulated since wells were installed in December 2017). Parameter-well combinations that included a direct exceedance of the GWPS during these timeframes were retained for further analysis. Arsenic in BCC-MW-15009, lithium in BCC-MW-15010, BCC-MW-17001, and BCC-MW-17002, molybdenum in BCC-MW-15014, and radium 226/228 in BCC-MW-15017 had individual results exceeding the GWPS.

[DRAFT - ELECTRONIC REVIEW]

Groundwater data were then evaluated utilizing Sanitas™ statistical software. Sanitas™ is a software tool that is commercially available for performing statistical evaluation consistent with procedures outlined in the Unified Guidance. Within the Sanitas™ statistical program, confidence limits were selected to perform the statistical comparison of compliance data to a fixed standard. Parametric and non-parametric confidence intervals were calculated, as appropriate, for each of the CCR Appendix IV parameters using a 99 percent confidence level, i.e., a significance level (α) of 0.01. The following narrative describes the methods employed, the results obtained and the Sanitas™ output files are included as an attachment.

The statistical data evaluation included the following steps:

- Review of data quality checklists for the data sets;
- Graphical representation of the monitoring data as time versus concentration by well-constituent pair;
- Outlier testing of individual data points that appear from the graphical representations as potential outliers;
- Evaluation of visual trends apparent in the graphical representations for statistical significance;
- Evaluation of percentage of non-detects for each well-constituent pair;
- Distribution of the data; and
- Calculation of the confidence intervals for each cumulative dataset.

The results of these evaluations are presented and discussed below.

Data from each round were evaluated for completeness, overall quality, and usability and were deemed appropriate for the purposes of the CCR assessment monitoring program. Initially, the recent baseline for the BCC-MW-15000-series monitoring wells (from July 2017 to November 2018) and for the BCC-MW-17000-series wells (February 2018 to November 2018) were observed visually for potential trends. No outliers or significant trends were identified.

The Sanitas™ software was then used to test compliance at the downgradient monitoring wells using the confidence interval method for the most recent four sampling events. The software outputs are included in Attachment 1 along with data reports showing the values used for the evaluation. The percentage of non-detect observations are also included in Attachment 1. Non-detect data was handled in accordance with the Stats Plan for the purposes of calculating the confidence intervals. The tests were run with a per-well significance of $\alpha = 0.01$.

The Sanitas™ software generates an output that includes graphs of the parametric or non-parametric confidence intervals for each well along with notes on data transformations, as appropriate. The data sets with direct exceedances of the GWPS were found to be normally distributed. The confidence interval test compares the lower confidence limit to the GWPS.

[DRAFT - ELECTRONIC REVIEW]

The statistical evaluation of the Appendix IV parameters shows exceedances for lithium at BCC-MW-17001 and BCC-MW-17002. The lower confidence limits for the other Appendix IV constituents statistically evaluated at BCC-MW-15009, BCC-MW-15010, BCC-MW-15014, and BCC-MW-15017 were below their respective GWPSs. These results are consistent with the results of the initial assessment monitoring data statistical evaluation and CEC will continue to initiate an assessment of corrective measures per §257.95(g). CEC will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Although the four most recent data points are used to statistically evaluate the November 2018 data, statistical analysis using the eight most recent data points are also included in Attachment 2 for reference to compare the outcome using both approaches. Using eight data points results in the same outcome as using the four most recent data points and shows exceedances for lithium at BCC-MW-17001 and BCC-MW-17002. For the BCC-MW-15000-series monitoring wells, the confidence interval tests included data collected between July 2016 and November 2018. For the BCC-MW-17000-series wells, the confidence interval tests included data collected between December 2017 and November 2018 (only five data points are available since wells were installed in December 2017). Statistically significant decreasing trends were observed for arsenic in BCC-MW-15009 and BCC-MW-15017 (note that these trends are not present in the statistical evaluation based on the four most recent data points). Potential outliers were identified for arsenic (high values in December 2017 at BCC-MW-17002 and BCC-MW-17003) and lithium (low value in December 2017 at BCC-MW-17002).

The Dixon's Outlier Test in Sanitas™ was used to test the potential outlier in the arsenic and lithium data sets for BCC-MW-17002 and BCC-MW-17003 that were identified in the time versus concentration graphs (Attachment 2). The suspect arsenic value for BCC-MW-17002 was found to be an outlier at the 0.05 significance level. With the outlier removed, Sanitas™ found that the arsenic data at BCC-MW-17002 was normally distributed at the 0.01 significance level. The outlier data point was excluded from the confidence interval calculations. The suspect arsenic value at BCC-MW-17003 and lithium value at BCC-MW-17002 were found to not be outliers at the 0.05 significance level and were included in the confidence interval calculations that use available data up to eight data points. The data sets with direct exceedances of the GWPS were found to be normally distributed, with the exception of arsenic in BCC-MW-17003 and lithium in BCC-MW-15010. The software outputs are included in Attachment 2 along with data reports showing the values used for the evaluation.

Sincerely,

TRC

Graham Crockford
Program Manager

Sarah B. Holmstrom
Project Hydrogeologist

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Attachments

Table A1.	Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
Attachment 1	Sanitas™ Output (n=4)
Attachment 2	Sanitas™ Output (n=8)

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Table

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15009												
					Sample Date:	12/1/2015	2/17/2016	4/18/2016	7/12/2016	9/28/2016	2/14/2017	4/5/2017	7/11/2017	7/11/2017	9/13/2017	4/16/2018	6/13/2018	11/28/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient												
Appendix III														Field Dup				
Boron	ug/L	NC	NA	1,320	NA	2,380	2,520	2,170	2,070	2,190	2,110	2,190	2,210	1,690	2,120	--	1,670	1,690
Calcium	mg/L	NC	NA	259	NA	42.7	44.1	40.1	44.1	46.7	37.7	38.2	37.6	36.5	34.9	--	42.4	27.9
Chloride	mg/L	250*	NA	5,980	NA	24	24.0	27.1	26.9	24.3	22.8	24.9	26.3	26.3	26	--	95.7	51.1
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	63	39.3	49.5	55.2	49.1	31.6	39.8	43.0	47.2	41.7	--	< 2.0	19.2
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	240	230	220	220	230	200	190	216	246	188	--	456	454
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	10.6	10.8	10.3	10.0	10.0	10.2	10.1	9.6	--	10.2	9.8	9.8	9.8
Appendix IV																		
Antimony	ug/L	6	NA	1	6	1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	**45**	**31**	**24**	**24**	**20**	**14**	**13**	**12**	**10.8**	--	9.4	8.5	4.1
Barium	ug/L	2,000	NA	340	2,000	16	12	11	11	11	9	10	13.2	10.8	--	16.5	13.8	10.2
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	< 1	1	2	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	15.6	14.6	15	14	14	13	14	19	19	--	24	21	20
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	57	60	50	49	49	40	38	43.7	41.8	--	16.0	11.6	5.2
Radium-226	pCi/L	NC	NA	NA	NA	< 0.166	< 0.157	< 0.209	< 0.158	< 0.269	< 0.159	< 0.347	< 0.756	< 0.887	--	< 0.934	< 0.580	< 0.567
Radium-228	pCi/L	NC	NA	NA	NA	< 0.451	< 0.475	< 0.467	< 0.461	< 0.628	0.678	< 0.502	< 1.96	< 2.96	--	< 0.957	< 3.27	< 0.903
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.451	< 0.475	< 0.467	< 0.461	< 0.628	0.747	< 0.502	< 2.72	< 3.95	--	< 1.89	< 3.85	< 1.47
Selenium	ug/L	50	NA	3	50	< 1	< 1	2	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15010												
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/13/2016	9/28/2016	2/14/2017	4/5/2017	7/11/2017	9/13/2017	9/13/2017	4/16/2018	6/14/2018	11/28/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient												
Appendix III															Field Dup			
Boron	ug/L	NC	NA	1,320	NA	1,970	1,510	1,340	1,270	1,570	1,440	1,760	1,340	1,770	1,770	--	2,100	1,850
Calcium	mg/L	NC	NA	259	NA	71.2	51.9	37.4	58.2	66.4	49.8	80.5	40.7	129	133	--	133	115
Chloride	mg/L	250*	NA	5,980	NA	23	22.5	21.5	22.7	25.1	22.3	24.2	25.5	24.5	24.4	--	29.3	39.6
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	120	52.6	31.0	50.7	69.7	24.2	53.5	24.8	143	143	--	73.7	48.3
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	410	270	220	260	320	250	360	288	570	618	--	636	590
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.7	7.8	7.8	7.8	8.0	8.0	7.8	7.8	7.8	--	7.8	7.4	7.5
Appendix IV																		
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	49	34	28	42	45	31	51	29.2	--	--	63.4	64.8	68.1
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	< 1	2	< 1	< 1	1	< 1	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	--	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	36.1	22.7	18	15	22	14	18	21	--	--	**46**	**54**	**51**
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	33	29	27	15	20	9	7	16.2	--	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.302	< 0.217	< 0.244	< 0.145	< 0.297	< 0.179	< 0.216	< 0.642	--	--	< 0.869	0.661	< 0.820
Radium-228	pCi/L	NC	NA	NA	NA	0.849	< 0.502	< 0.447	0.420	0.728	< 0.363	< 0.380	< 0.956	--	--	< 0.877	< 0.978	< 0.805
Radium-226/228	pCi/L	5	NA	2.42	**5**	0.973	< 0.502	< 0.447	0.451	0.82	< 0.363	< 0.38	< 1.60	--	--	< 1.75	< 1.45	< 1.63
Selenium	ug/L	50	NA	3	50	< 1	< 1	1	1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	--	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15011											
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/12/2016	9/28/2016	2/14/2017	4/5/2017	7/11/2017	9/13/2017	4/16/2018	6/13/2018	11/28/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient											
Appendix III																	
Boron	ug/L	NC	NA	1,320	NA	1,680	1,420	1,340	1,210	1,180	1,280	1,340	1,060	1,490	--	1,630	1,650
Calcium	mg/L	NC	NA	259	NA	53	47.6	36.9	47.3	48.0	47.9	52.0	42.2	23.9	--	22.6	29.5
Chloride	mg/L	250*	NA	5,980	NA	22	20.7	22.1	24.8	21.0	19.5	22.2	22.9	24.0	--	23.2	26.3
Fluoride	ug/L	4,000	NA	1,000	NA	1,200	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	50	30.8	35.8	43.8	38.5	37.2	42.8	29.1	6.4	--	12.3	21.9
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	270	230	210	240	230	230	240	224	140	--	244	182
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	8.7	8.5	8.2	8.5	8.7	9.2	9.0	8.2	8.5	9.1	8.5	8.9
Appendix IV																	
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	5	3	3	4	6	7	8	< 1.0	--	6.4	1.5	7.3
Barium	ug/L	2,000	NA	340	2,000	36	29	25	30	31	31	32	30.7	--	15.2	16.6	18.5
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	1	< 1	2	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	1,200	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	17.2	16	14	15	16	17	17	20	--	21	11	18
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	20	29	35	26	27	25	22	21.4	--	8.9	5.8	13.9
Radium-226	pCi/L	NC	NA	NA	NA	< 0.199	< 0.141	< 0.319	< 0.166	< 0.284	< 0.160	< 0.296	< 1.12	--	< 0.742	0.350	< 0.771
Radium-228	pCi/L	NC	NA	NA	NA	0.956	< 0.447	< 0.435	< 0.402	< 0.496	< 0.394	< 0.599	< 0.954	--	< 0.872	< 0.923	< 0.747
Radium-226/228	pCi/L	5	NA	2.42	**5**	1.01	< 0.447	< 0.435	< 0.402	< 0.496	< 0.394	< 0.599	< 2.07	--	< 1.61	< 1.25	< 1.52
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15012											
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	9/13/2017	4/17/2018	6/13/2018	11/28/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient											
Appendix III																	
Boron	ug/L	NC	NA	1,320	NA	961	1,390	1,830	1,450	1,470	1,380	1,500	1,340	1,140	--	1,450	1,280
Calcium	mg/L	NC	NA	259	NA	49.5	82.1	65.5	44.5	43.5	32.0	34.9	24.6	48.7	--	95.1	55.7
Chloride	mg/L	250*	NA	5,980	NA	20	20.4	23.7	23.0	22.6	19.7	22.7	24.1	23.3	--	22.7	21.5
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,200	1,100	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	69	111	106	65.6	50.9	55.7	57.2	21.8	59.6	--	355	137
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	300	370	340	250	210	190	200	168	318	--	902	302
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	8.0	8.1	8.1	8.9	9.2	8.6	8.5	9.9	11.4	9.7	10.2	9.8
Appendix IV																	
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	< 1	2	8	**12**	9	2	3	6.1	--	1.8	3.4	1.3
Barium	ug/L	2,000	NA	340	2,000	40	63	68	34	22	25	28	14.3	--	109	105	51.7
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	< 1	1	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,200	1,100	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	15.6	20.8	19	18	15	11	12	12	--	13	11	10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	29	9	35	37	44	35	27	94.5	--	50.8	71.3	28.3
Radium-226	pCi/L	NC	NA	NA	NA	< 0.164	< 0.243	< 0.256	< 0.216	< 0.335	< 0.153	< 0.243	0.436	--	< 0.693	< 0.526	0.700
Radium-228	pCi/L	NC	NA	NA	NA	< 0.471	< 0.634	0.827	< 0.539	< 0.548	< 0.416	< 0.554	< 2.08	--	< 0.733	< 0.789	< 0.992
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.471	< 0.634	0.919	< 0.539	< 0.548	< 0.416	< 0.554	< 2.28	--	< 1.43	< 1.32	1.27
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1.2	--	1.2	3.3	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15013													
					Sample Date:	12/1/2015	2/18/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	9/13/2017	4/17/2018	4/17/2018	6/13/2018	6/13/2018	11/29/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient													
Appendix III																Field Dup		Field Dup	
Boron	ug/L	NC	NA	1,320	NA	1,140	1,290	1,180	1,080	1,090	1,050	1,120	916	1,270	--	--	1,130	1,100	1,070
Calcium	mg/L	NC	NA	259	NA	65.2	58.3	47.5	48.4	59.7	52.5	50.9	43.9	34.4	--	--	47.3	48.9	50.8
Chloride	mg/L	250*	NA	5,980	NA	21	20.9	21.5	21.0	22.9	19.8	19.9	23.4	21.2	--	--	21.5	21.6	21.3
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	89	44.3	34.3	27.5	31.3	23.1	15.1	8.7	59.9	--	--	8.7	7.9	5.9
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	330	290	260	250	250	260	250	240	192	--	--	324	268	210
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.6	7.2	7.4	7.3	7.4	7.7	7.4	7.4	7.9	7.6	--	7.7	--	7.0
Appendix IV																			
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	71	58	49	47	51	52	48	41.9	--	43.3	44.7	43.9	41.1	39.5
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	< 1	2	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	17.5	19.9	18	17	18	18	17	23	--	27	28	24	24	23
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	17	20	21	12	11	10	9	7.7	--	< 5.0	< 5.0	< 5.0	< 5.0	5.0
Radium-226	pCi/L	NC	NA	NA	NA	0.272	< 0.299	0.173	< 0.181	< 0.215	< 0.230	< 0.215	0.731	--	< 0.505	< 0.506	< 0.546	< 0.585	< 0.696
Radium-228	pCi/L	NC	NA	NA	NA	0.914	< 0.527	0.727	0.483	< 0.598	< 0.481	< 0.516	< 0.940	--	< 0.633	< 0.780	< 0.754	< 0.903	< 0.728
Radium-226/228	pCi/L	5	NA	2.42	**5**	1.19	< 0.527	0.9	0.596	< 0.598	< 0.481	< 0.516	< 1.56	--	< 1.14	< 1.29	< 1.30	< 1.49	< 1.42
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15014											
					Sample Date:	12/1/2015	2/18/2016	4/18/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	9/13/2017	4/17/2018	6/13/2018	11/29/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient											
Appendix III																	
Boron	ug/L	NC	NA	1,320	NA	2,560	2,230	1,840	1,630	1,690	1,530	1,560	1,300	1,410	--	1,370	1,400
Calcium	mg/L	NC	NA	259	NA	75.6	75.3	63.9	73.5	64.7	66.3	65.3	61.8	57.8	--	50.8	51.1
Chloride	mg/L	250*	NA	5,980	NA	21	21.9	21.9	22.0	22.7	18.6	22.1	22.4	22.5	--	21.3	20.5
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	43	34.7	31.4	35.6	23.7	27.8	23.9	24.9	19.2	--	2.4	12.4
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	350	310	270	290	250	280	270	292	282	--	338	224
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	11.5	11.6	11.2	11.0	11.1	11.5	11.3	11.5	12.0	11.6	11.4	11.5
Appendix IV																	
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1.7	--	1.1	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	**15**	**11**	**11**	8	9	7	7	8.4	--	6.2	5.5	4.0
Barium	ug/L	2,000	NA	340	2,000	329	376	257	508	357	571	546	732	--	779	607	604
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	2	1	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	19	--	27	16	21
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	**119**	76	58	69	81	80	77	70.9	--	94.7	100	**106**
Radium-226	pCi/L	NC	NA	NA	NA	< 0.176	< 0.175	< 0.177	0.214	< 0.218	< 0.211	< 0.289	< 0.511	--	< 1.11	< 1.17	< 1.52
Radium-228	pCi/L	NC	NA	NA	NA	1.23	< 0.735	< 0.562	< 0.606	< 0.485	0.810	< 0.423	< 1.07	--	< 0.972	< 1.85	< 1.73
Radium-226/228	pCi/L	5	NA	2.42	**5**	1.31	< 0.735	< 0.562	< 0.606	< 0.485	0.883	< 0.423	< 1.58	--	< 2.08	< 3.02	< 3.25
Selenium	ug/L	50	NA	3	50	< 1	1	< 1	< 1	< 1	1	8	2.3	--	1.2	1.2	2.6
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
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[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15015													
					Sample Date:	12/1/2015	2/18/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	7/12/2017	9/13/2017	9/13/2017	4/17/2018	6/13/2018	11/29/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient													
Appendix III														Field Dup		Field Dup			
Boron	ug/L	NC	NA	1,320	NA	1,190	1,170	963	614	656	662	599	489	678	433	374	--	398	505
Calcium	mg/L	NC	NA	259	NA	32.8	33.0	30.6	36.2	40.1	38.4	37.6	29.4	32.3	36.9	38.8	--	45.0	50.8
Chloride	mg/L	250*	NA	5,980	NA	21	22.0	21.6	20.4	19.5	19.2	22.7	20.1	20.0	20.3	20.3	--	19.5	17.8
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	7.8	6.56	8.34	13.9	9.26	10.4	13.8	18.8	17.9	16.1	15.6	--	12.6	13.2
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	220	200	190	180	180	200	190	166	190	192	274	--	316	238
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.6	7.4	7.4	7.4	7.8	7.7	7.6	8.4	--	8.7	--	8.3	7.9	7.8
Appendix IV																			
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	2	2	2	6	5	5	6	6.4	7.6	--	--	4.7	5.5	4.3
Barium	ug/L	2,000	NA	340	2,000	23	22	21	25	28	30	28	30.1	33.6	--	--	39.9	37.9	41.0
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	< 1	1	1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	--	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	12	11	--	--	16	13	14
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	17	14	17	11	10	9	11	11.9	13.0	--	--	9.4	7.0	7.2
Radium-226	pCi/L	NC	NA	NA	NA	< 0.193	< 0.157	< 0.242	< 0.133	< 0.378	< 0.166	< 0.340	< 0.832	< 0.698	--	--	< 0.467	< 0.475	< 0.677
Radium-228	pCi/L	NC	NA	NA	NA	< 0.578	< 0.577	< 0.521	< 0.467	0.850	< 0.408	< 0.420	< 0.799	< 0.748	--	--	< 0.730	< 0.763	< 1.07
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.578	< 0.577	< 0.521	< 0.467	0.85	< 0.408	< 0.42	< 1.63	< 1.45	--	--	< 1.20	< 1.24	< 1.75
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	--	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15016											
					Sample Date:	12/1/2015	2/18/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	9/13/2017	4/17/2018	6/12/2018	11/29/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient											
Appendix III																	
Boron	ug/L	NC	NA	1,320	NA	108	119	86	100	88	92	83	85.9	83	--	76.6	80.8
Calcium	mg/L	NC	NA	259	NA	172	184	164	172	181	176	172	170	182	--	168	169
Chloride	mg/L	250*	NA	5,980	NA	200	204	203	165	204	196	200	10.4	226	--	197	201
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	980	1,000	980	920	930	990	1,000	1,050	995	--	986	968
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	6.6	6.5	6.4	6.3	6.4	6.4	6.6	6.4	6.6	6.8	6.5	6.6
Appendix IV																	
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	2	2	3	3	2	2	2	1.5	--	1.5	1.3	1.3
Barium	ug/L	2,000	NA	340	2,000	656	647	614	619	621	666	613	596	--	649	652	548
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	2	3	3	4	3	3	3	1.9	--	2.1	2.0	2.3
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.263	1.51	1.31	1.50	1.06	1.17	1.60	1.30	--	1.56	< 0.810	1.75
Radium-228	pCi/L	NC	NA	NA	NA	2.29	2.32	1.69	1.68	1.68	2.37	2.06	1.06	--	2.08	1.81	2.20
Radium-226/228	pCi/L	5	NA	2.42	**5**	2.29	3.83	3	3.18	2.74	3.54	3.66	2.36	--	3.64	2.50	3.95
Selenium	ug/L	50	NA	3	50	2	4	2	7	1	2	2	3.6	--	1.5	1.4	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15017												
					Sample Date:	12/1/2015	2/18/2016	4/18/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	9/13/2017	4/17/2018	6/12/2018	6/12/2018	11/29/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient												
Appendix III																	Field Dup	
Boron	ug/L	NC	NA	1,320	NA	59	90	66	76	78	76	75	75	82.8	--	83.8	79.0	73.2
Calcium	mg/L	NC	NA	259	NA	225	247	220	232	252	232	232	203	245	--	243	232	242
Chloride	mg/L	250*	NA	5,980	NA	200	201	184	204	182	192	187	199	224	--	224	224	193
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	850	1,100	1,200	1,100	1,100	1,200	1,100	1,230	1,130	--	1,120	1,170	1,110
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	6.5	6.4	6.4	6.4	6.4	6.6	6.5	6.4	6.5	6.8	6.5	–	6.7
Appendix IV																		
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	**13**	7	5	**12**	**12**	5	4	3	–	2.3	2.1	2.1	1.8
Barium	ug/L	2,000	NA	340	2,000	1,030	981	924	985	955	968	876	772	–	955	936	953	824
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	–	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	4	4	4	9	11	5	5	5.3	–	3.4	3.4	3.3	3.1
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	–	< 15.0	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	–	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	–	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	–	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	1.61	2.38	2.18	1.91	1.94	1.82	1.56	1.97	–	2.23	2.13	2.87	1.93
Radium-228	pCi/L	NC	NA	NA	NA	2.69	2.97	3.50	3.98	2.50	3.15	2.78	2.78	–	2.93	3.30	2.72	3.19
Radium-226/228	pCi/L	5	NA	2.42	**5**	4.3	**5.35**	**5.68**	**5.89**	4.44	4.97	4.34	4.75	–	**5.16**	**5.43**	**5.59**	**5.12**
Selenium	ug/L	50	NA	3	50	3	4	3	8	2	2	3	2.7	–	1.7	2.4	2.5	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	–	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
– - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15018														
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	9/29/2016	2/14/2017	4/5/2017	7/11/2017	7/11/2017	9/13/2017	9/13/2017	4/18/2018	4/18/2018	6/12/2018	11/29/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient														
Appendix III														Field Dup		Field Dup		Field Dup		
Boron	ug/L	NC	NA	1,320	NA	487	526	478	399	438	479	493	538	446	492	502	--	--	559	488
Calcium	mg/L	NC	NA	259	NA	88.6	100	87.9	86.8	98.5	100	92.1	84.8	81.1	90.7	89.1	--	--	87.6	101
Chloride	mg/L	250*	NA	5,980	NA	38.0	38.0	40.8	39.3	37.5	43.6	44.4	53.4	52.6	49.1	50.2	--	--	48.9	49.1
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	< 2.0	< 2.0	--	--	< 2.0	< 2.0
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	290	400	430	390	410	450	410	420	438	392	380	--	--	598	426
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.0	6.9	6.8	6.5	6.5	6.7	6.8	6.8	--	6.8	--	6.9	--	6.8	6.9
Appendix IV																				
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	10	1	< 1	< 1	2	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	155	149	139	133	143	171	149	153	143	--	--	139	141	156	127
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	1	1	1	1	< 1	1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	--	< 15.0	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	40	21.4	23.1	24	12	14	21	21	26	26	--	--	29	27	26	22
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	100	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	--	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	0.227	0.394	0.430	0.234	0.522	0.363	< 0.314	< 0.479	< 1.02	--	--	< 0.843	0.290	< 0.756	< 0.842
Radium-228	pCi/L	NC	NA	NA	NA	< 0.586	0.778	0.649	0.845	0.803	0.996	1.08	< 0.767	< 0.950	--	--	0.869	0.622	1.39	< 0.997
Radium-226/228	pCi/L	5	NA	2.42	5	< 0.586	1.17	1.08	1.08	1.33	1.36	1.37	< 1.25	< 1.97	--	--	1.59	0.912	1.77	< 1.84
Selenium	ug/L	50	NA	3	50	< 1	< 1	1	4	< 1	< 1	< 1	< 1.0	1	--	--	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	--	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15019											
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/13/2016	9/30/2016	2/15/2017	4/5/2017	7/11/2017	9/13/2017	4/18/2018	6/12/2018	11/30/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient											
Appendix III																	
Boron	ug/L	NC	NA	1,320	NA	1,530	1,590	1,440	1,320	1,260	1,370	1,410	1,430	1,010	--	1,170	1,540
Calcium	mg/L	NC	NA	259	NA	84.6	93.6	83.0	90.0	92.6	91.8	92.8	90.1	107	--	97.7	98.2
Chloride	mg/L	250*	NA	5,980	NA	34	32.4	33.7	37.7	35.6	34.5	33.6	52.5	73.9	--	67.7	42.6
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	340	390	440	410	370	410	420	470	618	--	524	556
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.0	6.8	6.9	6.7	6.4	6.8	6.9	6.8	6.7	7.0	6.7	6.9
Appendix IV																	
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	91	94	88	88	96	93	90	109	--	161	187	114
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	< 1	1	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	23.7	27.9	26	24	22	23	22	27	--	25	23	26
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	0.333	0.279	0.465	0.282	0.315	0.329	< 0.36	< 0.620	--	< 0.717	< 0.594	< 0.880
Radium-228	pCi/L	NC	NA	NA	NA	< 0.484	< 0.567	0.532	< 0.718	< 0.739	1.80	0.872	< 1.02	--	< 0.742	1.36	1.16
Radium-226/228	pCi/L	5	NA	2.42	**5**	0.674	0.798	0.997	0.969	< 0.739	2.13	0.974	< 1.64	--	< 1.46	1.75	< 1.77
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	2	< 1	< 1	< 1	1.2	--	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15020													
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	9/30/2016	2/15/2017	4/5/2017	7/11/2017	9/13/2017	4/18/2018	6/12/2018	6/12/2018	11/30/2018	11/30/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient													
Appendix III																	Field Dup		Field Dup
Boron	ug/L	NC	NA	1,320	NA	630	738	638	603	608	621	667	618	745	--	708	699	721	930
Calcium	mg/L	NC	NA	259	NA	61	67.6	59.1	60.7	66.5	67.0	66.6	68.1	107	--	96.3	91.6	81.5	81.7
Chloride	mg/L	250*	NA	5,980	NA	39	35.4	34.3	69.6	33.5	33.3	33.9	45.7	87.8	--	92.1	92.0	49.6	49.6
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	2.2	2.34	< 2	< 2	< 2	< 2	< 2	< 2.0	3	--	< 2.0	< 2.0	< 2.0	< 2.0
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	320	310	320	310	310	330	320	388	608	--	622	508	428	382
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.3	7.2	7.0	6.9	6.9	7.0	7.1	7.0	6.8	7.0	6.7	–	6.9	--
Appendix IV																			
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	48	52	51	47	54	53	52	60.4	–	148	197	196	119	115
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	–	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	2	< 1	1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	–	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	15.1	17.8	16	14	14	14	14	18	–	16	16	16	20	20
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	–	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	–	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.269	< 0.240	< 0.341	< 0.190	< 0.276	< 0.294	< 0.290	< 0.761	–	0.744	< 0.899	< 0.774	1.14	< 1.06
Radium-228	pCi/L	NC	NA	NA	NA	< 0.467	0.731	0.474	< 0.598	0.682	< 0.591	0.543	< 0.627	–	0.813	1.75	1.47	0.925	1.30
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.467	0.847	0.73	< 0.598	0.724	< 0.591	0.652	< 1.39	–	1.56	2.64	2.00	2.07	1.79
Selenium	ug/L	50	NA	3	50	< 1	1	< 1	2	< 1	< 1	< 1	1.4	–	< 1.0	< 1.0	1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	–	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
– - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15021											
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/13/2016	10/5/2016	2/15/2017	4/6/2017	7/12/2017	9/13/2017	4/18/2018	6/12/2018	11/30/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient											
Appendix III																	
Boron	ug/L	NC	NA	1,320	NA	362	489	400	425	491	465	519	519	602	--	809	798
Calcium	mg/L	NC	NA	259	NA	86.4	98.5	89.6	97.4	96.9	97.9	96.3	86.8	91.3	--	89.4	96.6
Chloride	mg/L	250*	NA	5,980	NA	88	82.7	87.2	98.3	98.9	94.6	93.9	97.0	108	--	112	120
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	610	540	570	590	620	570	560	548	490	--	576	534
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	6.8	6.8	6.8	6.7	6.8	6.9	6.9	6.8	6.8	7.1	6.8	6.7
Appendix IV																	
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	3	1	1	2	2	2	2	1.0	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	274	244	236	233	252	240	228	211	--	236	238	224
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	2	2	2	1	2	2	< 1.0	--	< 1.0	1.1	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	0.569	0.629	0.563	0.429	0.483	0.524	< 0.215	< 0.768	--	< 0.461	< 0.689	1.49
Radium-228	pCi/L	NC	NA	NA	NA	0.984	0.782	0.846	0.871	1.52	< 0.582	< 0.354	< 0.697	--	< 1.50	1.60	1.12
Radium-226/228	pCi/L	5	NA	2.42	**5**	1.55	1.41	1.41	1.3	2	0.966	< 0.354	< 1.47	--	< 1.96	1.97	2.61
Selenium	ug/L	50	NA	3	50	1	2	1	4	< 1	< 1	1	1.6	--	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15022											
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	10/5/2016	2/15/2017	4/6/2017	7/12/2017	9/13/2017	4/18/2018	6/11/2018	11/27/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient											
Appendix III																	
Boron	ug/L	NC	NA	1,320	NA	250	388	387	362	391	394	434	478	833	--	1,170	3,840
Calcium	mg/L	NC	NA	259	NA	46.7	46.4	47.8	43.0	43.7	54.1	49.3	51.8	35.2	--	38.2	265
Chloride	mg/L	250*	NA	5,980	NA	25	18.7	17.6	16.8	17.1	18.2	18.6	22.1	23.3	--	21.5	23.1
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	39	38.3	29.9	34.3	32.8	34.1	32.8	45.9	44.1	--	24.1	953
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	270	210	250	250	210	250	230	254	266	--	210	1,670
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	8.3	8.5	8.2	8.2	8.1	7.8	8.1	8.4	7.6	7.8	8.3	7.8
Appendix IV																	
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	1.9	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	6	7	8	8	6	4	4	5.8	--	< 1.0	1.1	< 1.0
Barium	ug/L	2,000	NA	340	2,000	139	119	155	116	119	137	129	138	--	102	104	242
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	1	2	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	13	11	25
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	22	16	11	17	19	12	14	13.6	--	< 5.0	< 5.0	47.6
Radium-226	pCi/L	NC	NA	NA	NA	0.246	< 0.242	< 0.247	< 0.150	< 0.346	< 0.217	< 0.291	< 0.468	--	0.666	< 0.708	< 0.596
Radium-228	pCi/L	NC	NA	NA	NA	< 0.484	< 0.450	0.740	< 0.472	< 0.514	< 0.477	0.709	< 0.799	--	< 0.644	< 0.742	< 0.807
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.484	< 0.45	0.812	< 0.472	< 0.514	< 0.477	0.862	< 1.27	--	1.13	< 1.45	< 1.40
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15023											
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	10/5/2016	2/15/2017	4/5/2017	7/11/2017	9/13/2017	4/18/2018	6/11/2018	11/29/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient											
Appendix III																	
Boron	ug/L	NC	NA	1,320	NA	414	284	267	308	526	484	1,590	701	504	--	1,650	1,350
Calcium	mg/L	NC	NA	259	NA	59.7	59.4	53.3	54.1	64.0	59.9	74.5	50.8	60.9	--	98.9	116
Chloride	mg/L	250*	NA	5,980	NA	30	26.9	24.6	28.7	24.8	23.8	24.6	26.8	25.5	--	19.4	17.0
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	20	26.5	28.9	25.0	24.3	21.0	22.5	22.6	36.2	--	139	156
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	240	270	270	290	290	280	300	290	408	--	474	530
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.4	7.5	7.5	7.5	7.4	7.6	7.6	7.6	7.6	7.6	7.4	7.5
Appendix IV																	
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	2	2	1	3	2	2	< 1	1.9	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	57	48	43	40	47	42	46	38.0	--	97.1	87.8	90.4
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	< 1	2	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	12.1	10.6	< 10	< 10	< 10	< 10	11	< 10	--	19	18	20
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	8	6	< 5	7	6	6	< 5	6.0	--	< 5.0	7.1	6.6
Radium-226	pCi/L	NC	NA	NA	NA	0.232	< 0.237	< 0.242	0.226	< 0.309	0.257	0.455	< 0.889	--	< 0.572	< 0.958	< 0.537
Radium-228	pCi/L	NC	NA	NA	NA	< 0.530	0.426	< 0.456	< 0.545	< 0.355	< 0.400	0.963	< 0.636	--	< 0.749	< 0.891	< 1.18
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.53	0.599	< 0.456	< 0.545	< 0.355	0.426	1.42	< 1.53	--	< 1.32	< 1.85	< 1.72
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-17001						BCC-MW-17002				
					Sample Date:	12/7/2017	2/20/2018	6/15/2018	8/6/2018	11/29/2018	11/29/2018	12/7/2017	2/20/2018	6/15/2018	8/6/2018	11/29/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	Shallow 2017 Wells										
Appendix III											Field Dup					
Boron	ug/L	NC	NA	1,320	NA	991	827	1,100	1,220	1,480	1,550	8,280	12,800	13,300	9,440	9,030
Calcium	mg/L	NC	NA	259	NA	118	118	124	117	135	134	178	201	224	194	197
Chloride	mg/L	250*	NA	5,980	NA	27.3	28.5	29.1	29.1	29.0	29.2	15.3	14.2	13.2	15.4	16.8
Fluoride	ug/L	4,000	NA	1,000	NA	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	<1,000	<1,000	<1,000	<1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	156	135	90.8	18.7	148	140	330	325	332	226	402
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	558	552	566	476	568	554	726	892	936	740	800
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.1	7.0	7.2	6.9	7.3	--	7.0	7.1	7.2	7.1	7.0
Appendix IV																
Antimony	ug/L	6	NA	1	6	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	1.5	< 1.0	< 1.0	< 2.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	5.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**45.5**	2.0	2.6	3.8	2.0
Barium	ug/L	2,000	NA	340	2,000	85.6	71.3	65.8	73.8	74.4	70.6	148	76.7	62.8	57.6	97.7
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	<1,000	<1,000	<1,000	<1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	**55**	**73**	**65**	**62**	**64**	**63**	**75**	**160**	**150**	**130**	**120**
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	30.1	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.509	< 0.890	< 0.766	< 0.616	< 0.942	< 0.754	< 1.03	< 1.07	< 0.757	0.306	< 0.968
Radium-228	pCi/L	NC	NA	NA	NA	< 0.830	< 0.901	< 0.947	< 0.822	0.989	1.20	< 0.996	< 3.77	< 2.35	1.25	2.01
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 1.34	< 1.79	< 1.71	< 1.44	< 1.69	< 1.45	< 2.03	< 4.84	< 3.11	1.56	2.29
Selenium	ug/L	50	NA	3	50	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	1.1	< 1.0	< 1.0	< 2.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-17003						BCC-MW-17004				
					Sample Date:	12/7/2017	2/20/2018	6/15/2018	8/7/2018	8/7/2018	11/29/2018	12/6/2017	2/20/2018	6/15/2018	8/7/2018	11/30/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	Shallow 2017 Wells										
Appendix III										Field Dup						
Boron	ug/L	NC	NA	1,320	NA	413	394	369	383	377	410	367	429	525	425	601
Calcium	mg/L	NC	NA	259	NA	74.3	55.7	63.2	74.6	76.9	88.7	53.7	48.1	73.1	68.9	116
Chloride	mg/L	250*	NA	5,980	NA	18.3	21.5	22.7	21.9	21.8	19.1	21.3	21.3	21.4	21.2	18.7
Fluoride	ug/L	4,000	NA	1,000	NA	<1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	<1,000	<1,000	<1,000	<1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	48.4	< 2.0	< 2.0	17.7	25.9	49.6	< 2.0	< 2.0	8.3	< 2.0	166
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	324	330	412	326	324	362	228	238	410	320	500
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.0	7.2	7.4	7.3	--	7.3	7.2	7.3	7.4	7.3	7.3
Appendix IV																
Antimony	ug/L	6	NA	1	6	1.1	< 1.0	< 1.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	**26**	< 1.0	< 1.0	1.0	1.1	< 1.0	2.5	1.8	1.1	< 1.0	2.1
Barium	ug/L	2,000	NA	340	2,000	128	78.1	66.5	77.9	83.3	92.7	145	116	175	148	252
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.2	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	<1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	<1,000	<1,000	<1,000	<1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	19	17	13	18	18	19	< 10	< 10	< 10	< 10	14
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	48.8	6.3	< 5.0	< 5.0	< 5.0	< 5.0	9.9	5.9	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.889	< 0.755	< 0.594	< 0.687	0.353	< 0.685	< 0.945	< 0.723	< 0.441	< 0.519	< 0.766
Radium-228	pCi/L	NC	NA	NA	NA	< 0.663	< 0.707	< 0.828	0.932	< 0.871	< 0.695	< 0.804	< 0.719	< 0.810	1.03	< 0.790
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 1.55	< 1.46	< 1.42	< 1.49	< 1.03	< 1.38	< 1.75	< 1.44	< 1.25	< 1.46	< 1.56
Selenium	ug/L	50	NA	3	50	< 1.0	2.2	< 1.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-17005								BCC-MW-17006				
					Sample Date:	12/6/2017	12/6/2017	2/20/2018	2/20/2018	6/15/2018	6/15/2018	8/7/2018	11/30/2018	12/6/2017	2/20/2018	6/15/2018	8/7/2018	11/30/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	Shallow 2017 Wells												
Appendix III							Field Dup		Field Dup		Feld Dup							
Boron	ug/L	NC	NA	1,320	NA	191	208	238	228	377	353	342	350	669	594	653	765	630
Calcium	mg/L	NC	NA	259	NA	51.9	54.0	54.2	53.1	71.2	71.1	68.1	68.1	105	95.0	97.5	90.4	99.8
Chloride	mg/L	250*	NA	5,980	NA	19.4	19.4	21.6	21.3	20.5	20.5	19.6	18.5	19.0	20.3	20.9	21.5	20.4
Fluoride	ug/L	4,000	NA	1,000	NA	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	<1,000	<1,000	<1,000	<1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	11.5	11.00	< 2.0	< 2.0	9.6	9.0	4.3	42.1	129	93.1	69.8	46.2	102
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	262	220	310	266	358	416	318	318	474	472	478	438	432
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.3	--	7.3	--	7.4	--	7.3	7.6	7.7	7.3	7.5	7.5	7.7
Appendix IV																		
Antimony	ug/L	6	NA	1	6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	2.9	2.8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	4.9	2.4	4.6	< 1.0	6.6
Barium	ug/L	2,000	NA	340	2,000	168	167	123	128	161	149	179	131	83.3	79.0	70.3	73	68.6
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	<1,000	<1,000	<1,000	<1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	10	12	11	11	< 10	< 10	13	11	38	37	31	36	32
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.863	1.56	< 0.804	0.910	< 0.692	< 0.610	0.440	< 0.592	< 0.930	< 0.766	< 0.862	< 0.582	1.13
Radium-228	pCi/L	NC	NA	NA	NA	< 0.722	< 0.649	< 0.904	< 0.945	< 0.796	< 0.853	< 0.741	< 0.656	< 0.833	< 0.716	< 0.888	< 0.757	1.06
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 1.59	< 1.61	< 1.71	< 1.80	< 1.49	< 1.46	< 1.15	< 1.25	< 1.76	< 1.48	< 1.75	< 1.34	2.19
Selenium	ug/L	50	NA	3	50	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Attachment 1
Sanitas™ Output (n=4)

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Antimony, Total Analysis Run 2/18/2019 10:21 AM
Client: Consumers Energy Data: BCC_Sanitas_19.02.18

For observations made between 12/1/2015 and 11/30/2018, a summary of the selected data set:

Observations = 195
ND/Trace = 189
Wells = 21
Minimum Value = 1
Maximum Value = 2
Mean Value = 1.043
Median Value = 1
Standard Deviation = 0.1929
Coefficient of Variation = 0.185
Skewness = 4.511

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	11	10	1	1	1	1	0	0	NaN
BCC-MW-15010	11	11	1	1	1	1	0	0	NaN
BCC-MW-15011	11	11	1	1	1	1	0	0	NaN
BCC-MW-15012	11	11	1	1	1	1	0	0	NaN
BCC-MW-15013	11	11	1	1	1	1	0	0	NaN
BCC-MW-15014	11	9	1	1.7	1.073	1	0.2102	0.1959	2.749
BCC-MW-15015	11	11	1	1	1	1	0	0	NaN
BCC-MW-15016	11	11	1	1	1	1	0	0	NaN
BCC-MW-15017	11	11	1	1	1	1	0	0	NaN
BCC-MW-15018	11	11	1	1	1	1	0	0	NaN
BCC-MW-15019	11	11	1	1	1	1	0	0	NaN
BCC-MW-15020	11	11	1	1	1	1	0	0	NaN
BCC-MW-15021	11	11	1	1	1	1	0	0	NaN
BCC-MW-15022	11	10	1	1.9	1.082	1	0.2714	0.2508	2.846
BCC-MW-15023	11	11	1	1	1	1	0	0	NaN
BCC-MW-17001	5	5	1	2	1.2	1	0.4472	0.3727	1.5
BCC-MW-17002	5	4	1	2	1.3	1	0.4472	0.344	0.8437
BCC-MW-17003	5	4	1	2	1.22	1	0.4382	0.3592	1.465
BCC-MW-17004	5	5	1	2	1.2	1	0.4472	0.3727	1.5
BCC-MW-17005	5	5	1	2	1.2	1	0.4472	0.3727	1.5
BCC-MW-17006	5	5	1	2	1.2	1	0.4472	0.3727	1.5

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Arsenic, Total Analysis Run 2/18/2019 10:21 AM
Client: Consumers Energy Data: BCC_Sanitas_19.02.18

For observations made between 12/1/2015 and 11/30/2018, a summary of the selected data set:

Observations = 195
ND/Trace = 77
Wells = 21
Minimum Value = 1
Maximum Value = 45.5
Mean Value = 4.151
Median Value = 2
Standard Deviation = 6.28
Coefficient of Variation = 1.513
Skewness = 4.014

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	11	0	4.1	45	18.58	14	11.88	0.6395	0.9497
BCC-MW-15010	11	11	1	1	1	1	0	0	NaN
BCC-MW-15011	11	1	1	8	4.745	5	2.404	0.5066	-0.2163
BCC-MW-15012	11	1	1	12	4.509	3	3.702	0.821	0.8785
BCC-MW-15013	11	11	1	1	1	1	0	0	NaN
BCC-MW-15014	11	0	4	15	8.373	8	3.068	0.3664	0.7438
BCC-MW-15015	11	0	2	7	4.5	5	1.763	0.3918	-0.445
BCC-MW-15016	11	0	1.3	3	1.964	2	0.5887	0.2998	0.7416
BCC-MW-15017	11	0	1.8	13	6.109	5	4.283	0.701	0.6608
BCC-MW-15018	11	9	1	2	1.091	1	0.3015	0.2764	2.846
BCC-MW-15019	11	11	1	1	1	1	0	0	NaN
BCC-MW-15020	11	11	1	1	1	1	0	0	NaN
BCC-MW-15021	11	3	1	3	1.545	1	0.6876	0.4449	0.8
BCC-MW-15022	11	2	1	8	4.718	5.8	2.701	0.5726	-0.3344
BCC-MW-15023	11	4	1	3	1.627	1.9	0.6695	0.4114	0.5523
BCC-MW-17001	5	4	1	5.2	1.84	1	1.878	1.021	1.5
BCC-MW-17002	5	0	2	45.5	11.18	2.6	19.2	1.717	1.495
BCC-MW-17003	5	3	1	26	6.01	1	11.17	1.859	1.5
BCC-MW-17004	5	1	1	2.5	1.7	1.8	0.6442	0.3789	0.01882
BCC-MW-17005	5	4	1	2.85	1.37	1	0.8273	0.6039	1.5
BCC-MW-17006	5	1	1	6.6	3.9	4.6	2.205	0.5653	-0.1758

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Barium, Total Analysis Run 2/18/2019 10:21 AM
Client: Consumers Energy Data: BCC_Sanitas_19.02.18

For observations made between 12/1/2015 and 11/30/2018, a summary of the selected data set:

Observations = 195
ND/Trace = 0
Wells = 21
Minimum Value = 9
Maximum Value = 1030
Mean Value = 188.7
Median Value = 88
Standard Deviation = 248.7
Coefficient of Variation = 1.318
Skewness = 1.961

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	11	0	9	16.5	12.05	11	2.423	0.2012	0.8046
BCC-MW-15010	11	0	28	68.1	45.95	45	14.73	0.3206	0.2431
BCC-MW-15011	11	0	15.2	36	26.82	30	6.986	0.2605	-0.6326
BCC-MW-15012	11	0	14.3	109	50.91	40	32.43	0.637	0.7759
BCC-MW-15013	11	0	39.5	71	49.45	48	8.881	0.1796	1.308
BCC-MW-15014	11	0	257	779	515.1	546	168.2	0.3265	-0.0001905
BCC-MW-15015	11	0	21	41	29.79	28	7.151	0.2401	0.4026
BCC-MW-15016	11	0	548	666	625.5	621	33.93	0.05425	-0.967
BCC-MW-15017	11	0	772	1030	928.6	955	75.93	0.08177	-0.877
BCC-MW-15018	11	0	127	171	146.4	148	12.04	0.08229	0.3717
BCC-MW-15019	11	0	88	187	110.1	94	33.19	0.3015	1.544
BCC-MW-15020	11	0	47	196.5	79.9	53	50.87	0.6367	1.412
BCC-MW-15021	11	0	211	274	237.8	236	16.09	0.06767	0.6913
BCC-MW-15022	11	0	102	242	136.4	129	38.49	0.2823	2.007
BCC-MW-15023	11	0	38	97.1	57.85	47	22.44	0.388	0.9019
BCC-MW-17001	5	0	65.8	85.6	73.8	72.5	7.266	0.09846	0.8111
BCC-MW-17002	5	0	57.6	148	88.56	76.7	36.67	0.4141	0.92
BCC-MW-17003	5	0	66.5	128	89.18	80.6	23.61	0.2648	0.953
BCC-MW-17004	5	0	116	252	167.2	148	51.8	0.3098	0.9209
BCC-MW-17005	5	0	125.5	179	151.6	155	23.03	0.1519	-0.04331
BCC-MW-17006	5	0	68.6	83.3	74.84	73	6.161	0.08232	0.4001

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Beryllium, Total Analysis Run 2/18/2019 10:21 AM
Client: Consumers Energy Data: BCC_Sanitas_19.02.18

For observations made between 12/1/2015 and 11/30/2018, a summary of the selected data set:

Observations = 195
ND/Trace = 195
Wells = 21
Minimum Value = 1
Maximum Value = 1
Mean Value = 1
Median Value = 1
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	11	11	1	1	1	1	0	0	NaN
BCC-MW-15010	11	11	1	1	1	1	0	0	NaN
BCC-MW-15011	11	11	1	1	1	1	0	0	NaN
BCC-MW-15012	11	11	1	1	1	1	0	0	NaN
BCC-MW-15013	11	11	1	1	1	1	0	0	NaN
BCC-MW-15014	11	11	1	1	1	1	0	0	NaN
BCC-MW-15015	11	11	1	1	1	1	0	0	NaN
BCC-MW-15016	11	11	1	1	1	1	0	0	NaN
BCC-MW-15017	11	11	1	1	1	1	0	0	NaN
BCC-MW-15018	11	11	1	1	1	1	0	0	NaN
BCC-MW-15019	11	11	1	1	1	1	0	0	NaN
BCC-MW-15020	11	11	1	1	1	1	0	0	NaN
BCC-MW-15021	11	11	1	1	1	1	0	0	NaN
BCC-MW-15022	11	11	1	1	1	1	0	0	NaN
BCC-MW-15023	11	11	1	1	1	1	0	0	NaN
BCC-MW-17001	5	5	1	1	1	1	0	0	NaN
BCC-MW-17002	5	5	1	1	1	1	0	0	NaN
BCC-MW-17003	5	5	1	1	1	1	0	0	NaN
BCC-MW-17004	5	5	1	1	1	1	0	0	NaN
BCC-MW-17005	5	5	1	1	1	1	0	0	NaN
BCC-MW-17006	5	5	1	1	1	1	0	0	NaN

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Summary Report

Constituent: Cadmium, Total Analysis Run 2/18/2019 10:21 AM
Client: Consumers Energy Data: BCC_Sanitas_19.02.18

For observations made between 12/1/2015 and 11/30/2018, a summary of the selected data set:

Observations = 195
ND/Trace = 195
Wells = 21
Minimum Value = 0.2
Maximum Value = 0.2
Mean Value = 0.2
Median Value = 0.2
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15010	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15011	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15012	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15013	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15014	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15015	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15016	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15017	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15018	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15019	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15020	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15021	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15022	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15023	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17001	5	5	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17002	5	5	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17003	5	5	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17004	5	5	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17005	5	5	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17006	5	5	0.2	0.2	0.2	0.2	0	0	NaN

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Chromium, Total Analysis Run 2/18/2019 10:21 AM
Client: Consumers Energy Data: BCC_Sanitas_19.02.18

For observations made between 12/1/2015 and 11/30/2018, a summary of the selected data set:

Observations = 195
ND/Trace = 135
Wells = 21
Minimum Value = 1
Maximum Value = 11
Mean Value = 1.399
Median Value = 1
Standard Deviation = 1.188
Coefficient of Variation = 0.8496
Skewness = 4.875

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	11	9	1	2	1.091	1	0.3015	0.2764	2.846
BCC-MW-15010	11	9	1	2	1.091	1	0.3015	0.2764	2.846
BCC-MW-15011	11	8	1	2	1.091	1	0.3015	0.2764	2.846
BCC-MW-15012	11	9	1	1	1	1	0	0	NaN
BCC-MW-15013	11	9	1	2	1.091	1	0.3015	0.2764	2.846
BCC-MW-15014	11	8	1	2	1.091	1	0.3015	0.2764	2.846
BCC-MW-15015	11	9	1	1	1	1	0	0	NaN
BCC-MW-15016	11	0	1.9	4	2.664	3	0.6531	0.2452	0.4969
BCC-MW-15017	11	0	3.1	11	5.195	4	2.521	0.4853	1.468
BCC-MW-15018	11	6	1	1	1	1	0	0	NaN
BCC-MW-15019	11	9	1	1	1	1	0	0	NaN
BCC-MW-15020	11	9	1	2	1.091	1	0.3015	0.2764	2.846
BCC-MW-15021	11	4	1	2	1.464	1.1	0.5143	0.3514	0.1735
BCC-MW-15022	11	8	1	2	1.091	1	0.3015	0.2764	2.846
BCC-MW-15023	11	9	1	2	1.091	1	0.3015	0.2764	2.846
BCC-MW-17001	5	5	1	1	1	1	0	0	NaN
BCC-MW-17002	5	5	1	1	1	1	0	0	NaN
BCC-MW-17003	5	5	1	1	1	1	0	0	NaN
BCC-MW-17004	5	4	1	1.2	1.04	1	0.08944	0.086	1.5
BCC-MW-17005	5	5	1	1	1	1	0	0	NaN
BCC-MW-17006	5	5	1	1	1	1	0	0	NaN

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Cobalt, Total Analysis Run 2/18/2019 10:21 AM
Client: Consumers Energy Data: BCC_Sanitas_19.02.18

For observations made between 12/1/2015 and 11/30/2018, a summary of the selected data set:

Observations = 195
ND/Trace = 195
Wells = 21
Minimum Value = 6
Maximum Value = 15
Mean Value = 14.03
Median Value = 15
Standard Deviation = 2.797
Coefficient of Variation = 0.1994
Skewness = -2.531

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	11	11	6	15	14.18	15	2.714	0.1913	-2.846
BCC-MW-15010	11	11	6	15	14.18	15	2.714	0.1913	-2.846
BCC-MW-15011	11	11	6	15	14.18	15	2.714	0.1913	-2.846
BCC-MW-15012	11	11	6	15	14.18	15	2.714	0.1913	-2.846
BCC-MW-15013	11	11	6	15	14.18	15	2.714	0.1913	-2.846
BCC-MW-15014	11	11	6	15	14.18	15	2.714	0.1913	-2.846
BCC-MW-15015	11	11	6	15	14.18	15	2.714	0.1913	-2.846
BCC-MW-15016	11	11	6	15	14.18	15	2.714	0.1913	-2.846
BCC-MW-15017	11	11	6	15	14.18	15	2.714	0.1913	-2.846
BCC-MW-15018	11	11	6	15	14.18	15	2.714	0.1913	-2.846
BCC-MW-15019	11	11	6	15	14.18	15	2.714	0.1913	-2.846
BCC-MW-15020	11	11	6	15	14.18	15	2.714	0.1913	-2.846
BCC-MW-15021	11	11	6	15	14.18	15	2.714	0.1913	-2.846
BCC-MW-15022	11	11	6	15	14.18	15	2.714	0.1913	-2.846
BCC-MW-15023	11	11	6	15	14.18	15	2.714	0.1913	-2.846
BCC-MW-17001	5	5	6	15	13.2	15	4.025	0.3049	-1.5
BCC-MW-17002	5	5	6	15	13.2	15	4.025	0.3049	-1.5
BCC-MW-17003	5	5	6	15	13.2	15	4.025	0.3049	-1.5
BCC-MW-17004	5	5	6	15	13.2	15	4.025	0.3049	-1.5
BCC-MW-17005	5	5	6	15	13.2	15	4.025	0.3049	-1.5
BCC-MW-17006	5	5	6	15	13.2	15	4.025	0.3049	-1.5

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Fluoride Analysis Run 2/18/2019 10:21 AM
Client: Consumers Energy Data: BCC_Sanitas_19.02.18

For observations made between 12/1/2015 and 11/30/2018, a summary of the selected data set:

Observations = 210
ND/Trace = 206
Wells = 21
Minimum Value = 1000
Maximum Value = 1200
Mean Value = 1002
Median Value = 1000
Standard Deviation = 20.61
Coefficient of Variation = 0.02056
Skewness = 8.959

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	12	12	1000	1000	1000	1000	0	0	NaN
BCC-MW-15010	12	12	1000	1000	1000	1000	0	0	NaN
BCC-MW-15011	12	10	1000	1200	1017	1000	57.74	0.05679	3.015
BCC-MW-15012	12	10	1000	1200	1025	1000	62.16	0.06064	2.224
BCC-MW-15013	12	12	1000	1000	1000	1000	0	0	NaN
BCC-MW-15014	12	12	1000	1000	1000	1000	0	0	NaN
BCC-MW-15015	12	12	1000	1000	1000	1000	0	0	NaN
BCC-MW-15016	12	12	1000	1000	1000	1000	0	0	NaN
BCC-MW-15017	12	12	1000	1000	1000	1000	0	0	NaN
BCC-MW-15018	12	12	1000	1000	1000	1000	0	0	NaN
BCC-MW-15019	12	12	1000	1000	1000	1000	0	0	NaN
BCC-MW-15020	12	12	1000	1000	1000	1000	0	0	NaN
BCC-MW-15021	12	12	1000	1000	1000	1000	0	0	NaN
BCC-MW-15022	12	12	1000	1000	1000	1000	0	0	NaN
BCC-MW-15023	12	12	1000	1000	1000	1000	0	0	NaN
BCC-MW-17001	5	5	1000	1000	1000	1000	0	0	NaN
BCC-MW-17002	5	5	1000	1000	1000	1000	0	0	NaN
BCC-MW-17003	5	5	1000	1000	1000	1000	0	0	NaN
BCC-MW-17004	5	5	1000	1000	1000	1000	0	0	NaN
BCC-MW-17005	5	5	1000	1000	1000	1000	0	0	NaN
BCC-MW-17006	5	5	1000	1000	1000	1000	0	0	NaN

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Lead, Total Analysis Run 2/18/2019 10:21 AM
Client: Consumers Energy Data: BCC_Sanitas_19.02.18

For observations made between 12/1/2015 and 11/30/2018, a summary of the selected data set:

Observations = 195
ND/Trace = 195
Wells = 21
Minimum Value = 1
Maximum Value = 1
Mean Value = 1
Median Value = 1
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	11	11	1	1	1	1	0	0	NaN
BCC-MW-15010	11	11	1	1	1	1	0	0	NaN
BCC-MW-15011	11	11	1	1	1	1	0	0	NaN
BCC-MW-15012	11	11	1	1	1	1	0	0	NaN
BCC-MW-15013	11	11	1	1	1	1	0	0	NaN
BCC-MW-15014	11	11	1	1	1	1	0	0	NaN
BCC-MW-15015	11	11	1	1	1	1	0	0	NaN
BCC-MW-15016	11	11	1	1	1	1	0	0	NaN
BCC-MW-15017	11	11	1	1	1	1	0	0	NaN
BCC-MW-15018	11	11	1	1	1	1	0	0	NaN
BCC-MW-15019	11	11	1	1	1	1	0	0	NaN
BCC-MW-15020	11	11	1	1	1	1	0	0	NaN
BCC-MW-15021	11	11	1	1	1	1	0	0	NaN
BCC-MW-15022	11	11	1	1	1	1	0	0	NaN
BCC-MW-15023	11	11	1	1	1	1	0	0	NaN
BCC-MW-17001	5	5	1	1	1	1	0	0	NaN
BCC-MW-17002	5	5	1	1	1	1	0	0	NaN
BCC-MW-17003	5	5	1	1	1	1	0	0	NaN
BCC-MW-17004	5	5	1	1	1	1	0	0	NaN
BCC-MW-17005	5	5	1	1	1	1	0	0	NaN
BCC-MW-17006	5	5	1	1	1	1	0	0	NaN

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Lithium, Total Analysis Run 2/18/2019 10:21 AM
Client: Consumers Energy Data: BCC_Sanitas_19.02.18

For observations made between 12/1/2015 and 11/30/2018, a summary of the selected data set:

Observations = 195
ND/Trace = 65
Wells = 21
Minimum Value = 10
Maximum Value = 160
Mean Value = 20.25
Median Value = 14
Standard Deviation = 20.93
Coefficient of Variation = 1.033
Skewness = 4.425

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	11	0	13	24	16.75	15	3.633	0.217	0.8166
BCC-MW-15010	11	0	14	54	28.89	22	15.05	0.5208	0.6896
BCC-MW-15011	11	0	11	21	16.56	17	2.738	0.1653	-0.3168
BCC-MW-15012	11	0	10	20.8	14.31	13	3.643	0.2546	0.5423
BCC-MW-15013	11	0	17	27.5	20.26	18	3.546	0.175	0.8152
BCC-MW-15014	11	7	10	27	13.91	10	5.991	0.4307	1.133
BCC-MW-15015	11	7	10	16	11.32	10	2.101	0.1856	1.251
BCC-MW-15016	11	11	10	10	10	10	0	0	NaN
BCC-MW-15017	11	11	10	10	10	10	0	0	NaN
BCC-MW-15018	11	0	12	28	21.68	22	4.883	0.2252	-0.8403
BCC-MW-15019	11	0	22	27.9	24.51	24	2.011	0.08206	0.2845
BCC-MW-15020	11	0	14	20	15.9	16	1.998	0.1257	0.7502
BCC-MW-15021	11	11	10	10	10	10	0	0	NaN
BCC-MW-15022	11	8	10	25	11.73	10	4.496	0.3834	2.652
BCC-MW-15023	11	5	10	20	12.79	10.6	4.063	0.3177	0.9852
BCC-MW-17001	5	0	55	73	63.7	63.5	6.458	0.1014	0.1486
BCC-MW-17002	5	0	75	160	127	130	33.09	0.2606	-0.716
BCC-MW-17003	5	0	13	19	17.2	18	2.49	0.1448	-1.121
BCC-MW-17004	5	4	10	14	10.8	10	1.789	0.1656	1.5
BCC-MW-17005	5	1	10	13	11.2	11	1.095	0.09781	0.8675
BCC-MW-17006	5	0	31	38	34.8	36	3.114	0.0895	-0.2931

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Mercury, Total Analysis Run 2/18/2019 10:21 AM
Client: Consumers Energy Data: BCC_Sanitas_19.02.18

For observations made between 12/1/2015 and 11/30/2018, a summary of the selected data set:

Observations = 195
ND/Trace = 195
Wells = 21
Minimum Value = 0.2
Maximum Value = 0.2
Mean Value = 0.2
Median Value = 0.2
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15010	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15011	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15012	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15013	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15014	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15015	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15016	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15017	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15018	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15019	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15020	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15021	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15022	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15023	11	11	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17001	5	5	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17002	5	5	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17003	5	5	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17004	5	5	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17005	5	5	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17006	5	5	0.2	0.2	0.2	0.2	0	0	NaN

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Molybdenum, Total Analysis Run 2/18/2019 10:21 AM
Client: Consumers Energy Data: BCC_Sanitas_19.02.18

For observations made between 12/1/2015 and 11/30/2018, a summary of the selected data set:

Observations = 195
ND/Trace = 101
Wells = 21
Minimum Value = 5
Maximum Value = 119
Mean Value = 16.77
Median Value = 5
Standard Deviation = 22.11
Coefficient of Variation = 1.319
Skewness = 2.411

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	11	0	5.2	60	38.05	42.75	18.75	0.4927	-0.6822
BCC-MW-15010	11	3	5	33	15.56	15	10.43	0.6699	0.4501
BCC-MW-15011	11	0	5.8	35	21.27	22	8.753	0.4115	-0.4077
BCC-MW-15012	11	0	9	94.5	41.9	35	23.43	0.5592	1.038
BCC-MW-15013	11	2	5	21	11.15	10	5.845	0.524	0.575
BCC-MW-15014	11	0	58	119	84.69	80	18.12	0.214	0.4913
BCC-MW-15015	11	0	7	17	11.37	11	3.458	0.3042	0.5005
BCC-MW-15016	11	11	5	5	5	5	0	0	NaN
BCC-MW-15017	11	11	5	5	5	5	0	0	NaN
BCC-MW-15018	11	11	5	5	5	5	0	0	NaN
BCC-MW-15019	11	11	5	5	5	5	0	0	NaN
BCC-MW-15020	11	11	5	5	5	5	0	0	NaN
BCC-MW-15021	11	11	5	5	5	5	0	0	NaN
BCC-MW-15022	11	2	5	47.6	16.56	14	11.55	0.6973	1.816
BCC-MW-15023	11	3	5	8	6.155	6	0.9647	0.1568	0.3727
BCC-MW-17001	5	5	5	5	5	5	0	0	NaN
BCC-MW-17002	5	4	5	30.1	10.02	5	11.23	1.12	1.5
BCC-MW-17003	5	3	5	48.8	14.02	5	19.45	1.387	1.497
BCC-MW-17004	5	3	5	9.9	6.16	5	2.127	0.3452	1.384
BCC-MW-17005	5	5	5	5	5	5	0	0	NaN
BCC-MW-17006	5	5	5	5	5	5	0	0	NaN

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Radium-226 Analysis Run 2/18/2019 10:21 AM
Client: Consumers Energy Data: BCC_Sanitas_19.02.18

For observations made between 12/1/2015 and 11/30/2018, a summary of the selected data set:

Observations = 195
ND/Trace = 133
Wells = 21
Minimum Value = 0.133
Maximum Value = 2.5
Mean Value = 0.6269
Median Value = 0.509
Standard Deviation = 0.4873
Coefficient of Variation = 0.7772
Skewness = 1.578

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	11	11	0.157	0.934	0.403	0.269	0.2949	0.7317	0.8417
BCC-MW-15010	11	10	0.145	0.869	0.4175	0.297	0.273	0.654	0.6418
BCC-MW-15011	11	10	0.141	1.12	0.4135	0.296	0.32	0.774	1.176
BCC-MW-15012	11	9	0.153	0.7	0.3605	0.256	0.2002	0.5553	0.7451
BCC-MW-15013	11	8	0.173	0.731	0.373	0.272	0.214	0.5738	0.6862
BCC-MW-15014	11	10	0.175	1.52	0.5246	0.218	0.4959	0.9452	1.054
BCC-MW-15015	11	11	0.133	0.832	0.3691	0.34	0.228	0.6178	0.813
BCC-MW-15016	11	2	0.263	1.75	1.258	1.31	0.426	0.3387	-1.172
BCC-MW-15017	11	0	1.56	2.5	2.003	1.94	0.2958	0.1477	0.1582
BCC-MW-15018	11	4	0.227	1.02	0.5153	0.43	0.2588	0.5023	0.7085
BCC-MW-15019	11	5	0.279	0.88	0.4704	0.36	0.2034	0.4324	0.8077
BCC-MW-15020	11	9	0.19	1.1	0.4913	0.294	0.3202	0.6517	0.7852
BCC-MW-15021	11	4	0.215	1.49	0.62	0.563	0.323	0.521	1.808
BCC-MW-15022	11	9	0.15	0.708	0.3797	0.291	0.1967	0.5181	0.6217
BCC-MW-15023	11	7	0.226	0.958	0.4467	0.309	0.2677	0.5992	0.9565
BCC-MW-17001	5	5	0.509	0.942	0.7446	0.766	0.1821	0.2445	-0.2051
BCC-MW-17002	5	4	0.306	1.07	0.8262	0.968	0.3148	0.3811	-1.033
BCC-MW-17003	5	4	0.52	0.889	0.6886	0.685	0.1431	0.2079	0.2575
BCC-MW-17004	5	5	0.441	0.945	0.6788	0.723	0.2016	0.2969	0.07117
BCC-MW-17005	5	2	0.44	1.211	0.7585	0.692	0.2952	0.3891	0.6162
BCC-MW-17006	5	4	0.582	1.13	0.854	0.862	0.2023	0.2369	0.02224

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Radium-226/228 Analysis Run 2/18/2019 10:21 AM
Client: Consumers Energy Data: BCC_Sanitas_19.02.18

For observations made between 12/1/2015 and 11/30/2018, a summary of the selected data set:

Observations = 195
ND/Trace = 121
Wells = 21
Minimum Value = 0.354
Maximum Value = 5.89
Mean Value = 1.544
Median Value = 1.34
Standard Deviation = 1.198
Coefficient of Variation = 0.7761
Skewness = 1.716

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	11	10	0.451	3.85	1.345	0.628	1.325	0.9853	1.249
BCC-MW-15010	11	8	0.363	1.75	0.9424	0.82	0.5625	0.5969	0.3344
BCC-MW-15011	11	10	0.394	2.07	0.9303	0.599	0.5968	0.6415	0.6803
BCC-MW-15012	11	9	0.416	2.28	0.9437	0.634	0.578	0.6125	1.151
BCC-MW-15013	11	8	0.481	1.56	0.9607	0.9	0.4354	0.4532	0.1674
BCC-MW-15014	11	9	0.423	3.25	1.358	0.883	1.018	0.7499	0.8947
BCC-MW-15015	11	10	0.408	1.75	0.8765	0.578	0.4969	0.5669	0.6937
BCC-MW-15016	11	0	2.29	3.95	3.154	3.18	0.6109	0.1937	-0.1751
BCC-MW-15017	11	0	4.3	5.89	5.046	5.12	0.5437	0.1077	-0.02171
BCC-MW-15018	11	3	0.586	1.97	1.346	1.33	0.3967	0.2947	-0.07327
BCC-MW-15019	11	4	0.674	2.13	1.264	0.997	0.5005	0.3961	0.3648
BCC-MW-15020	11	4	0.467	2.32	1.074	0.73	0.6261	0.5832	0.8968
BCC-MW-15021	11	3	0.354	2.61	1.545	1.47	0.5958	0.3855	-0.2271
BCC-MW-15022	11	8	0.45	1.45	0.8474	0.812	0.401	0.4732	0.3811
BCC-MW-15023	11	8	0.355	1.85	0.9774	0.599	0.5852	0.5988	0.3113
BCC-MW-17001	5	5	1.34	1.79	1.594	1.69	0.1932	0.1212	-0.39
BCC-MW-17002	5	3	1.56	4.84	2.766	2.29	1.289	0.4659	0.8753
BCC-MW-17003	5	5	1.38	1.55	1.46	1.46	0.06519	0.04465	0.1816
BCC-MW-17004	5	5	1.25	1.75	1.492	1.46	0.1827	0.1224	0.1441
BCC-MW-17005	5	5	1.15	1.8	1.46	1.49	0.2642	0.181	0.05538
BCC-MW-17006	5	4	1.34	2.19	1.704	1.75	0.3256	0.1911	0.4501

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Radium-228 Analysis Run 2/18/2019 10:21 AM
Client: Consumers Energy Data: BCC_Sanitas_19.02.18

For observations made between 12/1/2015 and 11/30/2018, a summary of the selected data set:

Observations = 195
ND/Trace = 124
Wells = 21
Minimum Value = 0.354
Maximum Value = 3.98
Mean Value = 1.02
Median Value = 0.79
Standard Deviation = 0.7268
Coefficient of Variation = 0.7129
Skewness = 2.018

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	11	10	0.451	3.27	1.068	0.628	1.029	0.9635	1.56
BCC-MW-15010	11	8	0.363	0.978	0.6641	0.728	0.2432	0.3662	-0.03221
BCC-MW-15011	11	10	0.394	0.956	0.6568	0.599	0.2365	0.3601	0.1853
BCC-MW-15012	11	10	0.416	2.08	0.7803	0.634	0.4639	0.5945	2.192
BCC-MW-15013	11	8	0.481	0.94	0.6906	0.727	0.1791	0.2593	0.1529
BCC-MW-15014	11	9	0.423	1.85	0.9521	0.81	0.4838	0.5081	0.791
BCC-MW-15015	11	10	0.408	1.07	0.653	0.578	0.2073	0.3175	0.5663
BCC-MW-15016	11	0	1.06	2.37	1.931	2.06	0.3926	0.2033	-0.8545
BCC-MW-15017	11	0	2.5	3.98	3.044	2.97	0.4119	0.1353	1.016
BCC-MW-15018	11	3	0.586	1.39	0.8927	0.845	0.2249	0.2519	0.7667
BCC-MW-15019	11	6	0.484	1.8	0.9085	0.742	0.4009	0.4412	1.028
BCC-MW-15020	11	4	0.467	1.61	0.7499	0.627	0.338	0.4508	1.689
BCC-MW-15021	11	4	0.354	1.6	0.9869	0.871	0.408	0.4134	0.2503
BCC-MW-15022	11	9	0.45	0.807	0.6216	0.644	0.1434	0.2307	0.02636
BCC-MW-15023	11	9	0.355	1.18	0.6483	0.545	0.2664	0.4109	0.7515
BCC-MW-17001	5	4	0.822	1.095	0.9189	0.901	0.1109	0.1207	0.7815
BCC-MW-17002	5	3	0.996	3.77	2.075	2.01	1.095	0.5278	0.6532
BCC-MW-17003	5	4	0.663	0.9015	0.7589	0.707	0.1013	0.1335	0.5228
BCC-MW-17004	5	4	0.719	1.03	0.8306	0.804	0.1173	0.1412	1.117
BCC-MW-17005	5	5	0.656	0.945	0.7834	0.741	0.1148	0.1466	0.4026
BCC-MW-17006	5	4	0.716	1.06	0.8508	0.833	0.1346	0.1582	0.6798

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Selenium, Total Analysis Run 2/18/2019 10:21 AM
Client: Consumers Energy Data: BCC_Sanitas_19.02.18

For observations made between 12/1/2015 and 11/30/2018, a summary of the selected data set:

Observations = 195
ND/Trace = 141
Wells = 21
Minimum Value = 1
Maximum Value = 8
Mean Value = 1.358
Median Value = 1
Standard Deviation = 1.009
Coefficient of Variation = 0.7426
Skewness = 4.41

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	11	10	1	2	1.091	1	0.3015	0.2764	2.846
BCC-MW-15010	11	9	1	1	1	1	0	0	NaN
BCC-MW-15011	11	10	1	1	1	1	0	0	NaN
BCC-MW-15012	11	8	1	3.3	1.245	1	0.6861	0.5509	2.778
BCC-MW-15013	11	10	1	1	1	1	0	0	NaN
BCC-MW-15014	11	4	1	8	1.936	1	2.09	1.079	2.499
BCC-MW-15015	11	10	1	1	1	1	0	0	NaN
BCC-MW-15016	11	1	1	7	2.5	2	1.773	0.709	1.624
BCC-MW-15017	11	1	1	8	2.986	2.7	1.846	0.6182	1.917
BCC-MW-15018	11	8	1	4	1.273	1	0.9045	0.7107	2.846
BCC-MW-15019	11	9	1	2	1.109	1	0.3015	0.2719	2.664
BCC-MW-15020	11	7	1	2	1.127	1	0.3133	0.278	2.272
BCC-MW-15021	11	5	1	4	1.418	1	0.9185	0.6477	2.278
BCC-MW-15022	11	11	1	1	1	1	0	0	NaN
BCC-MW-15023	11	10	1	1	1	1	0	0	NaN
BCC-MW-17001	5	5	1	2	1.2	1	0.4472	0.3727	1.5
BCC-MW-17002	5	4	1	2	1.22	1	0.4382	0.3592	1.465
BCC-MW-17003	5	4	1	2.2	1.44	1	0.6066	0.4213	0.4495
BCC-MW-17004	5	5	1	2	1.2	1	0.4472	0.3727	1.5
BCC-MW-17005	5	5	1	2	1.2	1	0.4472	0.3727	1.5
BCC-MW-17006	5	5	1	2	1.2	1	0.4472	0.3727	1.5

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Thallium, Total Analysis Run 2/18/2019 10:21 AM
Client: Consumers Energy Data: BCC_Sanitas_19.02.18

For observations made between 12/1/2015 and 11/30/2018, a summary of the selected data set:

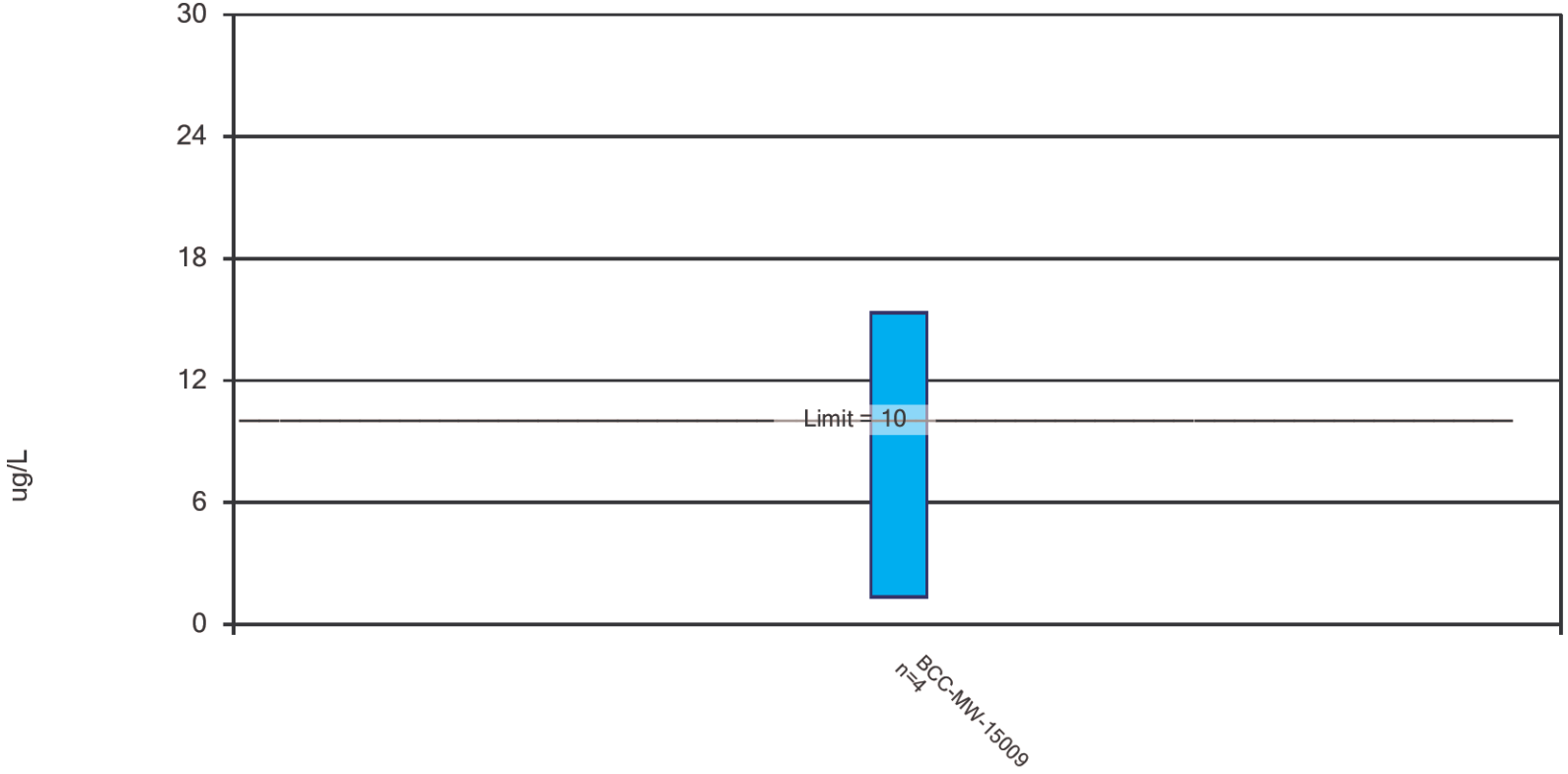
Observations = 195
ND/Trace = 195
Wells = 21
Minimum Value = 2
Maximum Value = 2
Mean Value = 2
Median Value = 2
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	11	11	2	2	2	2	0	0	NaN
BCC-MW-15010	11	11	2	2	2	2	0	0	NaN
BCC-MW-15011	11	11	2	2	2	2	0	0	NaN
BCC-MW-15012	11	11	2	2	2	2	0	0	NaN
BCC-MW-15013	11	11	2	2	2	2	0	0	NaN
BCC-MW-15014	11	11	2	2	2	2	0	0	NaN
BCC-MW-15015	11	11	2	2	2	2	0	0	NaN
BCC-MW-15016	11	11	2	2	2	2	0	0	NaN
BCC-MW-15017	11	11	2	2	2	2	0	0	NaN
BCC-MW-15018	11	11	2	2	2	2	0	0	NaN
BCC-MW-15019	11	11	2	2	2	2	0	0	NaN
BCC-MW-15020	11	11	2	2	2	2	0	0	NaN
BCC-MW-15021	11	11	2	2	2	2	0	0	NaN
BCC-MW-15022	11	11	2	2	2	2	0	0	NaN
BCC-MW-15023	11	11	2	2	2	2	0	0	NaN
BCC-MW-17001	5	5	2	2	2	2	0	0	NaN
BCC-MW-17002	5	5	2	2	2	2	0	0	NaN
BCC-MW-17003	5	5	2	2	2	2	0	0	NaN
BCC-MW-17004	5	5	2	2	2	2	0	0	NaN
BCC-MW-17005	5	5	2	2	2	2	0	0	NaN
BCC-MW-17006	5	5	2	2	2	2	0	0	NaN

[DRAFT - ELECTRONIC REVIEW]

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Arsenic, Total Analysis Run 3/5/2019 8:27 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

Confidence Interval

Constituent: Arsenic, Total (ug/L) Analysis Run 3/5/2019 8:28 AM

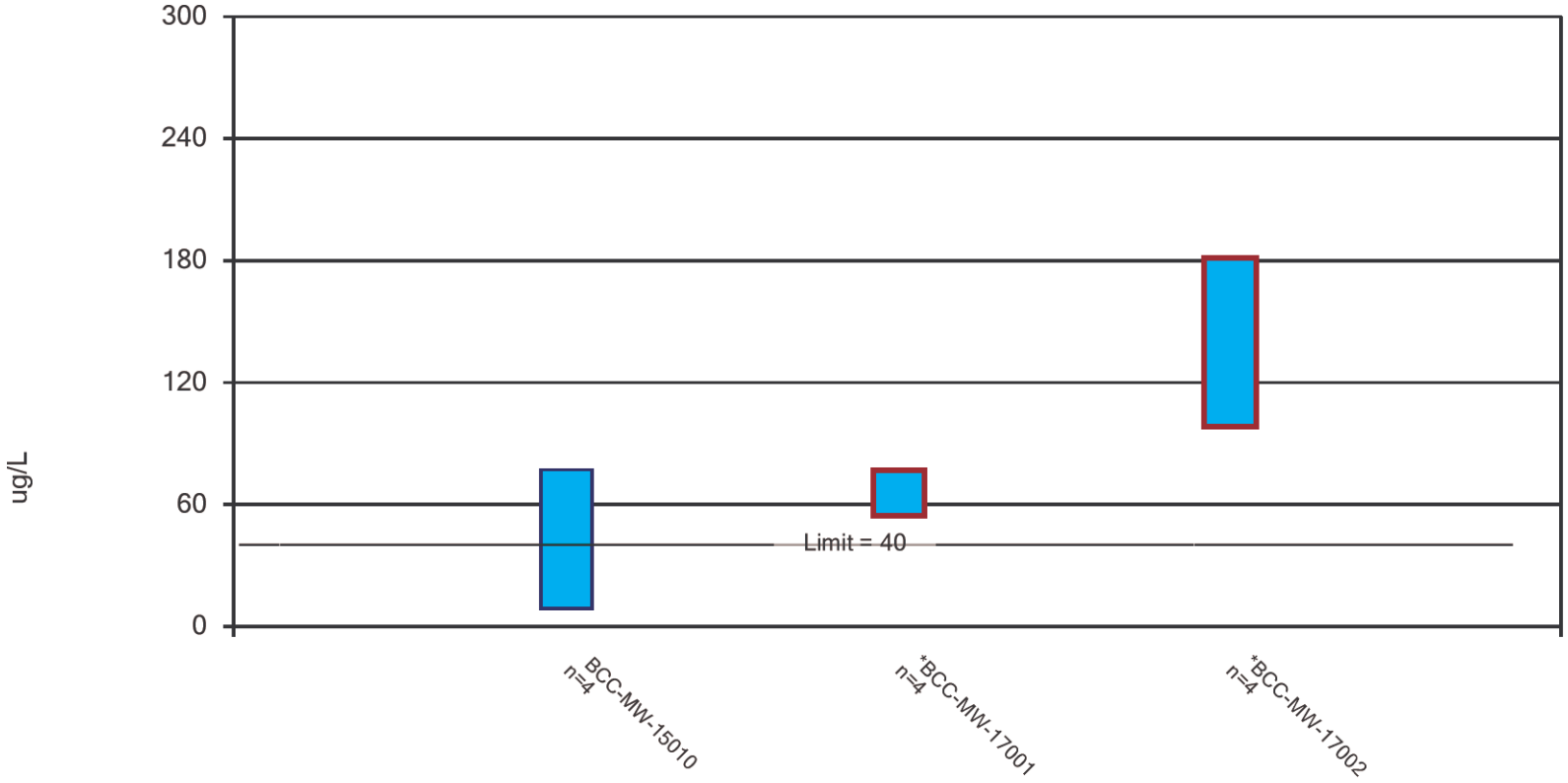
Client: Consumers Energy Data: BCC_Sanitas_19.02.18

	BCC-MW-15009
7/11/2017	11.4 (D)
4/16/2018	9.4
6/13/2018	8.5
11/28/2018	4.1
Mean	8.35
Std. Dev.	3.082
Upper Lim.	15.35
Lower Lim.	1.354

[DRAFT - ELECTRONIC REVIEW]

Parametric Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Lithium, Total Analysis Run 3/5/2019 8:28 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

Confidence Interval

Constituent: Lithium, Total (ug/L) Analysis Run 3/5/2019 8:29 AM

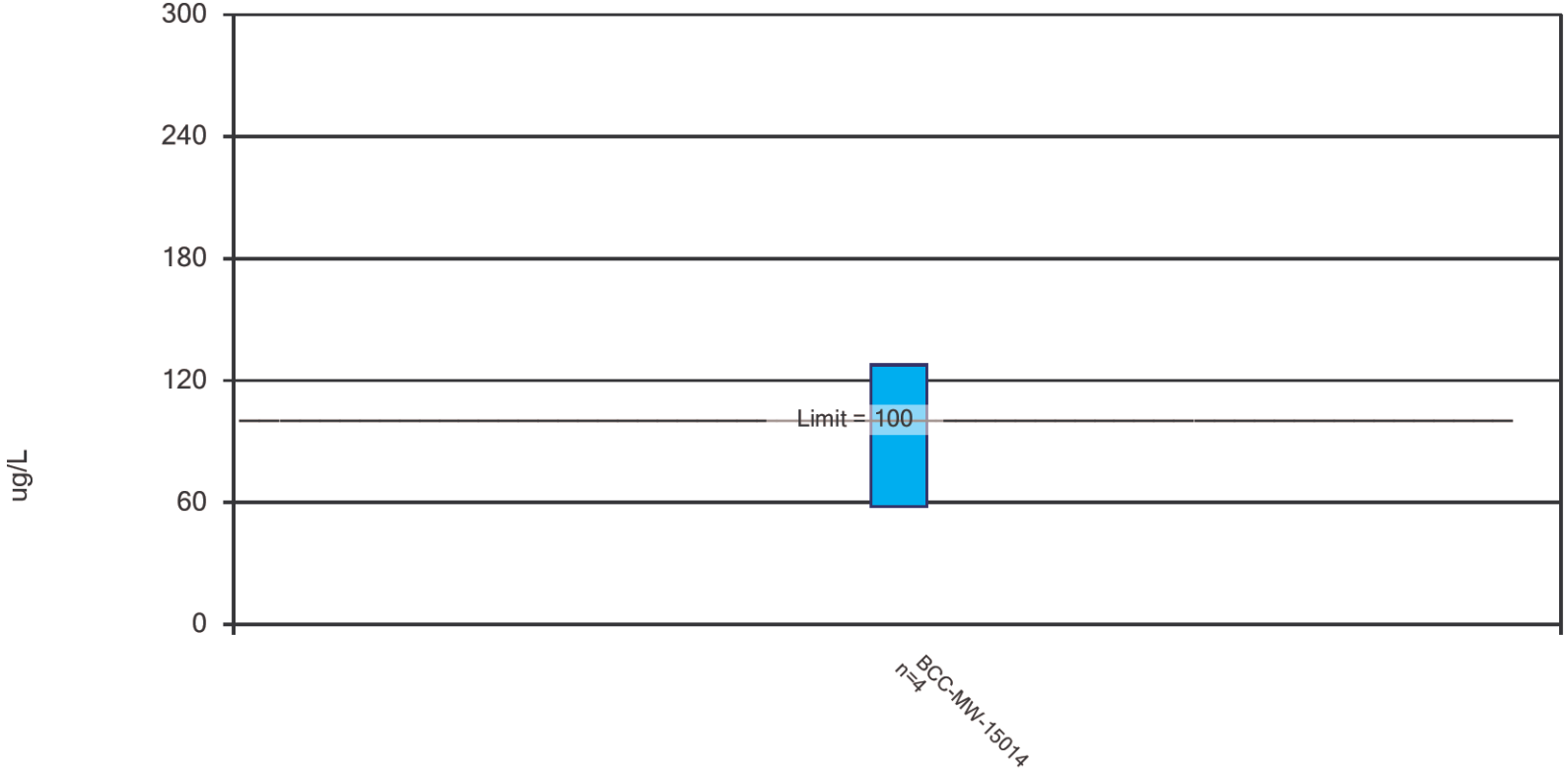
Client: Consumers Energy Data: BCC_Sanitas_19.02.18

	BCC-MW-15010	BCC-MW-17001	BCC-MW-17002
7/11/2017	21		
2/20/2018		73	160
4/16/2018	46		
6/14/2018	54		
6/15/2018		65	150
8/6/2018		62	130
11/28/2018	51		
11/29/2018		63.5 (D)	120
Mean	43	65.88	140
Std. Dev.	15.03	4.905	18.26
Upper Lim.	77.13	77.01	181.5
Lower Lim.	8.869	54.74	98.55

[DRAFT - ELECTRONIC REVIEW]

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Molybdenum, Total Analysis Run 3/5/2019 8:29 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

Confidence Interval

Constituent: Molybdenum, Total (ug/L) Analysis Run 3/5/2019 8:29 AM

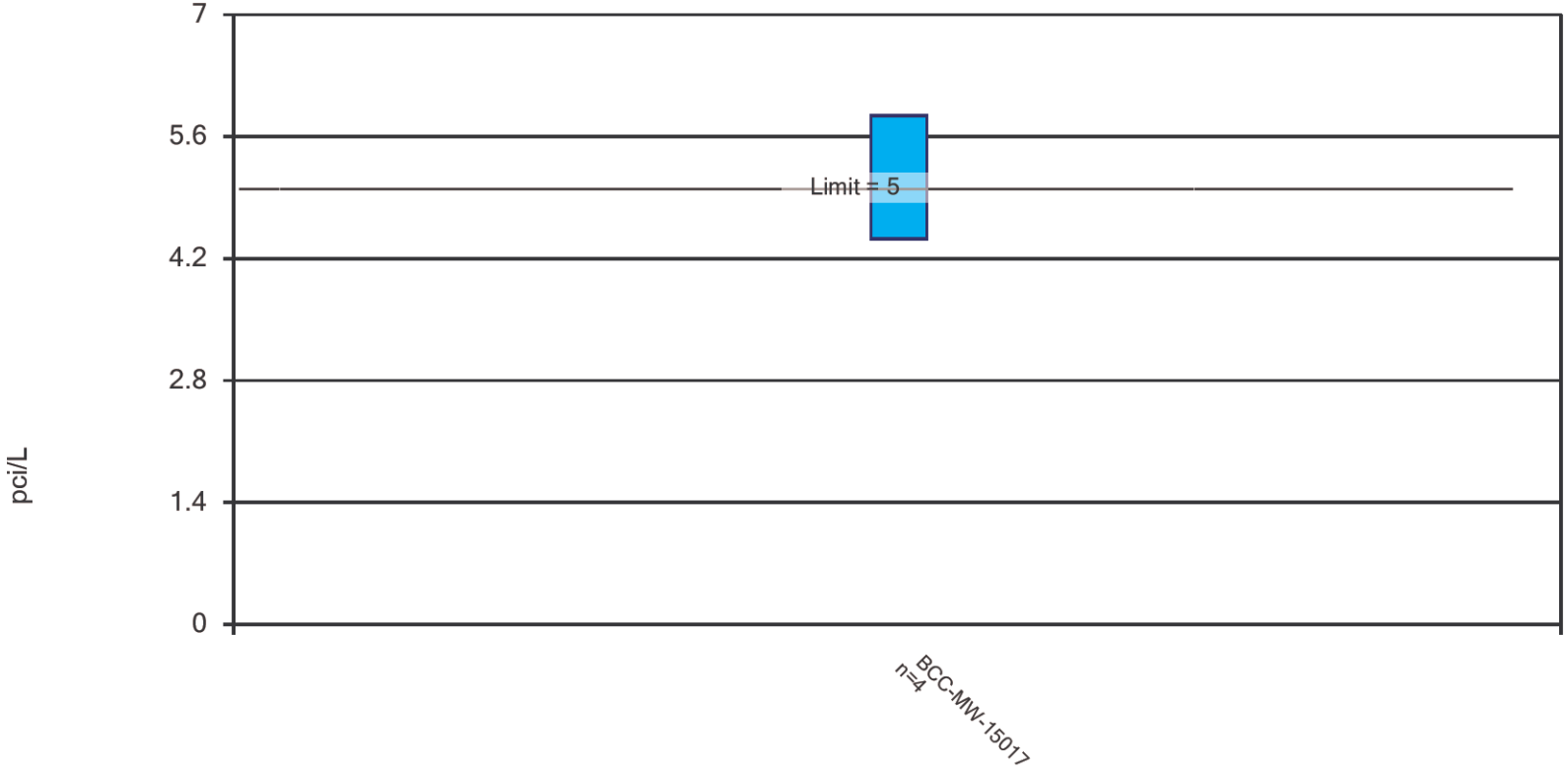
Client: Consumers Energy Data: BCC_Sanitas_19.02.18

	BCC-MW-15014
7/12/2017	70.9
4/17/2018	94.7
6/13/2018	100
11/29/2018	106
Mean	92.9
Std. Dev.	15.38
Upper Lim.	127.8
Lower Lim.	57.99

[DRAFT - ELECTRONIC REVIEW]

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Radium-226/228 Analysis Run 3/5/2019 8:30 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

Confidence Interval

Constituent: Radium-226/228 (pci/L) Analysis Run 3/5/2019 8:30 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

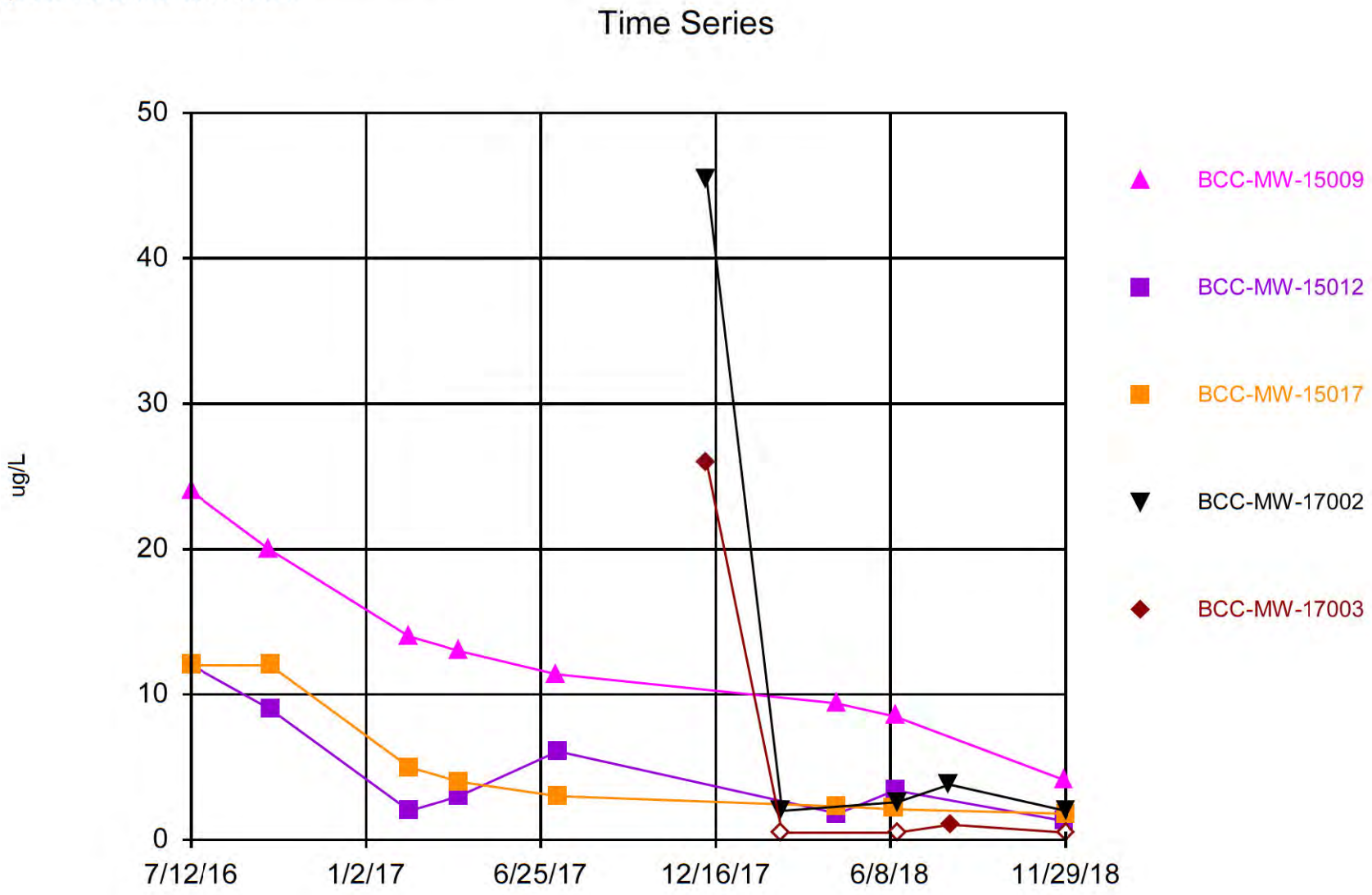
	BCC-MW-15017
7/12/2017	4.75
4/17/2018	5.16
6/12/2018	5.51 (D)
11/29/2018	5.12
Mean	5.135
Std. Dev.	0.3108
Upper Lim.	5.841
Lower Lim.	4.429

[DRAFT - ELECTRONIC REVIEW]

Attachment 2
Sanitas™ Output (n=8)

[DRAFT - ELECTRONIC REVIEW]

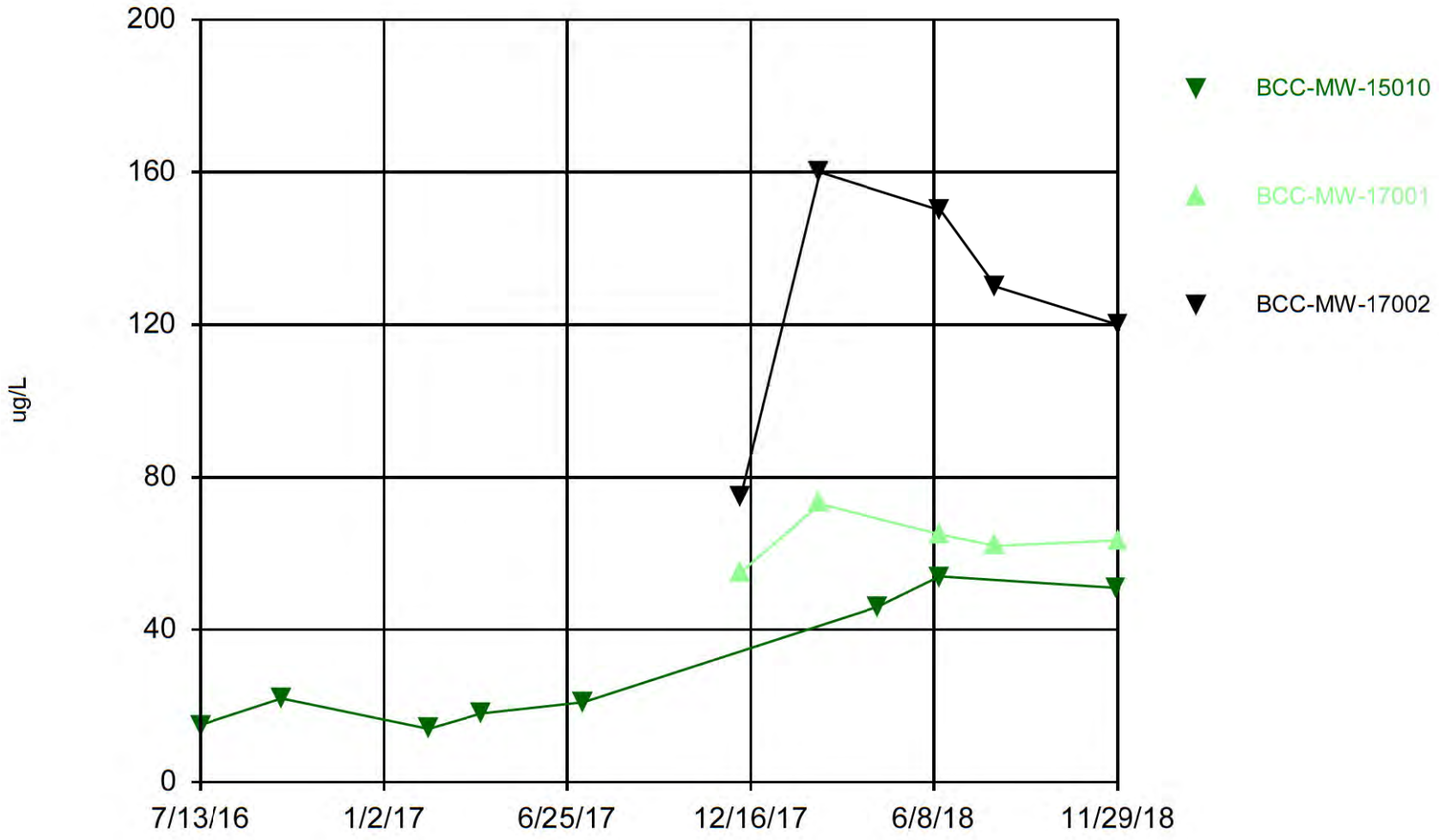
Sanitas™ v.9.6.12 Sanitas software licensed to Consumers Energy. EPA
Hollow symbols indicate censored values.



Constituent: Arsenic, Total Analysis Run 3/14/2019 9:27 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

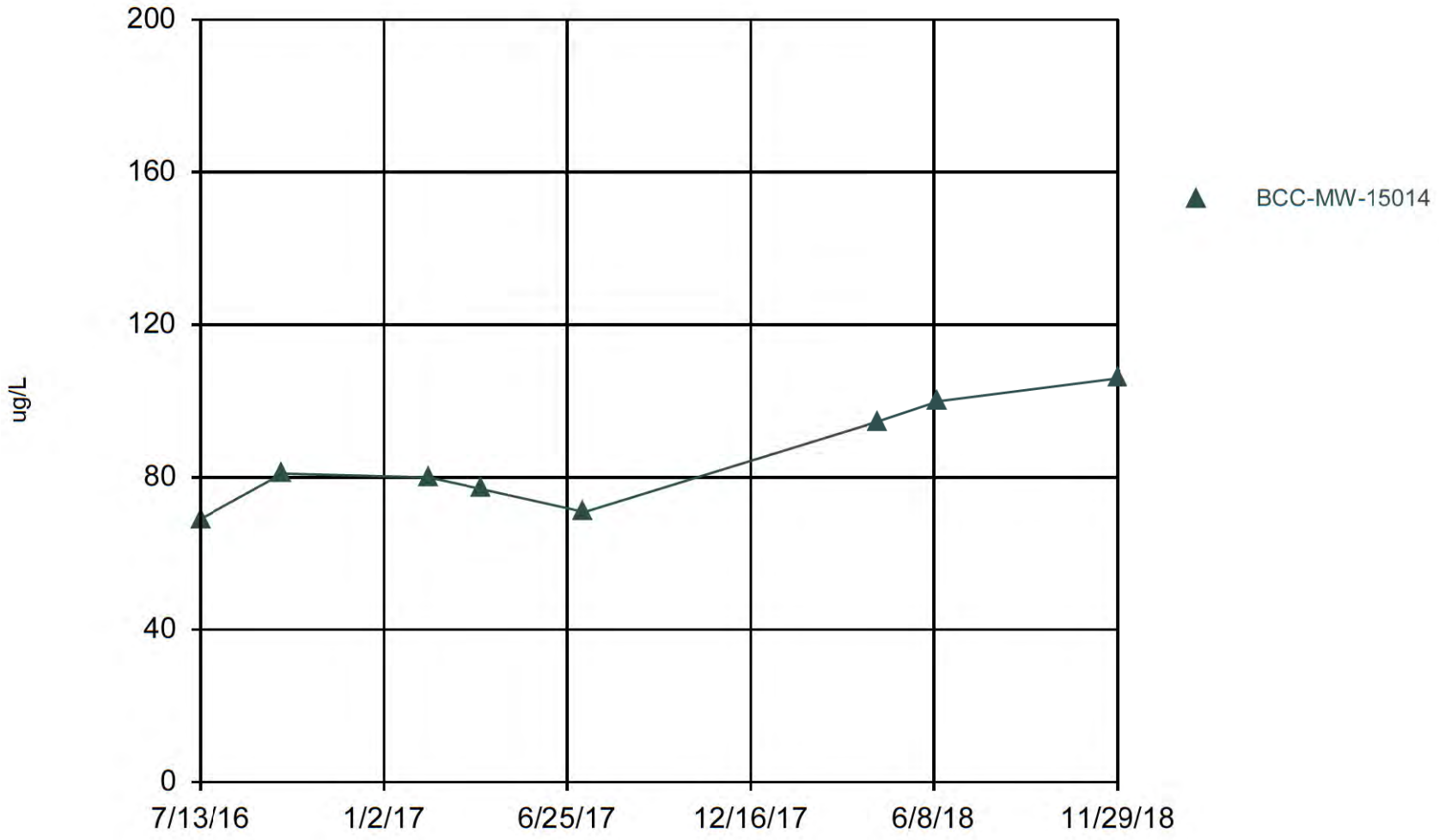
Time Series



Constituent: Lithium, Total Analysis Run 3/14/2019 9:27 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

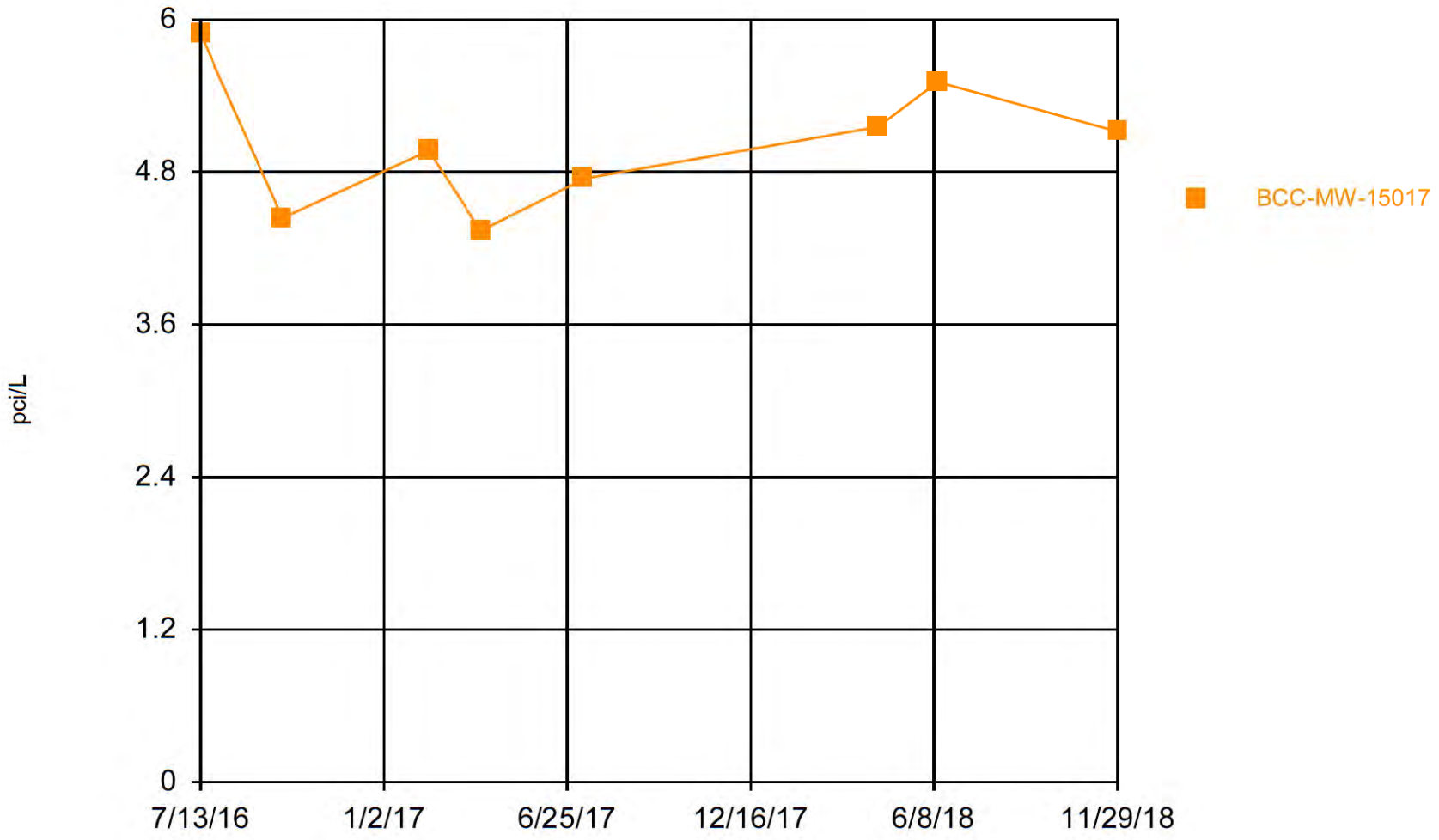
Time Series



Constituent: Molybdenum, Total Analysis Run 3/14/2019 9:27 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

Time Series

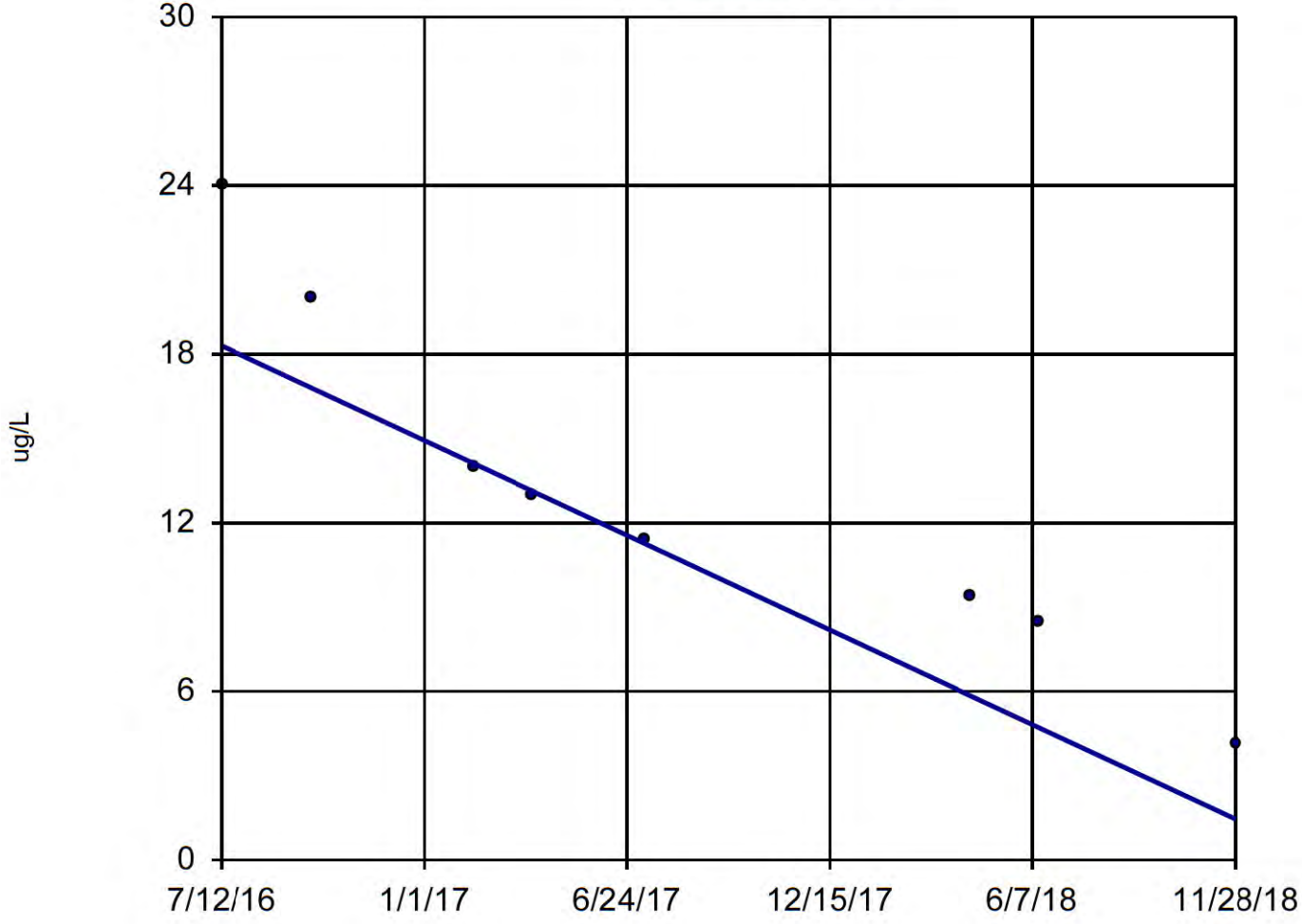


Constituent: Radium-226/228 Analysis Run 3/14/2019 9:27 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

Sen's Slope Estimator

BCC-MW-15009



n = 8

Slope = -7.074 units per year.

Mann-Kendall statistic = -28
critical = -20

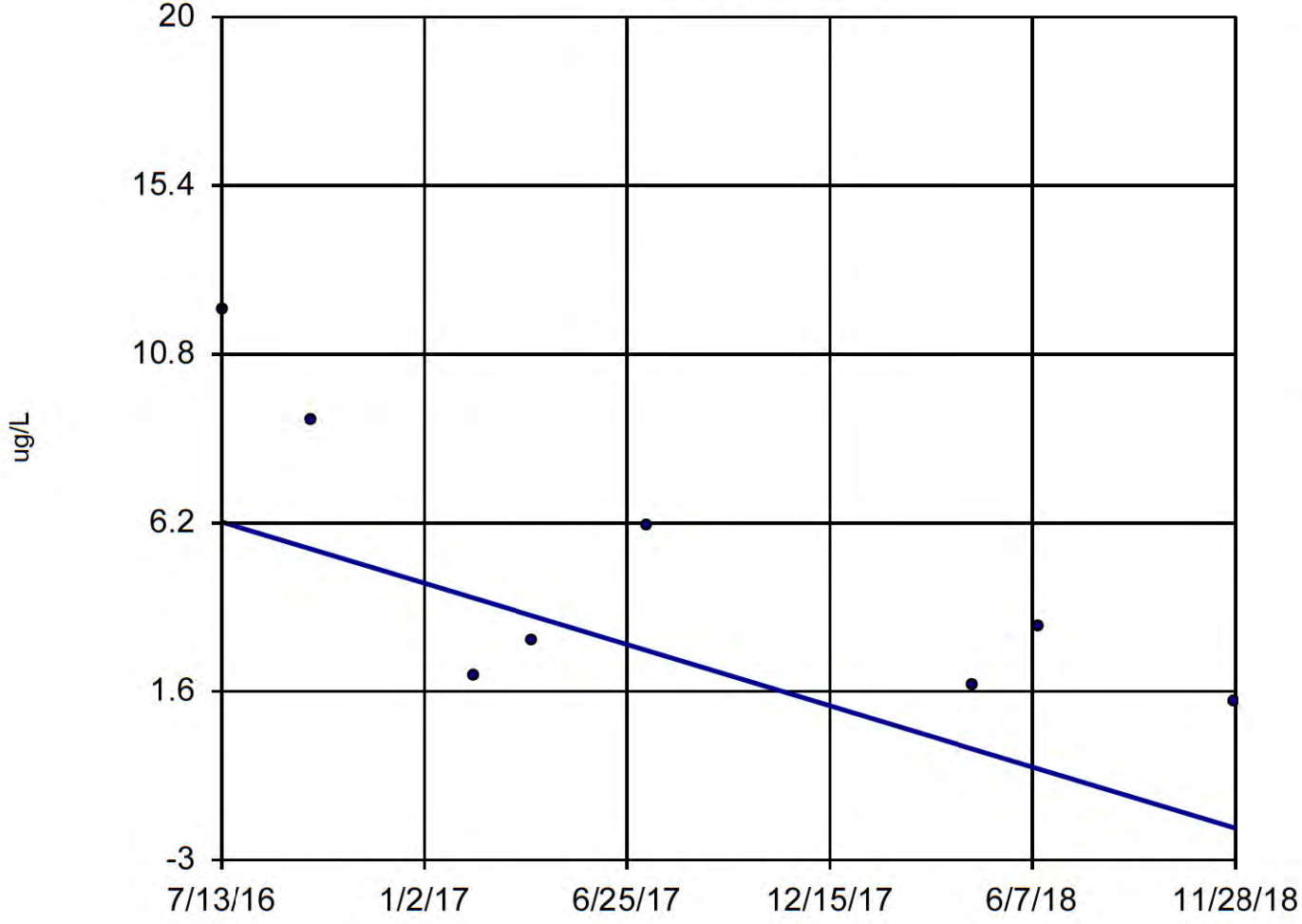
Decreasing trend significant at 98% confidence level (α = 0.01 per tail).

Constituent: Arsenic, Total Analysis Run 3/12/2019 9:34 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

Sen's Slope Estimator

BCC-MW-15012



n = 8

Slope = -3.517 units per year.

Mann-Kendall statistic = -16
critical = -20

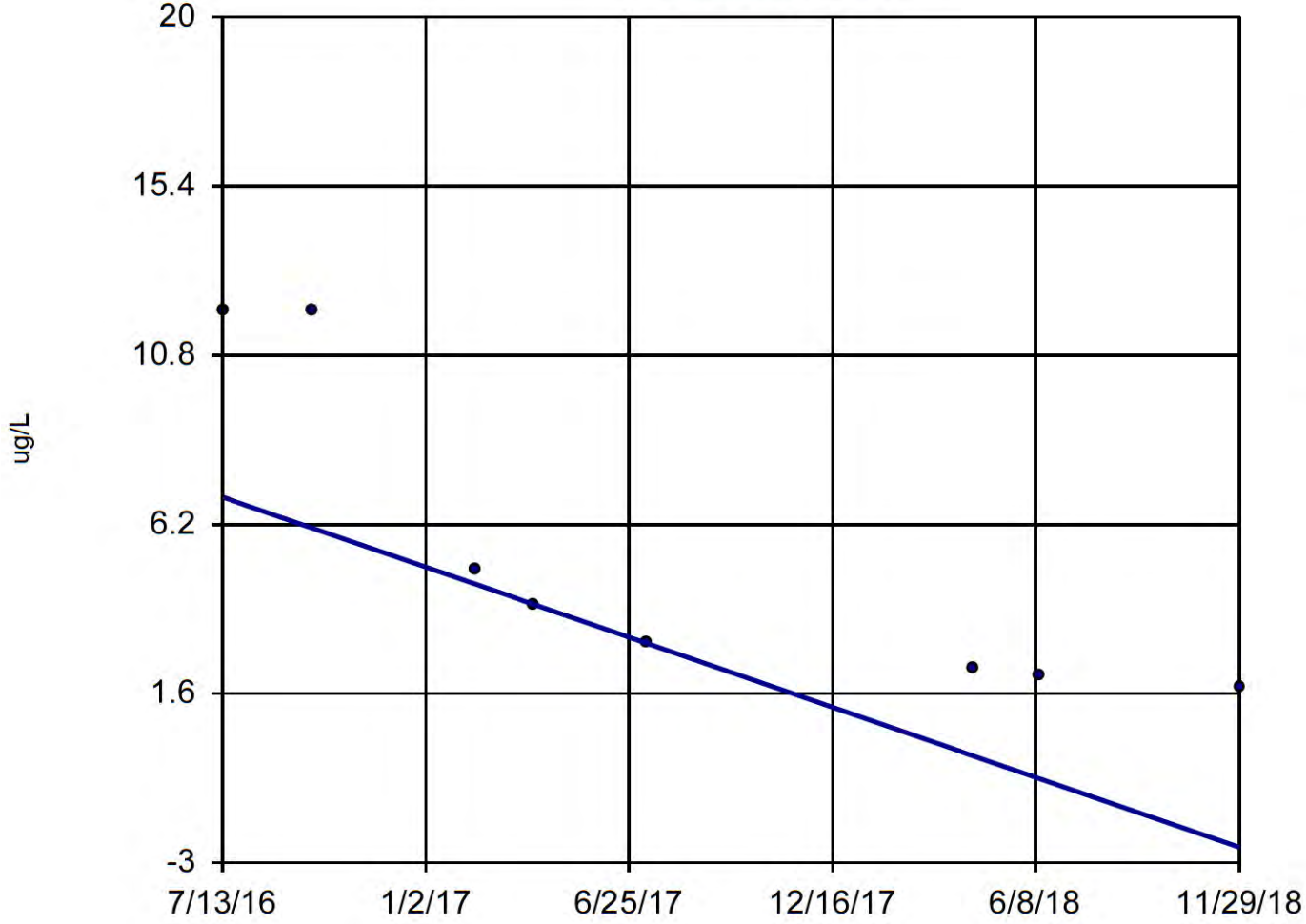
Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: Arsenic, Total Analysis Run 3/12/2019 9:34 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

Sen's Slope Estimator

BCC-MW-15017



n = 8

Slope = -4.004 units per year.

Mann-Kendall statistic = -27
critical = -20

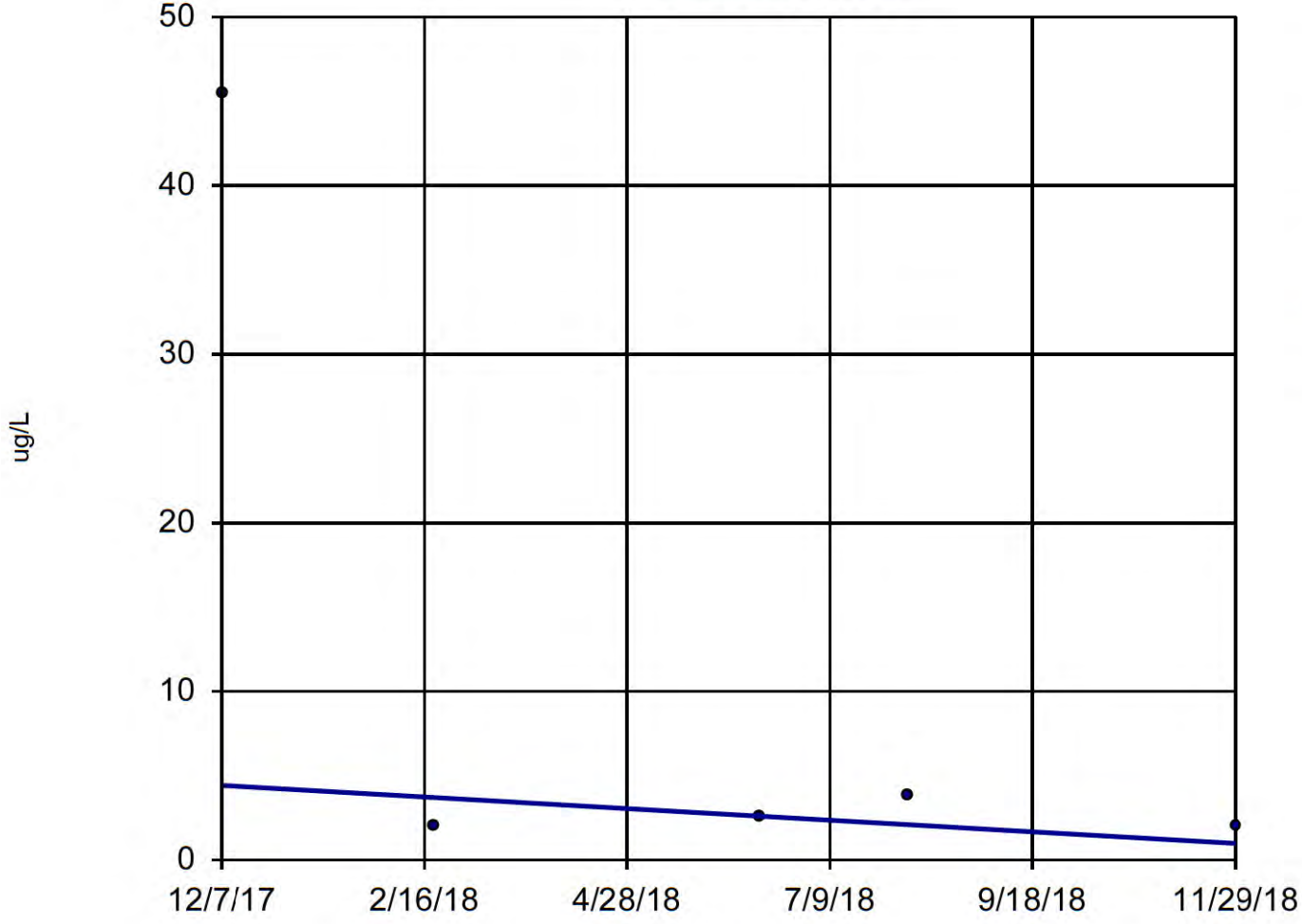
Decreasing trend significant at 98% confidence level (α = 0.01 per tail).

Constituent: Arsenic, Total Analysis Run 3/12/2019 9:34 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

Sen's Slope Estimator

BCC-MW-17002



n = 5

Slope = -3.512 units per year.

Mann-Kendall statistic = -3
critical = -10

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

Constituent: Arsenic, Total Analysis Run 3/12/2019 9:34 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

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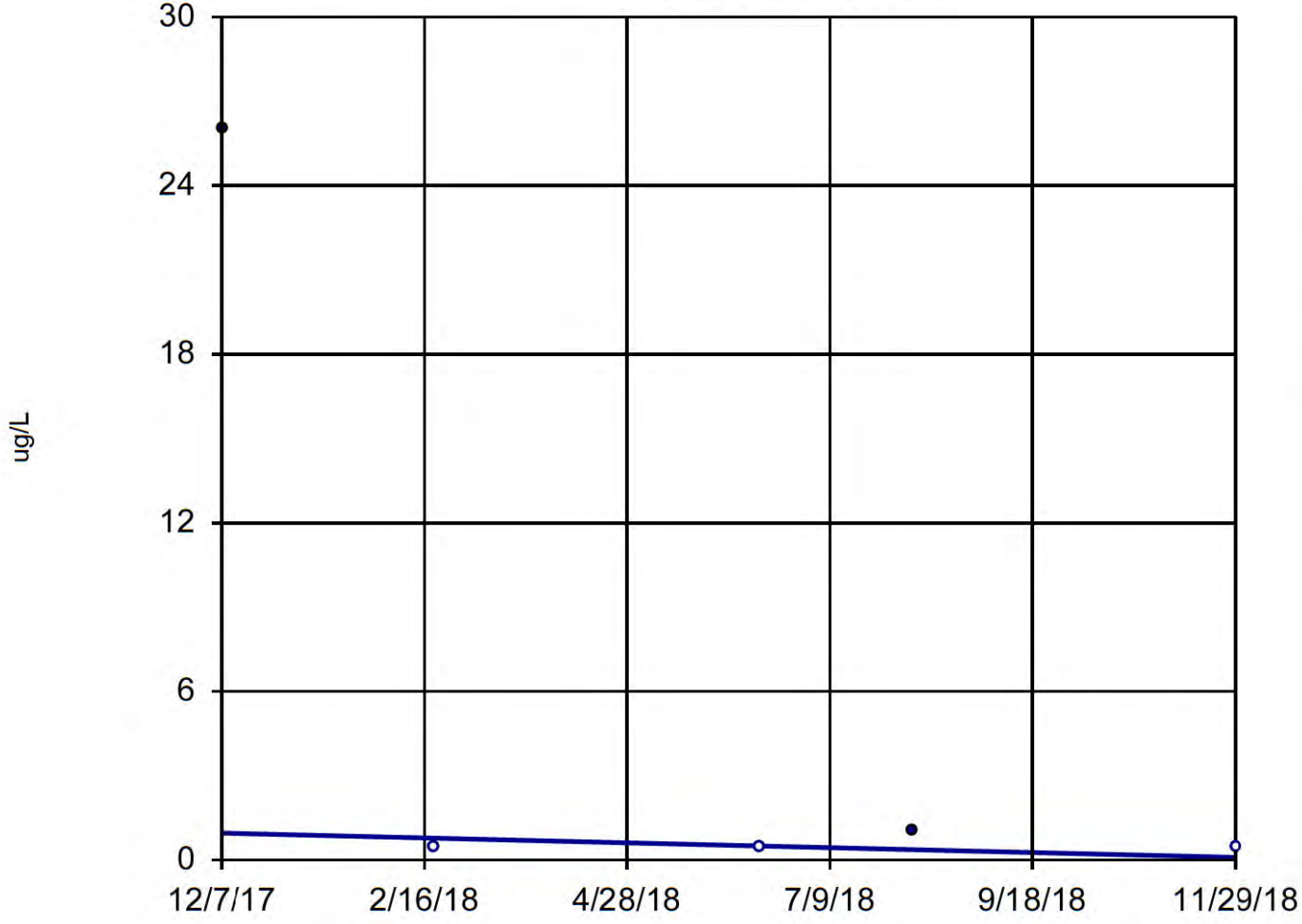
Hollow symbols indicate censored values.

Sen's Slope Estimator

BCC-MW-17003



n = 5

Slope = -0.8805 units per year.

Mann-Kendall statistic = -3
critical = -10

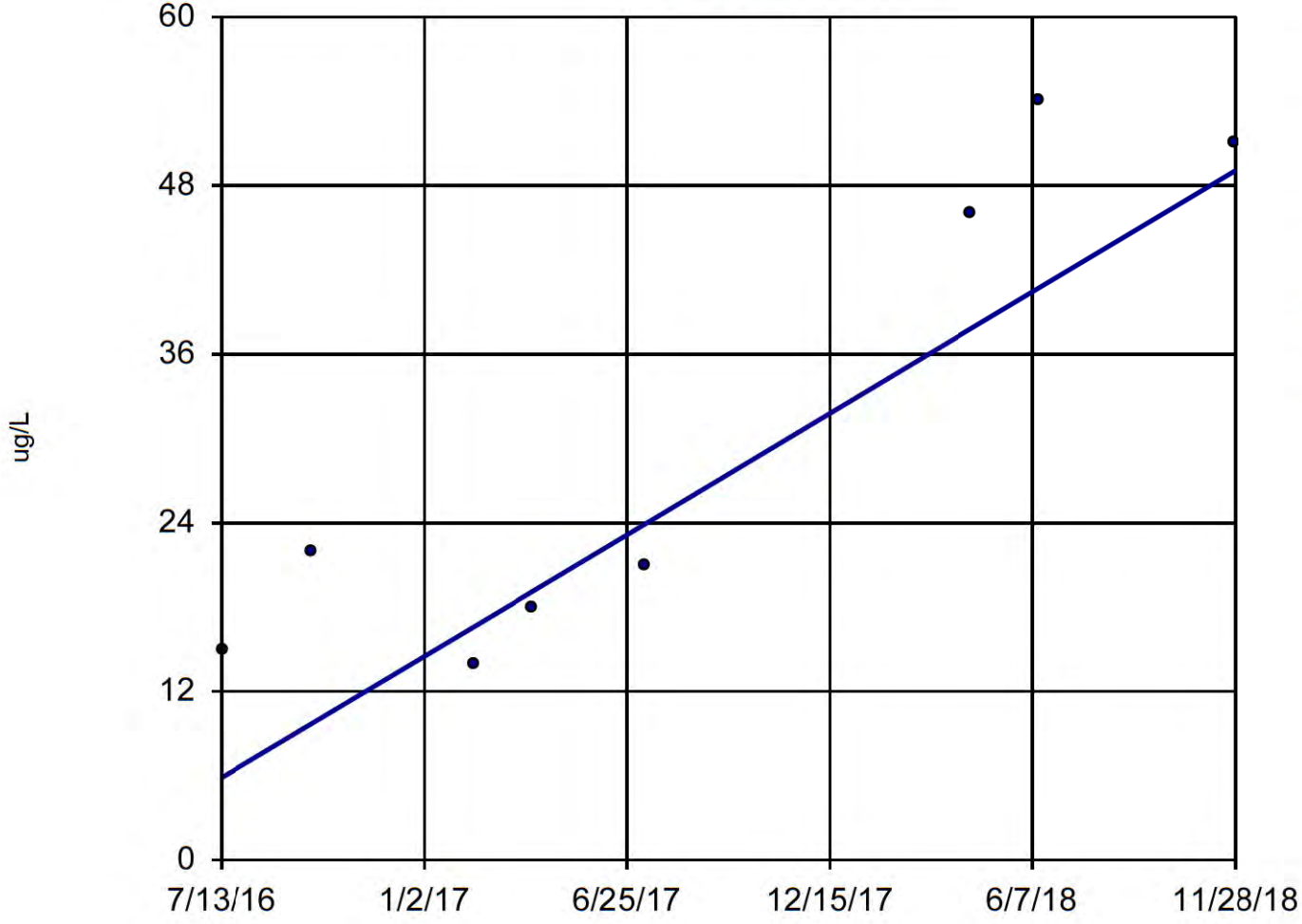
Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: Arsenic, Total Analysis Run 3/12/2019 9:34 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

Sen's Slope Estimator

BCC-MW-15010



n = 8

Slope = 18.17 units per year.

Mann-Kendall statistic = 18
critical = 20

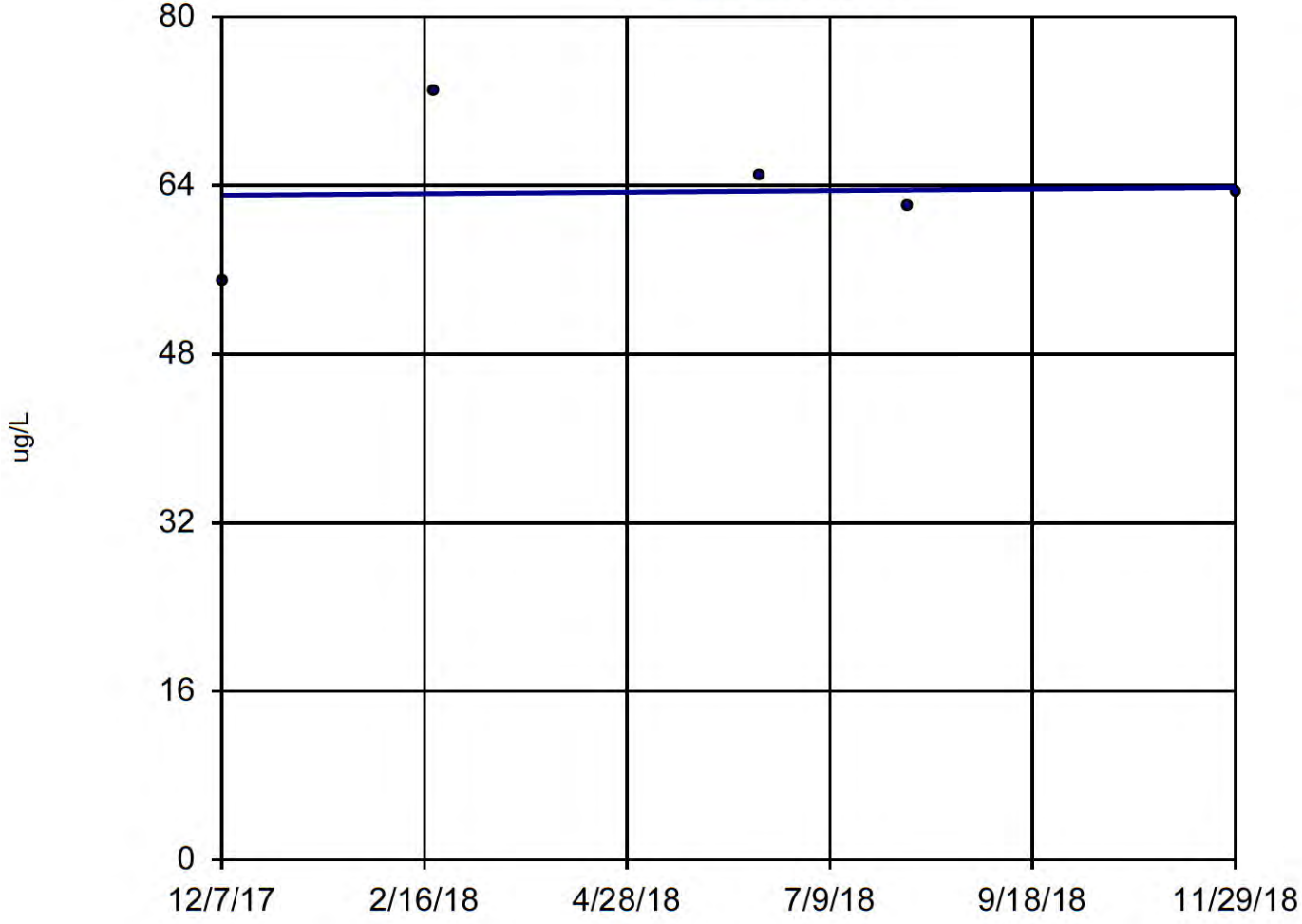
Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: Lithium, Total Analysis Run 3/12/2019 9:34 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

Sen's Slope Estimator

BCC-MW-17001



n = 5

Slope = 0.7412 units per year.

Mann-Kendall statistic = 0
critical = 10

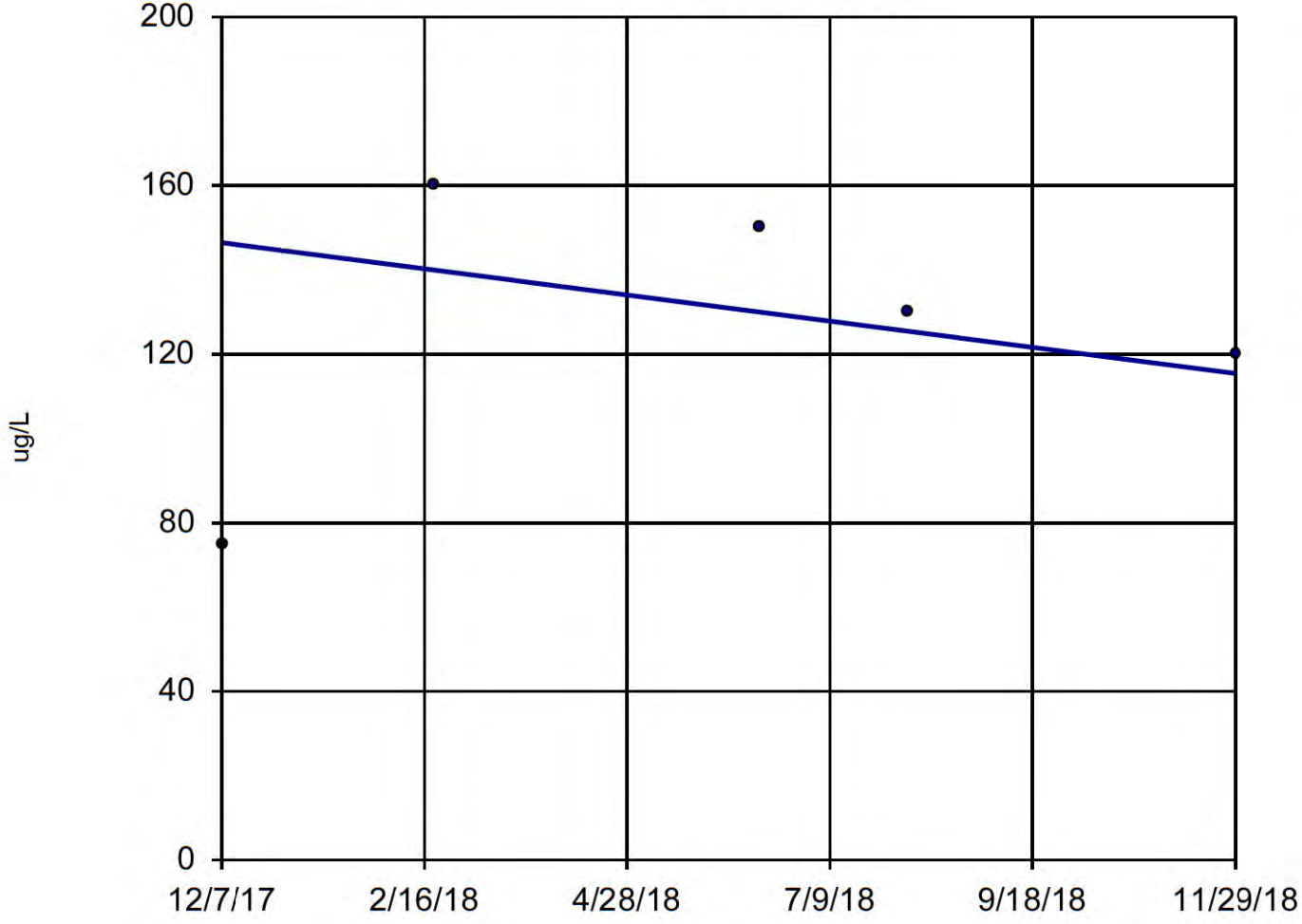
Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: Lithium, Total Analysis Run 3/12/2019 9:34 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

Sen's Slope Estimator

BCC-MW-17002



n = 5

Slope = -31.74 units per year.

Mann-Kendall statistic = -2
critical = -10

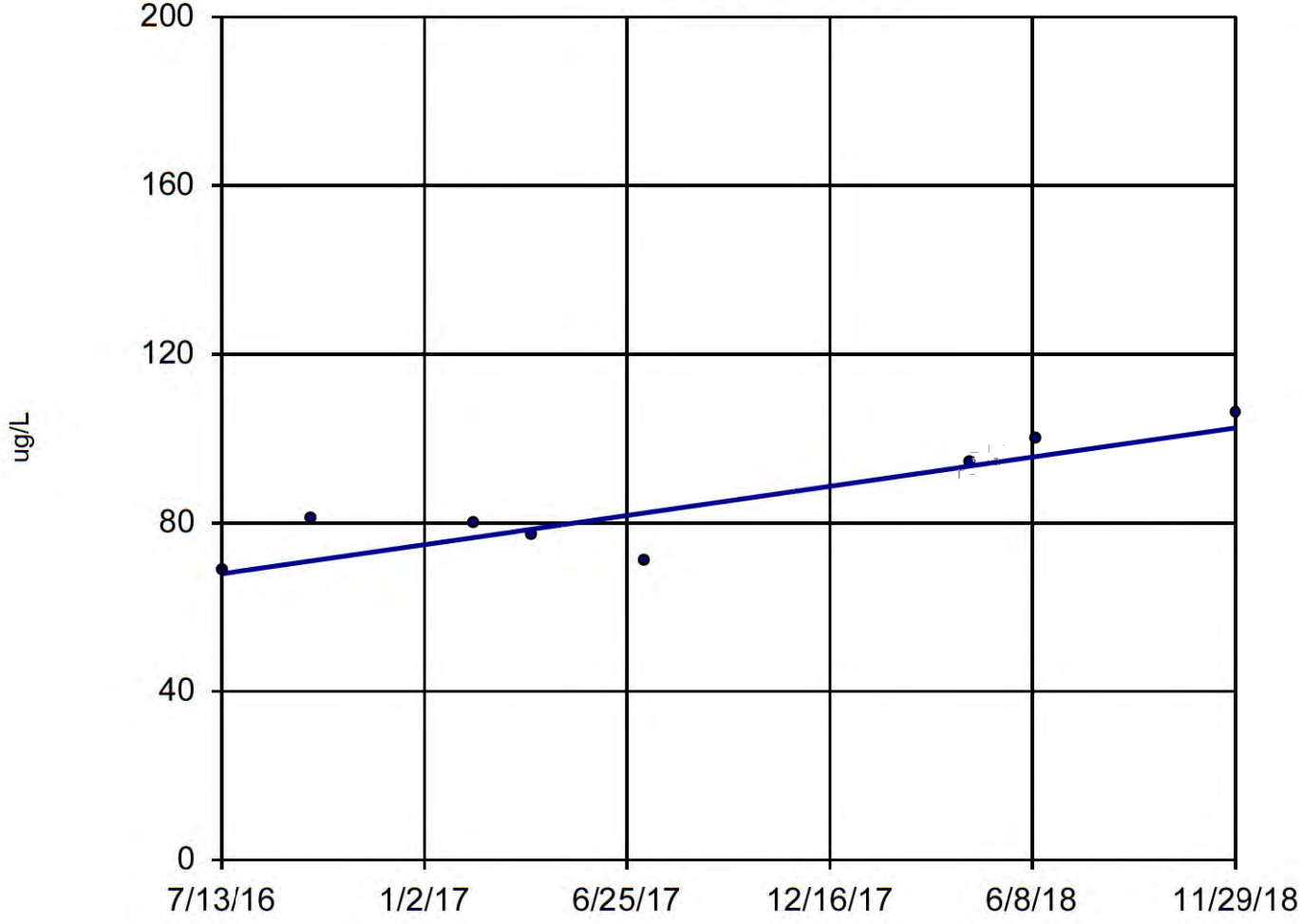
Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: Lithium, Total Analysis Run 3/12/2019 9:34 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

Sen's Slope Estimator

BCC-MW-15014



n = 8

Slope = 14.56 units per year.

Mann-Kendall statistic = 16
critical = 20

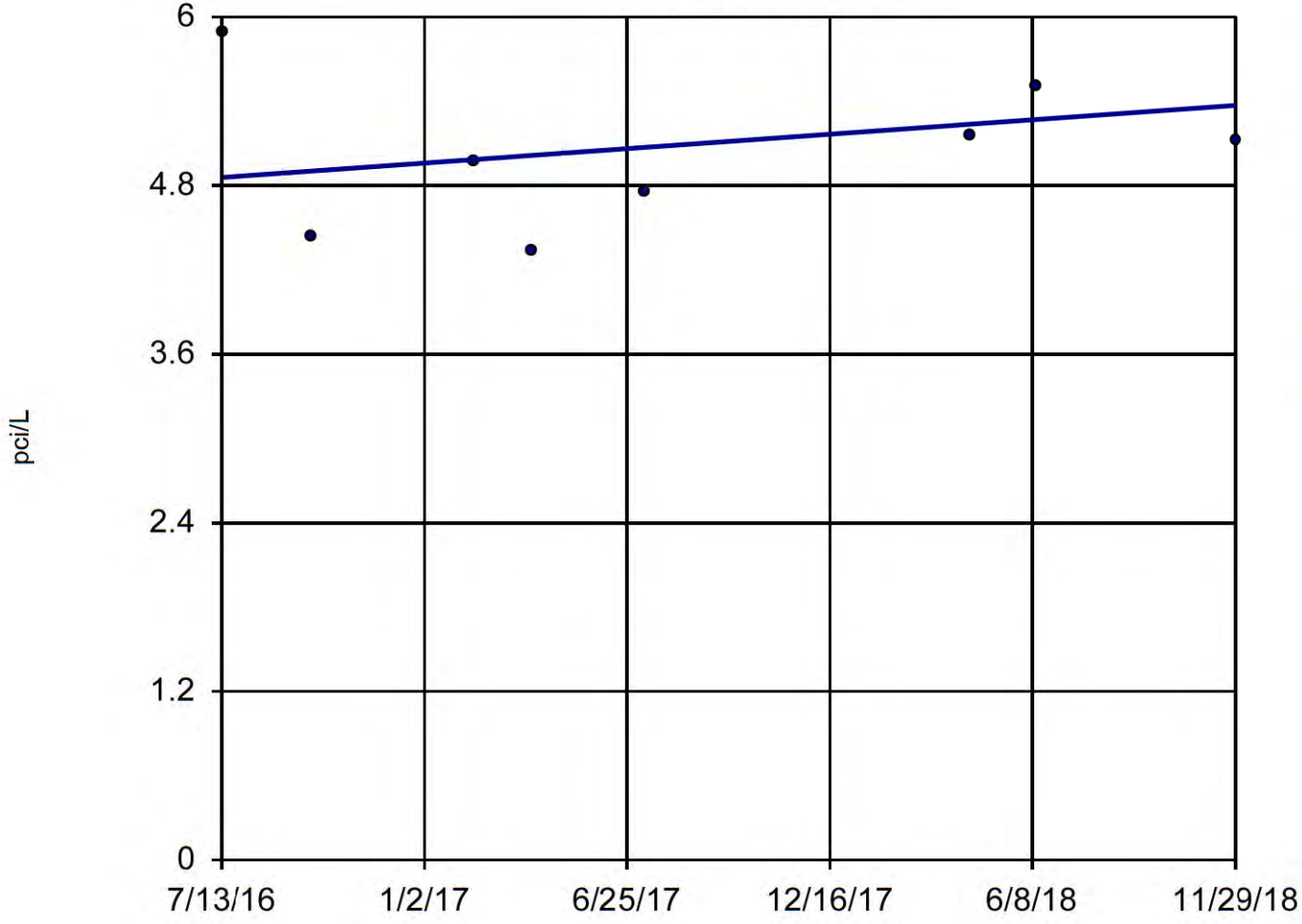
Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: Molybdenum, Total Analysis Run 3/12/2019 9:34 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

Sen's Slope Estimator

BCC-MW-15017



n = 8

Slope = 0.2149 units per year.

Mann-Kendall statistic = 4
critical = 20

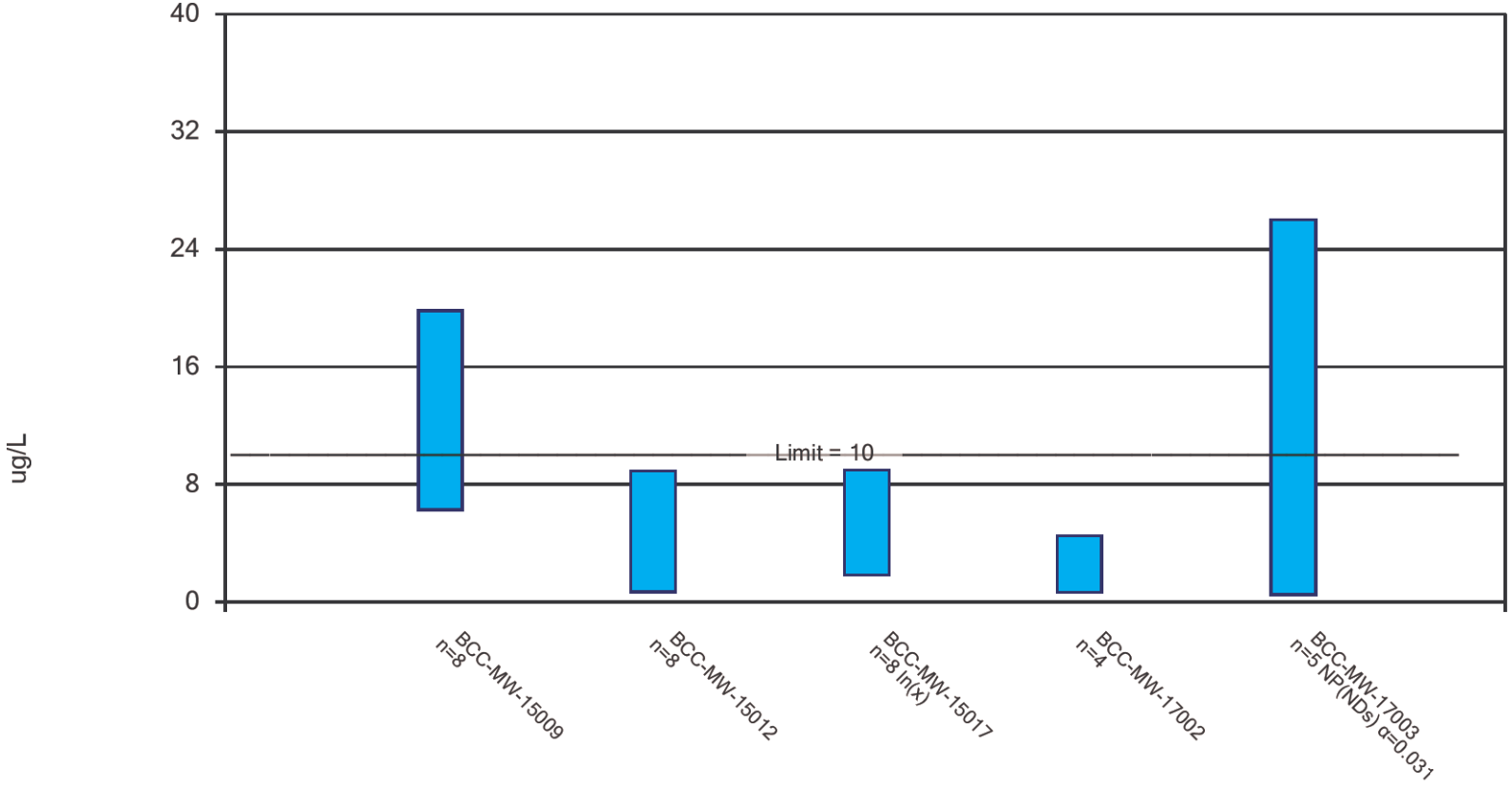
Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: Radium-226/228 Analysis Run 3/12/2019 9:34 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Arsenic, Total Analysis Run 3/12/2019 9:53 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

Confidence Interval

Constituent: Arsenic, Total (ug/L) Analysis Run 3/12/2019 9:54 AM

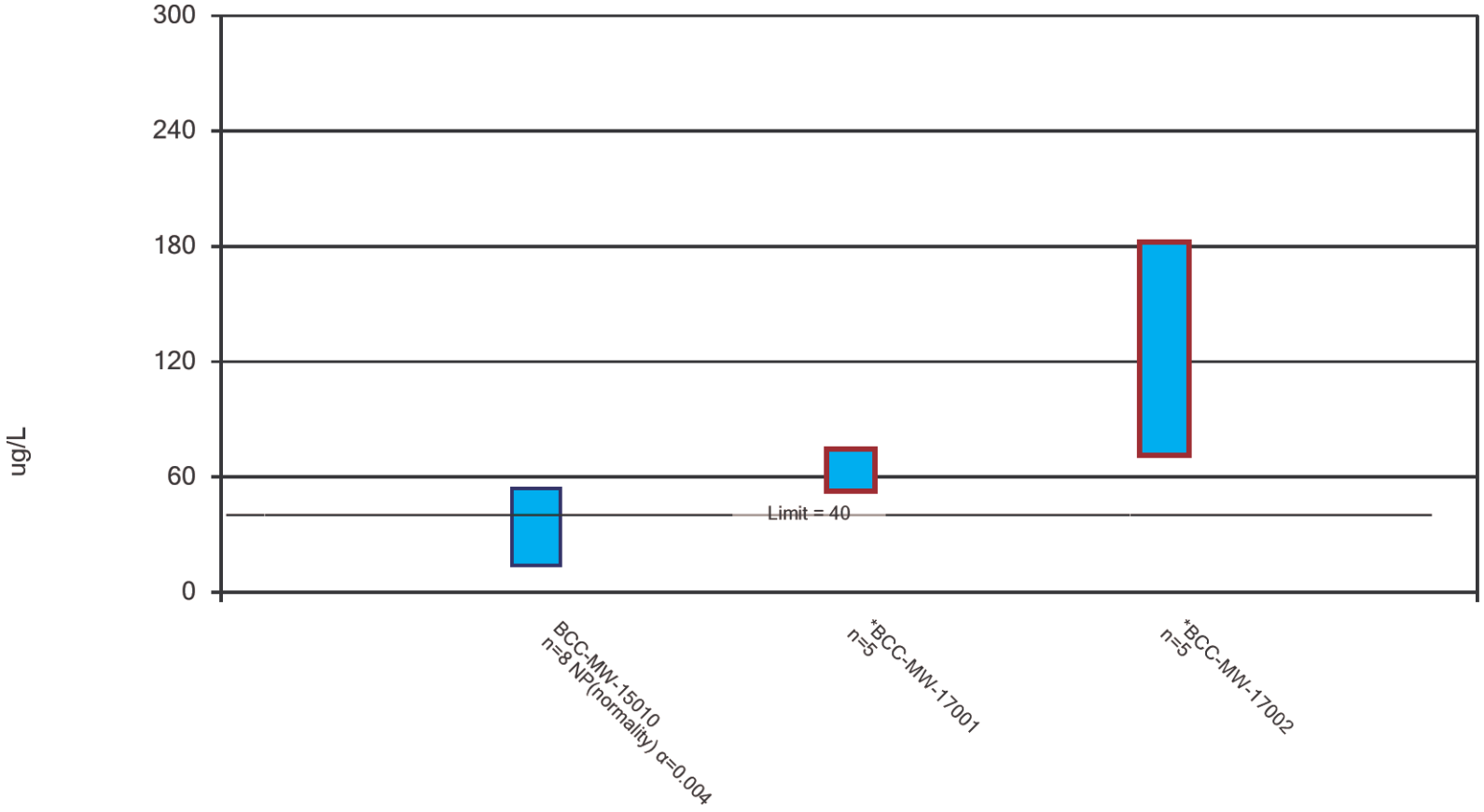
Client: Consumers Energy Data: BCC_Sanitas_19.02.18

	BCC-MW-15009	BCC-MW-15012	BCC-MW-15017	BCC-MW-17002	BCC-MW-17003
7/12/2016	24				
7/13/2016		12	12		
9/28/2016	20				
9/29/2016		9	12		
2/14/2017	14	2	5		
4/5/2017	13	3	4		
7/11/2017	11.4 (D)				
7/12/2017		6.1	3		
12/7/2017					26
2/20/2018				2	<1
4/16/2018	9.4				
4/17/2018		1.8	2.3		
6/12/2018			2.1 (D)		
6/13/2018	8.5	3.4			
6/15/2018				2.6	<1
8/6/2018				3.8	
8/7/2018					1.05 (D)
11/28/2018	4.1	1.3			
11/29/2018			1.8	2	<1
Mean	13.05	4.825	5.275	2.6	5.71
Std. Dev.	6.392	3.881	4.282	0.8485	11.34
Upper Lim.	19.82	8.939	8.978	4.526	26
Lower Lim.	6.275	0.711	1.844	0.6735	0.5

[DRAFT - ELECTRONIC REVIEW]

Parametric and Non-Parametric (NP) Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Lithium, Total Analysis Run 3/12/2019 9:33 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

Confidence Interval

Constituent: Lithium, Total (ug/L) Analysis Run 3/12/2019 9:33 AM

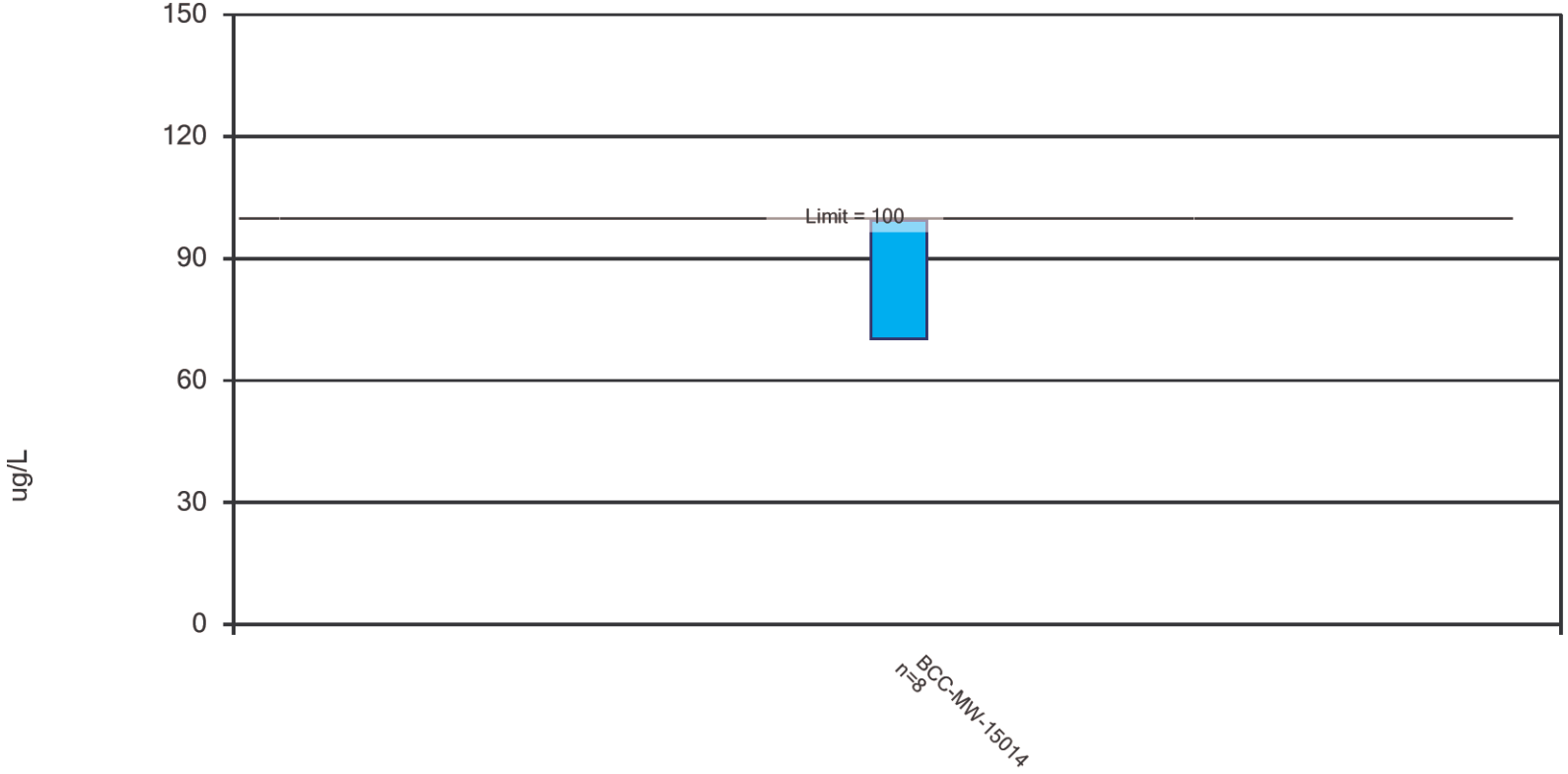
Client: Consumers Energy Data: BCC_Sanitas_19.02.18

	BCC-MW-15010	BCC-MW-17001	BCC-MW-17002
7/13/2016	15		
9/28/2016	22		
2/14/2017	14		
4/5/2017	18		
7/11/2017	21		
12/7/2017		55	75
2/20/2018		73	160
4/16/2018	46		
6/14/2018	54		
6/15/2018		65	150
8/6/2018		62	130
11/28/2018	51		
11/29/2018		63.5 (D)	120
Mean	30.13	63.7	127
Std. Dev.	17.08	6.458	33.09
Upper Lim.	54	74.52	182.4
Lower Lim.	14	52.88	71.55

[DRAFT - ELECTRONIC REVIEW]

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Molybdenum, Total Analysis Run 3/12/2019 9:33 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

Confidence Interval

Constituent: Molybdenum, Total (ug/L) Analysis Run 3/12/2019 9:33 AM

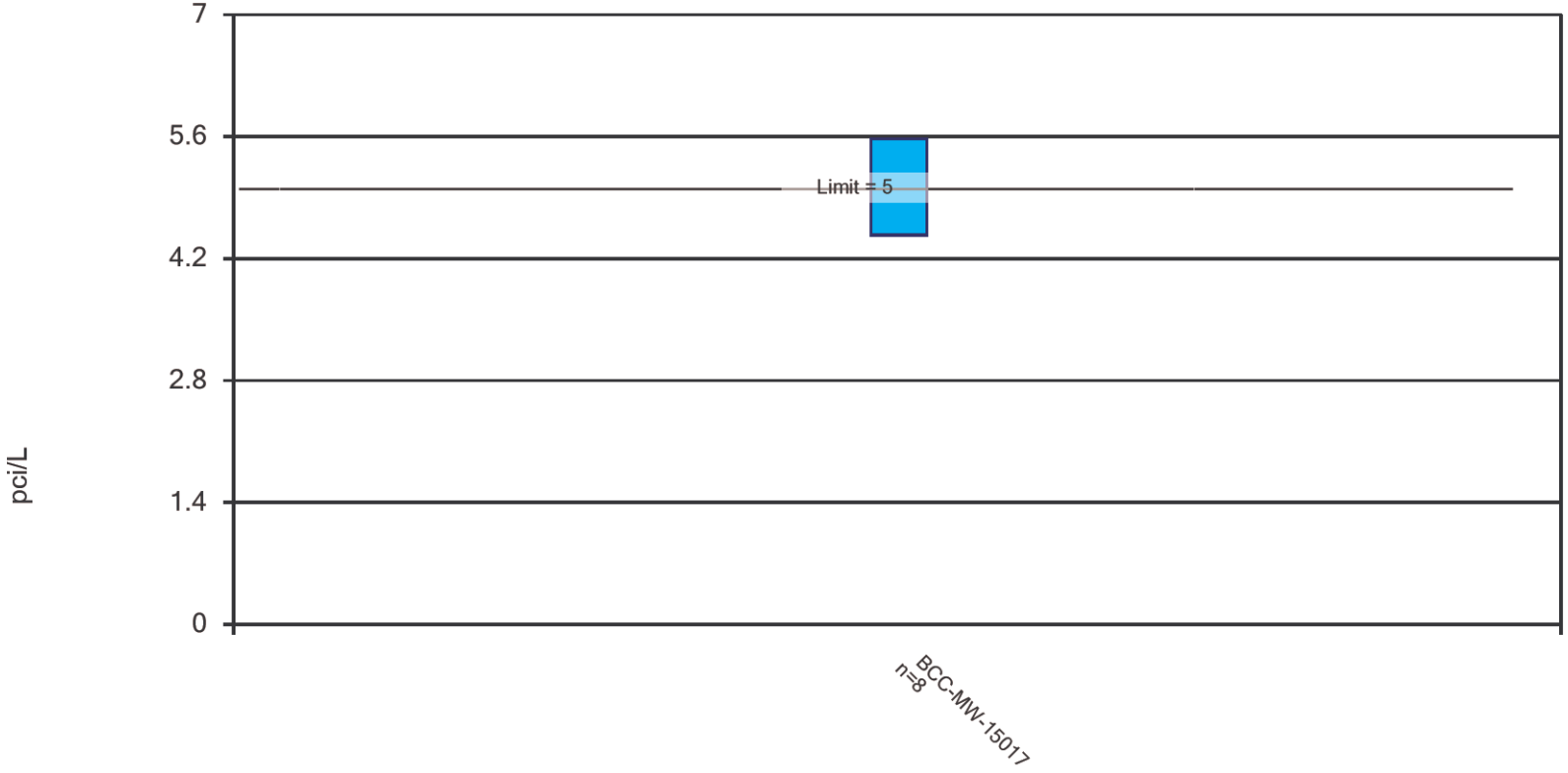
Client: Consumers Energy Data: BCC_Sanitas_19.02.18

	BCC-MW-15014
7/13/2016	69
9/29/2016	81
2/14/2017	80
4/5/2017	77
7/12/2017	70.9
4/17/2018	94.7
6/13/2018	100
11/29/2018	106
Mean	84.83
Std. Dev.	13.73
Upper Lim.	99.38
Lower Lim.	70.27

[DRAFT - ELECTRONIC REVIEW]

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Radium-226/228 Analysis Run 3/12/2019 9:33 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

Confidence Interval

Constituent: Radium-226/228 (pci/L) Analysis Run 3/12/2019 9:33 AM

Client: Consumers Energy Data: BCC_Sanitas_19.02.18

	BCC-MW-15017
7/13/2016	5.89
9/29/2016	4.44
2/14/2017	4.97
4/5/2017	4.34
7/12/2017	4.75
4/17/2018	5.16
6/12/2018	5.51 (D)
11/29/2018	5.12
Mean	5.023
Std. Dev.	0.5211
Upper Lim.	5.575
Lower Lim.	4.47

[DRAFT - ELECTRONIC REVIEW]

Appendix B
Data Quality Review

[DRAFT - ELECTRONIC REVIEW]

Laboratory Data Quality Review
Groundwater Monitoring Event April 2019
CEC BC Cobb

Groundwater samples were collected by TRC for the April 2019 sampling event. Samples were analyzed for anions, total dissolved solids, and total metals by Eurofins TestAmerica, located in Irvine, California (Eurofins TA - Irvine). The lithium analyses by method SW-846 6020 were subcontracted to Eurofins TA in North Canton, Ohio (Eurofins TA – Canton) and the radium analyses were subcontracted to Eurofins TA in St. Louis, MO (Eurofins TA – St. Louis). The laboratory analytical results were reported in laboratory sample delivery groups (SDGs) 440-238859-1, 440-239119-1, 440-238857-1, and 440-239127-1.

During the April 2019 sampling event, a groundwater sample was collected from each of the following wells:

440-238859-1/440-238857-1

- BCC-MW-15002
- BCC-MW-15003
- BCC-MW-15004
- BCC-MW-15005
- BCC-MW-15006
- BCC-MW-15007
- BCC-MW-15008
- BCC-MW-15009
- BCC-MW-15010
- BCC-MW-15011
- BCC-MW-15012
- BCC-MW-15013
- BCC-MW-15014
- BCC-MW-15015
- BCC-MW-15016
- BCC-MW-15017
- BCC-MW-15018
- BCC-MW-17001
- BCC-MW-17002
- BCC-MW-17003

440-239119-1/440-239127-1

- BCC-MW-15019
- BCC-MW-15020
- BCC-MW-15021
- BCC-MW-15022
- BCC-MW-15023
- BCC-MW-17004
- BCC-MW-17005
- BCC-MW-17006

Each sample was analyzed for one or more of the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Total Dissolved Solids	SM 2540C-11
Total Metals	SW-846 6020B/6010C/7470A
Radium (Radium-226, Radium-228, Total Radium)	EPA 903.0, EPA 904.0

[DRAFT - ELECTRONIC REVIEW]

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2017) and the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

- Sample receipt;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field blanks are used to assess potential contamination arising from field procedures;
- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Data for laboratory duplicates, when performed on project samples. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Percent recoveries for carriers, where applicable, for radiochemistry only. Carriers are used to assess the chemical yield for the preparation and/or instrument efficiency;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation, are noted below.

[DRAFT - ELECTRONIC REVIEW]

- The reviewed Appendix III and IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- Sample receipt:
  - The laboratory noted that the pH of the 6010 metals container for sample BCC-MW-15017 upon receipt at the laboratory was 3; the sample was properly preserved by the laboratory in order to meet the sample preservation requirement of pH <2 13 days after collection. Since the pH was just slightly above the acceptance criteria, there was no significant impact on data usability.
- Holding time criteria were met except the TDS holding time for samples BCC-MW-15004 and BCC-MW-15014 exceeded the 7-day holding time criteria by 6 minutes and by 18 minutes, respectively. These results may be estimated, biased low, as summarized in the attached table.
- A method blank was analyzed with each analytical batch. Target analytes were not detected in the method blanks.
- Four equipment blanks (EB-01, EB-02, EB-03, EB-04) and three field blanks (FB-01, FB-02, and FB-04) were collected. Target analytes were not detected in equipment blanks and field blanks.
- LCS and/or LCSD recoveries and relative percent differences (RPDs) recoveries were within laboratory control limits with the following exception:
  - The recovery for radium 226 in the LCS performed in batch 160-429160 was below the laboratory control limits. Potential low bias exists for the positive and nondetect results for radium 226 in select samples in this data set, as summarized in the attached table.
- MS/MSDs were performed on the following samples:
  - BCC-MW-15009, BCC-MW-15022, and BCC-MW-17006 for anions, mercury, metals;
  - BCC-MW-15019 for mercury;
  - BCC-MW-15014 for anions; and
  - BCC-MW-17003 for select metals (calcium and boron).
- The MS/MSD recoveries and RPDs were within the acceptance limits with the following exceptions:
  - The recoveries for sulfate, calcium, and boron in the MS and/or MSD performed on sample BCC-MW-15022, and the recovery for calcium in the MSD performed on sample

BCC-MW-17003 were outside of the laboratory control limits. However, the concentrations of these analytes in the parent samples were >4x the spike concentration; therefore, the laboratory control limits are not applicable. Data usability is not affected.

- The recoveries for barium in the MS/MSD performed on sample BCC-MW-15022 were above the laboratory control limits and the post digestion spike (PDS) recoveries were within the control limits. Potential high bias exists for the positive results for barium in select groundwater samples in this data set, as summarized in the attached table.
- The recoveries for selenium in the MS/MSDs performed on samples BCC-MW-15009, BCC-MW-15022, and BCC-MW-17006 were below the lower laboratory control limits and the PDS recoveries were within the control limits. Potential low bias exists for the results for selenium in all groundwater samples in this data set, as summarized in the attached table.

- Laboratory duplicates were performed on the samples BCC-MW-15009, BCC-MW-15022. and BCC-MW-17006 for TDS. RPDs were within laboratory control limits.
- The field duplicate pair samples submitted with this data set are as follows:
  - Dup-01 corresponds with BCC-MW-15012
  - Dup-02 corresponds with BCC-MW-15014
  - Dup-03 corresponds with BCC-MW-15019
  - Dup-04 corresponds with BCC-MW-17004
  - RPDs between the parent and duplicate samples were within the QC limits for all analytes with one exception. The RPD for selenium (66.7%) was above the acceptance criteria in the field duplicate pair Dup-02/BCC-MW-15014. Potential uncertainty exists for the results for selenium in select groundwater samples in this data set, as summarized in the attached table.
- Carrier recoveries, where applicable, were within 40-110%.
- Reporting limits (RLs) for fluoride (5 mg/L) and sulfate (10 mg/L) in sample BCC-MW-15007 were elevated due to a 5-fold dilution required due to the elevated concentration of chloride in this sample. Project-specified RLs (1 mg/L and 2 mg/L, respectively) were not met.

Attachment A
Summary of Data Non-Conformances for Groundwater Analytical Data
BC Cobb - RCRA CCR Detection Monitoring Program
Muskegon, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
BCC-MW-15004	4/9/2019	TDS	Analysis performed past holding time; sample results may be biased low.
BCC-MW-15014	4/11/2019		
BCC-MW-15002	4/8/2019	Barium	MS/MSD recoveries above the upper laboratory control limits. Sample result may be biased high.
BCC-MW-15003	4/8/2019		
BCC-MW-15004	4/9/2019		
BCC-MW-15005	4/9/2019		
BCC-MW-15006	4/9/2019		
BCC-MW-15007	4/9/2019		
BCC-MW-15008	4/9/2019		
BCC-MW-15010	4/9/2019		
BCC-MW-15011	4/10/2019		
BCC-MW-15012	4/10/2019		
BCC-MW-15013	4/11/2019		
BCC-MW-15014	4/11/2019		
BCC-MW-15015	4/11/2019		
BCC-MW-15016	4/11/2019		
BCC-MW-15017	4/11/2019		
BCC-MW-15018	4/11/2019		
BCC-MW-17001	4/11/2019		
BCC-MW-17002	4/11/2019		
BCC-MW-17003	4/12/2019		
DUP-01	4/10/2019		
DUP-02	4/11/2019		
BCC-MW-15019	4/12/2019		
BCC-MW-15020	4/12/2019		
BCC-MW-15021	4/12/2019		
BCC-MW-15022	4/12/2019		
BCC-MW-15023	4/12/2019		
BCC-MW-17004	4/12/2019		
BCC-MW-17005	4/12/2019		
DUP-03	4/12/2019		
DUP-04	4/12/2019		

Attachment A
Summary of Data Non-Conformances for Groundwater Analytical Data
BC Cobb - RCRA CCR Detection Monitoring Program
Muskegon, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
BCC-MW-15002	4/8/2019	Selenium	MS/MSD recoveries below the lower laboratory control limits. Sample result may be biased low.
BCC-MW-15003	4/8/2019		
BCC-MW-15004	4/9/2019		
BCC-MW-15005	4/9/2019		
BCC-MW-15006	4/9/2019		
BCC-MW-15007	4/9/2019		
BCC-MW-15008	4/9/2019		
BCC-MW-15009	4/9/2019		
BCC-MW-15010	4/9/2019		
BCC-MW-15011	4/10/2019		
BCC-MW-15012	4/10/2019		
BCC-MW-15013	4/11/2019		
BCC-MW-15014	4/11/2019		
BCC-MW-15015	4/11/2019		
BCC-MW-15016	4/11/2019		
BCC-MW-15017	4/11/2019		
BCC-MW-15018	4/11/2019		
BCC-MW-17001	4/11/2019		
BCC-MW-17002	4/11/2019		
BCC-MW-17003	4/12/2019		
DUP-01	4/10/2019		
DUP-02	4/11/2019		
BCC-MW-15019	4/12/2019		
BCC-MW-15020	4/12/2019		
BCC-MW-15021	4/12/2019		
BCC-MW-15022	4/12/2019		
BCC-MW-15023	4/12/2019		
BCC-MW-17004	4/12/2019		
BCC-MW-17005	4/12/2019		
BCC-MW-17006	4/12/2019		
DUP-03	4/12/2019		
DUP-04	4/12/2019		

Attachment A
Summary of Data Non-Conformances for Groundwater Analytical Data
BC Cobb - RCRA CCR Detection Monitoring Program
Muskegon, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
BCC-MW-15002	4/8/2019	Selenium	Field duplicate RPD >30%. Sample result may be estimated.
BCC-MW-15003	4/8/2019		
BCC-MW-15004	4/9/2019		
BCC-MW-15005	4/9/2019		
BCC-MW-15006	4/9/2019		
BCC-MW-15007	4/9/2019		
BCC-MW-15008	4/9/2019		
BCC-MW-15009	4/9/2019		
BCC-MW-15010	4/9/2019		
BCC-MW-15011	4/10/2019		
BCC-MW-15013	4/11/2019		
BCC-MW-15014	4/11/2019		
BCC-MW-15015	4/11/2019		
BCC-MW-15016	4/11/2019		
BCC-MW-15017	4/11/2019		
BCC-MW-15018	4/11/2019		
BCC-MW-17001	4/11/2019		
BCC-MW-17002	4/11/2019		
BCC-MW-17003	4/12/2019		
DUP-02	4/11/2019		
BCC-MW-15020	4/12/2019		
BCC-MW-15021	4/12/2019		
BCC-MW-15022	4/12/2019		
BCC-MW-15023	4/12/2019		
BCC-MW-17005	4/12/2019		
BCC-MW-17006	4/12/2019		
BCC-MW-15019	4/12/2019	Radium 226	LCS recovery below the lower laboratory control limits. Sample result may be biased low.
BCC-MW-15020	4/12/2019		
BCC-MW-15021	4/12/2019		
BCC-MW-15022	4/12/2019		
BCC-MW-15023	4/12/2019		
BCC-MW-17004	4/12/2019		
BCC-MW-17005	4/12/2019		
BCC-MW-17006	4/12/2019		
EB-04	4/12/2019		
DUP-03	4/12/2019		
DUP-04	4/12/2019		

Notes:
LCS - Laboratroy control sample.
MS/MSD - Matrix spike/matrix spike duplicate.
RPD - Relative percent difference.

Laboratory Data Quality Review
Groundwater Monitoring Event September 2019
Consumers Energy BC Cobb

Groundwater samples were collected by TRC for the September 2019 sampling event. Samples were analyzed for lithium, anions, and total dissolved solids by Eurofins TA in North Canton, Ohio (Eurofins TA – Canton). The remaining metals analyses were subcontracted to Eurofins TA in Irvine, California (Eurofins TA - Irvine). The radium analyses were subcontracted to Eurofins TA in St. Louis, Missouri (Eurofins TA – St. Louis). The laboratory analytical results were reported in laboratory sample delivery groups (SDGs) 240-119709-1, 240-119709-2, 240-119386-1, 240-119386-2, 240-119637-1, 240-119637-2, 240-119643-1, and 240-119643-2.

During the September 2019 sampling event, a groundwater sample was collected from each of the following wells:

- BCC-MW-15002
- BCC-MW-15003
- BCC-MW-15004
- BCC-MW-15005
- BCC-MW-15006
- BCC-MW-15007
- BCC-MW-15008
- BCC-MW-15009
- BCC-MW-15010
- BCC-MW-15011
- BCC-MW-15012
- BCC-MW-15013
- BCC-MW-15014
- BCC-MW-15015
- BCC-MW-15016
- BCC-MW-15017
- BCC-MW-15018
- BCC-MW-15019
- BCC-MW-15020
- BCC-MW-15021
- BCC-MW-15022
- BCC-MW-15023
- BCC-MW-17001
- BCC-MW-17002
- BCC-MW-17003
- BCC-MW-17004
- BCC-MW-17005
- BCC-MW-17006

Each sample was analyzed for one or more of the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Total Dissolved Solids	SM 2540C-11
Total Metals	SW-846 6020, SW-846 6010B
Radium (Radium-226, Radium-228, Combined Radium)	EPA 903.0, EPA 904.0

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

[DRAFT - ELECTRONIC REVIEW]

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2017) and the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

- Sample receipt;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field blanks are used to assess potential contamination arising from field procedures;
- Data for laboratory control samples (LCSs) and LCS duplicates (LCSD), when performed. The LCS/LCSDs are used to assess the accuracy and precision, where applicable, of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Data for laboratory duplicates, when performed on project samples. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Percent recoveries for carriers, where applicable, for radiochemistry only. Carriers are used to assess the chemical yield for the preparation and/or instrument efficiency;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation, are noted below.

[DRAFT - ELECTRONIC REVIEW]

- The reviewed Appendix III and IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- A method blank was analyzed with each analytical batch. For radium, normalized absolute difference comparisons between blank and sample that are between 1.96 and 2.58 may indicate biased high results and normalized absolute differences <1.96 may indicate a false positive sample result. Normalized absolute difference comparisons between blank and sample that are > 2.58 are not impacted and therefore not discussed. Target analytes were not detected in method blanks with the following exception:
    - Radium-228 was detected in the method blank in preparation batch 446859 at a concentration of 0.4541 ± 0.239 pCi/L. The positive results for radium-228 in samples associated with this blank were potentially impacted, as summarized in the attached table, Attachment A.
- Four equipment blanks (EB #01, EB #02, EB #03, EB #04) and three field blanks (FB #01, FB #02, and FB #04) were collected. For radium, normalized absolute difference comparisons between blank and sample that are between 1.96 and 2.58 may indicate biased high results and normalized absolute differences <1.96 may indicate a false positive sample result. Normalized absolute difference comparisons between blank and sample that are > 2.58 are not impacted and therefore not discussed. Target analytes were not detected in equipment blanks and field blanks with the following exceptions:
    - Radium-228 was detected in EB #04 at a concentration of 0.567 ± 0.322 pCi/L. The positive results for radium-228 in select samples associated with this blank were potentially impacted, as summarized in the attached table, Attachment A.
    - Combined Radium was detected in EB #04 at a concentration of 0.691 ± 0.343 pCi/L. The positive results for combined radium in select samples associated with this blank were potentially impacted, as summarized in the attached table, Attachment A.
    - Chromium was detected in EB #02 at a concentration of 0.0012 mg/L and in EB #03 at a concentration of 0.0010 mg/L. The positive results for chromium in select samples associated with these blanks were potentially impacted, as summarized in the attached table, Attachment A.
- LCS and/or LCSD recoveries and relative percent differences (RPDs), where applicable, were within laboratory control limits for all analytes.
- MS and/or MSDs were performed on the following samples:
    - BCC-MW-17003 and DUP #01 for anions

[DRAFT - ELECTRONIC REVIEW]

- BCC-MW-15006 for calcium and boron
- BCC-MW-15009 for all metals and anions
- BCC-MW-15022 for all metals and anions
- BCC-MW-17006 for all metals and anions

The MS/MSD recoveries and RPDs, where applicable, were within the acceptance limits with the following exceptions:

- The recovery for fluoride in the MS performed on sample BCC-MW-15009 was above the upper laboratory control limit. However, there was no impact on data usability since fluoride was not detected in this sample.
- The recoveries for selenium in the MS/MSD performed on samples BCC-MW-15009, BCC-MW-15022, and BCC-MW-17006 were below the lower laboratory control limits. Potential low bias exists for positive and nondetect results for all groundwater samples collected during this event as summarized in the attached table, Attachment A.
- The recoveries for boron and/or calcium were outside of the acceptance limits in the MS/MSD analyses performed on samples BCC-MW-17006, BCC-MW-15009, and BCC-MW-15022. However, the concentrations in the parent sample for calcium in BCC-MW-17006, BCC-MW-15022, and BCC-MW-15009, and boron in BCC-MW-15022, were >4x the spike concentration; therefore, the MS/MSD results are not applicable. Data usability is not affected.

- Laboratory duplicates were performed on samples BCC-MW-17002 , BCC-MW-15022, BCC-MW-17006, and BCC-MW-15009 for TDS; RPDs were within laboratory control limits.
- The field duplicate pair samples submitted with this data set are as follows:
  - Dup#01 corresponds with BCC-MW-15006
  - Dup#02 corresponds with BCC-MW-15011
  - Dup#03 corresponds with BCC-MW-15021
  - Dup#04 corresponds with BCC-MW-17005
- RPDs between the parent and duplicate samples were within the QC limits for all analytes with the following exceptions.
  - The absolute difference was > the RL for chromium in Dup#01/BCC-MW-15006. Potential uncertainty exists for the results for chromium in samples in SDG 240-119386-1 as summarized in the attached table, Attachment A.
  - The absolute difference was > the RL for chromium in Dup#04/BCC-MW-17005. However, these results are potential false positives due to equipment blank contamination (EB #03). Therefore, there is no impact on sample data.

[DRAFT - ELECTRONIC REVIEW]

- Carrier recoveries, where applicable, were within 40-110% with one exception. The barium carrier recovery (35%) in the radium-226 and combined radium 226+228 analyses of sample BCC-MW-15004 was below the control limits. The laboratory noted there was physical evidence of matrix interference apparent during the preparation of the sample and that the sample was re-plated which could have resulted in low recovery. Potential low bias exists for radium-226 and combined radium 226+228 in sample BCC-MW-15004 as summarized in the attached table, Attachment A.
- RLs for the following analytes were elevated due to various dilutions required:
  - Sulfate in select samples were above the project-specified RL (2.0 mg/L): BCC-MW-15016, BCC-MW-15017, , BCC-MW-15018, BCC-MW-15002, BCC-MW-15003, BCC-MW-15004, BCC-MW-15021, DUP #03, and BCC-MW-15019 due to matrix and/or non-target interference;
  - Fluoride in sample BCC-MW-15007 (2.0 mg/L) was above the project-specified RL (1.0 mg/L) due to elevated chloride; and
  - Chromium, molybdenum, and selenium in sample BCC-MW-15015 were above the project-specified RLs (0.001 mg/L, 0.005 mg/L, and 0.001 mg/L, respectively) due to matrix interference.
- Results for lithium were not originally reported in the MS/MSD analyses performed on samples BCC-MW-15009 and BCC-MW-15022; however, results for lithium were originally reported in the parent samples. Since lithium was requested on the MS/MSD analyses for samples BCC-MW-15009 and BCC-MW-15022 during this review, the laboratory had to re-analyze the parent samples for lithium as well. The re-analyzed results for lithium in samples BCC-MW-15009 and BCC-MW-15022 that were reported in SDG 240-119637-1, Revision 1, should be used for project objectives.

[DRAFT - ELECTRONIC REVIEW]

Attachment A

Summary of Data Non-Conformances for Groundwater Analytical Data
BC Cobb - RCRA CCR Detection Monitoring Program
Muskegon, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
BCC-MW-15018	9/26/2019	Radium-228	Detection in the equipment blank (EB #04). Normalized absolute difference between blank and samples <1.96; indicates possible false positive results.
BCC-MW-17001	9/26/2019		
BCC-MW-15018	9/26/2019	Combined Radium 226+228	Detection in the equipment blank (EB #04). Normalized absolute difference between blank and samples <1.96; indicates possible false positive results.
BCC-MW-17001	9/26/2019		
BCC-MW-17002	9/26/2019		
BCC-MW-17003	9/26/2019		
BCC-MW-15002	9/25/2019	Radium-228	Detection in the associated method blank. Normalized absolute difference between blank and samples <1.96; indicates possible false positive results.
BCC-MW-15003	9/25/2019		
BCC-MW-15004	9/25/2019		
BCC-MW-15011	9/25/2019		
BCC-MW-15022	9/25/2019		
BCC-MW-15004	9/25/2019	Chromium	Detection in the equipment blank (EB #02). Results <5x the blank concentration; indicates possible false positive results.
BCC-MW-15005	9/25/2019		
BCC-MW-15013	9/25/2019		
BCC-MW-15021	9/26/2019	Chromium	Detection in the equipment blank (EB #03). Results <5x the blank concentration; indicates possible false positive results.
DUP #03	9/26/2019		
BCC-MW-17006	9/26/2019		
BCC-MW-15020	9/26/2019		
BCC-MW-17005	9/26/2019		
DUP #04	9/26/2019		
BCC-MW-15006	9/24/2019	Chromium	Field duplicate variability; absolute difference between parent and duplicate sample > the reporting limit. Sample result may be uncertain.
BCC-MW-15007	9/24/2019		
BCC-MW-15008	9/24/2019		
DUP #01	9/24/2019		
BCC-MW-15010	9/24/2019		

Attachment A

Summary of Data Non-Conformances for Groundwater Analytical Data
BC Cobb - RCRA CCR Detection Monitoring Program
Muskegon, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
BCC-MW-15006	9/24/2019	Selenium	MS/MSD recoveries below the lower laboratory control limits. Sample result may be biased low.
BCC-MW-15007	9/24/2019		
BCC-MW-15008	9/24/2019		
DUP #01	9/24/2019		
BCC-MW-15010	9/24/2019		
BCC-MW-15002	9/25/2019		
BCC-MW-15003	9/25/2019		
BCC-MW-15004	9/25/2019		
BCC-MW-15005	9/25/2019		
BCC-MW-15011	9/25/2019		
DUP #02	9/25/2019		
BCC-MW-15012	9/25/2019		
BCC-MW-15014	9/25/2019		
BCC-MW-15013	9/25/2019		
BCC-MW-15009	9/25/2019		
BCC-MW-15022	9/25/2019		
BCC-MW-15015	9/26/2019		
BCC-MW-15021	9/26/2019		
DUP #03	9/26/2019		
BCC-MW-17006	9/26/2019		
BCC-MW-15023	9/26/2019		
BCC-MW-15020	9/26/2019		
BCC-MW-17005	9/26/2019		
DUP #04	9/26/2019		
BCC-MW-17004	9/26/2019		
BCC-MW-15019	9/26/2019		
BCC-MW-15016	9/26/2019		
BCC-MW-15017	9/26/2019		
BCC-MW-15018	9/26/2019		
BCC-MW-17001	9/26/2019		
BCC-MW-17002	9/26/2019		
BCC-MW-17003	9/26/2019		
BCC-MW-15004	9/25/2019	Radium-226, Combined Radium 226+228	Low barium carrier recovery; sample result may be biased low.

Appendix C
June 2018 Statistical Evaluation of Initial Assessment Monitoring Sampling Event

[DRAFT - ELECTRONIC REVIEW]

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January 14, 2019

Michell Marion
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Subject: Statistical Evaluation of Initial Assessment Monitoring Sampling Event
BC Cobb Bottom Ash Pond & Ponds 0-8 CCR Unit, Consumers Energy Company, Muskegon, Michigan

Dear Ms. Marion:

Consumers Energy Company (CEC) reported in the January 31, 2018 *Annual Groundwater Monitoring Report for the Former BC Cobb Power Plant Bottom Ash Pond & Ponds 0-8 CCR Unit* for the BC Cobb (BCC) site in Muskegon, Michigan, that boron, fluoride, and pH were observed within groundwater at one or more downgradient monitoring well(s) with potential statistically significant increases (SSIs) above background concentration levels. TRC completed an Alternate Source Demonstration for the parameters listed above and did not find strong enough evidence within 90 days to determine the observation of constituents above background was attributable to an error or source other than the coal combustion residual (CCR) unit.

Therefore, CEC initiated an Assessment Monitoring Program for the Bottom Ash Pond and Ponds 0-8 CCR Unit (BCC Ponds) pursuant to §257.95 of the CCR Rule[1] that included sampling and analyzing groundwater within the groundwater monitoring system for all constituents listed in Appendix IV. The results from the initial assessment monitoring sampling event were used to establish groundwater protection standards (GWPSs) for the Appendix IV constituents in accordance with §257.95(h), as presented in the October 15, 2018 *Assessment Monitoring Data Summary and Establishment of Groundwater Protection Standards*. The GWPS is established as the higher of the EPA Maximum Contaminant Level (MCL) or statistically derived background level for constituents with MCLs and the higher of the EPA Regional Screening Levels (RSLs) or background level for Appendix IV constituents with RSLs. The

[1] USEPA final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) published April 17, 2015, as amended per Phase One, Part One of the CCR Rule (83 FR 36435).

[DRAFT - ELECTRONIC REVIEW]

BCC Ponds monitoring system was subsequently sampled for the Appendix III and Appendix IV constituents within 90 days from the initial Appendix IV sampling event (June 2018). In accordance with §257.95, the assessment monitoring data must be compared to GWPSs to determine whether or not Appendix IV constituents are detected at statistically significant levels above the GWPSs.

This letter report presents a summary of the collected assessment monitoring data and the comparison of the assessment monitoring data to the GWPSs. The results of the assessment monitoring evaluation indicate that the following constituent is present at statistically significant levels exceeding the GWPS in downgradient monitoring wells at the BCC Ponds:

Constituent	GWPS	# Downgradient Wells Observed
Lithium	40 ug/L	2 of 21

As such, per §257.95(g), the facility must either conduct an alternate source demonstration or initiate an assessment of corrective measures according to §257.96 within 90 days of detecting a statistical exceedance of the GWPSs.

Background

The former BC Cobb coal-fired power generation facility is located east of Muskegon Lake, south of Cedar Creek, northwest of the CSX rail line, and west of the Muskegon River marsh in Muskegon, Michigan (Figure 1). The plant began operations in 1948 and ceased operations in April 2016. There are two RCRA CCR units associated with the plant—the Bottom Ash Pond and Ponds 0-8, both of which were wet ash dewatering areas, monitored using a multiunit groundwater monitoring system. From 1984 through plant closure in 2016, CCR have been deposited in the ash ponds by utilizing sluicing methods. These CCR units are surrounded by perimeter dikes that were primarily constructed of native material dredged to form the ponds during their initial construction and bottom ash. Site features are shown on Figure 2.

CEC provided notification of initiation of closure on March 30, 2018 to the Michigan Department of Environmental Quality (MDEQ) to implement the certified closure plan by removal of CCR under the self-implementing requirements and schedule of the CCR Rule.

Groundwater Monitoring System

In accordance with 40 CFR 257.91, CEC established a groundwater monitoring system for the BCC Ponds CCR unit, which had initially consisted of 22 monitoring wells (seven background monitoring wells and 15 downgradient monitoring wells) that are screened in the uppermost aquifer. Six additional downgradient monitoring wells were installed in late 2017 and incorporated into the groundwater monitoring system in 2018. Seven monitoring wells located southwest of the BCC Ponds provide data

on background groundwater quality that has not been affected by the CCR unit (BCC-MW-15002 through BCC-MW-15008). The monitoring well locations are shown on Figure 2.

Monitoring wells BCC-MW-15009 through BCC-MW-15014 encircle the BAP, while BCC-MW-15015 through BCC-MW-15023 and BCC-MW-17001 through BCC-MW-17006 are located at the outer edge of the peninsula formed by the bottom ash pond system. Because the perimeter and interior berms within the ash management area were constructed in part with ash and bodies of water surround the ash management area, wells could not be installed entirely beyond the CCR material boundary.

Significant changes occurred in the ash management area during the CCR Rule baseline period. The monitoring well system was installed in October 2015 while the plant and the pond system were in operation. The plant shut down in April 2016 and ceased sluicing ash to the CCR Rule units. The ponds were then dewatered. Veterans Pond to the north of the CCR ponds was dewatered sometime during the period between August and December 2017. These changes effected groundwater flow rates and directions at both the upgradient and downgradient monitoring wells. While the ponds were in operation, groundwater mounded within the pond area and flowed radially toward the surrounding water bodies. Starting with the July 2016 groundwater sampling round, groundwater continued to flow radially to the surrounding water bodies, but with a much lower gradient. When Veterans Pond was drained, a stronger gradient was established along the eastern side of the peninsula toward the Veterans Pond area. Veterans Pond is no longer drained and hydraulic loading of the BCC Ponds was discontinued back in 2016, so groundwater flow gradients in the BCC Ponds are essentially flat. The groundwater contour map for June 2018 is representative of current groundwater conditions at the site and is provided as Figure 3.

Data Quality

Data from each sampling round were evaluated for completeness, overall quality and usability, method-specified sample holding times, precision and accuracy, and potential sample contamination. The review was completed using the following quality control (QC) information which at a minimum included chain-of-custody forms, investigative sample results including blind field duplicates, and, as provided by the laboratory, method blanks, laboratory control spikes, laboratory duplicates. The data were found to be complete and usable for the purposes of the CCR monitoring program.

Assessment Monitoring Statistical Evaluation

Following the initial and resample assessment monitoring events, compliance well data for the BCC Ponds were evaluated in accordance with the *Groundwater Statistical Evaluation Plan* (Stats Plan) (TRC, October 2017). Consistent with the Unified Guidance[2], the preferred method for comparisons to a

[2] USEPA. 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance*. Office of Conservation and Recovery. EPA 530/R-09-007.

[DRAFT - ELECTRONIC REVIEW]

fixed standard are confidence limits. An exceedance of the standard occurs when the 99 percent lower confidence level of the downgradient data exceeds the GWPS.

For each detected Appendix IV constituent, the concentrations for each well were first compared directly to the GWPS, as shown on Table 1. Due to the aforementioned significant changes that occurred in the ash management area during the CCR Rule baseline period, where groundwater flow rates and directions were changed drastically over relatively short periods of time, the data set used for statistical evaluation was limited to the four most recent events. Use of the four most recent data points provides the minimum density of data as recommended per the Unified Guidance and, for the BCC Ponds, is appropriate in order to capture re-stabilized groundwater quality that is representative of the most current conditions, after hydraulic loading ceased and pumping from Veteran's Pond was completed. For the BCC-MW-15000-series monitoring wells, the confidence interval tests included data collected between April 2017 and June 2018. For the BCC-MW-17000-series wells, the confidence interval tests included data collected between December 2017 and August 2018. Parameter-well combinations that included a direct exceedance of the GWPS during these timeframes were retained for further analysis. Arsenic in BCC-MW-15009, BCC-MW-17002, and BCC-MW-17003, lithium in BCC-MW-15010, BCC-MW-17001, and BCC-MW-17002, and radium 226/228 in BCC-MW-15017 had individual results exceeding the GWPS.

Groundwater data were then evaluated utilizing Sanitas™ statistical software. Sanitas™ is a software tool that is commercially available for performing statistical evaluation consistent with procedures outlined in the Unified Guidance. Within the Sanitas™ statistical program, confidence limits were selected to perform the statistical comparison of compliance data to a fixed standard. Parametric and non-parametric confidence intervals were calculated, as appropriate, for each of the CCR Appendix IV parameters using a 99 percent confidence level, i.e., a significance level (α) of 0.01. The following narrative describes the methods employed, the results obtained and the Sanitas™ output files are included as an attachment.

The statistical data evaluation included the following steps:

- Review of data quality checklists for the data sets for CCR Appendix IV constituents;
- Graphical representation of the monitoring data as time versus concentration by well-constituent pair;
- Outlier testing of individual data points that appear from the graphical representations as potential outliers;
- Evaluation of visual trends apparent in the graphical representations for statistical significance;
- Evaluation of percentage of non-detects for each well-constituent pair;
- Distribution of the data; and
- Calculation of the confidence intervals for each cumulative dataset.

The results of these evaluations are presented and discussed below.

Initially, the recent baseline for the BCC-MW-15000-series monitoring wells (from April 2017 and June 2018) and for the BCC-MW-17000-series wells (December 2017 and August 2018) were observed visually for potential trends. No significant trends were identified. The Sanitas™ software was then used to test compliance at the downgradient monitoring wells using the confidence interval method for the most recent four sampling events. The software outputs are included in Attachment A along with data reports showing the values used for the evaluation. The percentage of non-detect observations are also included in Attachment A. Non-detect data was handled in accordance with the Stats Plan for the purposes of calculating the confidence intervals. The tests were run with a per-well significance of $\alpha = 0.01$.

The Sanitas™ software generates an output that includes graphs of the parametric or non-parametric confidence intervals for each well along with notes on data transformations, as appropriate. The data sets with direct exceedances of the GWPS were found to be normally distributed, with the exception of arsenic in BCC-MW-17002 and BCC-MW-17003. The confidence interval test compares the lower confidence limit to the GWPS. The calculated upper and lower confidence limits and comparison of the lower confidence limits to the GWPSs are also summarized in Table 2.

The statistical evaluation of the Appendix IV parameters shows exceedances for lithium at BCC-MW-17001 and BCC-MW-17002. The lower confidence limits for the other Appendix IV constituents statistically evaluated at BCC-MW-15009, BCC-MW-15010, BCC-MW-15017, and BCC-MW-17003 were below their respective GWPSs. Per §257.95(g), the facility must either conduct an alternate source demonstration or initiate an assessment of corrective measures according to §257.96 within 90 days of detecting a statistical exceedance of the GWPSs.

Next Steps

In accordance with the CCR Rule, CEC will enter this statistical evaluation of the assessment monitoring data into the operating record by January 14, 2019. The notification of the GWPS exceedances to the state will be posted by CEC to a public CCR compliance website as required by §257.105(h)(8) by February 13, 2019. By April 14, 2019, in accordance with §257.95(g)(3), an assessment of corrective measures will be initiated. This assessment will be completed no later than September 11, 2019 in accordance with the timeframes provided in §257.96(a)(1).

Sincerely,

TRC

Graham Crockford
Program Manager

Sarah B. Holmstrom
Project Hydrogeologist

[DRAFT - ELECTRONIC REVIEW]

Attachments

Table 1.	Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to August 2018
Table 2.	Summary of Groundwater Protection Standard Exceedances – June and August 2018
Figure 1.	Site Location Map
Figure 2.	Site Plan
Figure 3.	Shallow Groundwater Contour Map – June 2018
Attachment A	Sanitas™ Output

cc: Brad Runkel, Consumers Energy
JR Register, Consumers Energy
Bethany Swanberg, Consumers Energy
Central Files

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Tables

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15009											
					Sample Date:	12/1/2015	2/17/2016	4/18/2016	7/12/2016	9/28/2016	2/14/2017	4/5/2017	7/11/2017	7/11/2017	9/13/2017	4/16/2018	6/13/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient											
Appendix III														Field Dup			
Boron	ug/L	NC	NA	1,320	NA	2,380	2,520	2,170	2,070	2,190	2,110	2,190	2,210	1,690	2,120	--	1,670
Calcium	mg/L	NC	NA	259	NA	42.7	44.1	40.1	44.1	46.7	37.7	38.2	37.6	36.5	34.9	--	42.4
Chloride	mg/L	250*	NA	5,980	NA	24	24	27.1	26.9	24.3	22.8	24.9	26.3	26.3	26	--	95.7
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	10.6	10.8	10.3	10.0	10.0	10.2	10.1	9.6	--	10.2	9.8	9.8
Sulfate	mg/L	250*	NA	200	NA	63	39.3	49.5	55.2	49.1	31.6	39.8	43	47.2	41.7	--	< 2.0
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	240	230	220	220	230	200	190	216	246	188	--	456
Appendix IV																	
Antimony	ug/L	6	NA	1	6	1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	**45**	**31**	**24**	**24**	**20**	**14**	**13**	**12**	**10.8**	--	9.4	8.5
Barium	ug/L	2,000	NA	340	2,000	16	12	11	11	11	9	10	13.2	10.8	--	16.5	13.8
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	< 1	1	2	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	2	**40**	15.6	14.6	15	14	14	13	14	19	19	--	24	21
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	57	60	50	49	49	40	38	43.7	41.8	--	16.0	11.6
Radium-226	pCi/L	5	NA	NA	NA	< 0.166	< 0.157	< 0.209	< 0.158	< 0.269	< 0.159	< 0.347	< 0.756	< 0.887	--	< 0.934	< 0.580
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.451	< 0.475	< 0.467	< 0.461	< 0.628	0.747	< 0.502	< 2.72	< 3.85	--	< 1.89	< 3.85
Radium-228	pCi/L	5	NA	NA	NA	< 0.451	< 0.475	< 0.467	< 0.461	< 0.628	0.678	< 0.502	< 1.96	< 2.96	--	< 0.957	< 3.27
Selenium	ug/L	50	NA	3	50	< 1	< 1	2	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15010											
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/13/2016	9/28/2016	2/14/2017	4/5/2017	7/11/2017	9/13/2017	9/13/2017	4/16/2018	6/14/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient											
Appendix III															Field Dup		
Boron	ug/L	NC	NA	1,320	NA	1,970	1,510	1,340	1,270	1,570	1,440	1,760	1,340	1,770	1,770	--	2,100
Calcium	mg/L	NC	NA	259	NA	71.2	51.9	37.4	58.2	66.4	49.8	80.5	40.7	129	133	--	133
Chloride	mg/L	250*	NA	5,980	NA	23	22.5	21.5	22.7	25.1	22.3	24.2	25.5	24.5	24.4	--	29.3
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.7	7.8	7.8	7.8	8.0	8.0	7.8	7.8	7.8	--	7.8	7.4
Sulfate	mg/L	250*	NA	200	NA	120	52.6	31	50.7	69.7	24.2	53.5	24.8	143	143	--	73.7
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	410	270	220	260	320	250	360	288	570	618	--	636
Appendix IV																	
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	49	34	28	42	45	31	51	29.2	--	--	63.4	64.8
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	--	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	< 1	2	< 1	< 1	1	< 1	< 1.0	--	--	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	2	**40**	36.1	22.7	18	15	22	14	18	21	--	--	**46**	**54**
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	33	29	27	15	20	9	7	16.2	--	--	< 5.0	< 5.0
Radium-226	pCi/L	5	NA	NA	NA	< 0.302	< 0.217	< 0.244	< 0.145	< 0.297	< 0.179	< 0.216	< 0.642	--	--	< 0.869	0.661
Radium-226/228	pCi/L	5	NA	2.42	**5**	0.973	< 0.502	< 0.447	0.451	0.82	< 0.363	< 0.38	< 1.60	--	--	< 1.75	< 1.45
Radium-228	pCi/L	5	NA	NA	NA	0.849	< 0.502	< 0.447	0.42	0.728	< 0.363	< 0.38	< 0.956	--	--	< 0.877	< 0.978
Selenium	ug/L	50	NA	3	50	< 1	< 1	1	1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	--	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15011										
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/12/2016	9/28/2016	2/14/2017	4/5/2017	7/11/2017	9/13/2017	4/16/2018	6/13/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient										
Appendix III																
Boron	ug/L	NC	NA	1,320	NA	1,680	1,420	1,340	1,210	1,180	1,280	1,340	1,060	1,490	--	1,630
Calcium	mg/L	NC	NA	259	NA	53	47.6	36.9	47.3	48	47.9	52	42.2	23.9	--	22.6
Chloride	mg/L	250*	NA	5,980	NA	22	20.7	22.1	24.8	21	19.5	22.2	22.9	24	--	23.2
Fluoride	ug/L	4,000	NA	1,000	NA	1,200	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	8.7	8.5	8.2	8.5	8.7	9.2	9.0	8.2	8.5	9.1	8.5
Sulfate	mg/L	250*	NA	200	NA	50	30.8	35.8	43.8	38.5	37.2	42.8	29.1	6.4	--	12.3
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	270	230	210	240	230	230	240	224	140	--	244
Appendix IV																
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	5	3	3	4	6	7	8	< 1.0	--	6.4	1.5
Barium	ug/L	2,000	NA	340	2,000	36	29	25	30	31	31	32	30.7	--	15.2	16.6
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	1	< 1	2	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000	1,200	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	2	**40**	17.2	16	14	15	16	17	17	20	--	21	11
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	20	29	35	26	27	25	22	21.4	--	8.9	5.8
Radium-226	pCi/L	5	NA	NA	NA	< 0.199	< 0.141	< 0.319	< 0.166	< 0.284	< 0.16	< 0.296	< 1.12	--	< 0.742	0.35
Radium-226/228	pCi/L	5	NA	2.42	5	1.01	< 0.447	< 0.435	< 0.402	< 0.496	< 0.394	< 0.599	< 2.07	--	< 1.61	< 1.25
Radium-228	pCi/L	5	NA	NA	NA	0.956	< 0.447	< 0.435	< 0.402	< 0.496	< 0.394	< 0.599	< 0.954	--	< 0.872	< 0.923
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2013.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15012										
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	9/13/2017	4/17/2018	6/13/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient										
Appendix III																
Boron	ug/L	NC	NA	1,320	NA	961	1,390	1,830	1,450	1,470	1,380	1,500	1,340	1,140	--	1,450
Calcium	mg/L	NC	NA	259	NA	49.5	82.1	65.5	44.5	43.5	32	34.9	24.6	48.7	--	95.1
Chloride	mg/L	250*	NA	5,980	NA	20	20.4	23.7	23	22.6	19.7	22.7	24.1	23.3	--	22.7
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,200	1,100	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	8.0	8.1	8.1	8.9	9.2	8.6	8.5	9.9	11.4	9.7	10.2
Sulfate	mg/L	250*	NA	200	NA	69	111	106	65.6	50.9	55.7	57.2	21.8	59.6	--	355
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	300	370	340	250	210	190	200	168	318	--	902
Appendix IV																
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	< 1	2	8	**12**	9	2	3	6.1	--	1.8	3.4
Barium	ug/L	2,000	NA	340	2,000	40	63	68	34	22	25	28	14.3	--	109	105
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	< 1	1	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,200	1,100	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	2	**40**	15.6	20.8	19	18	15	11	12	12	--	13	11
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	29	9	35	37	44	35	27	94.5	--	50.8	71.3
Radium-226	pCi/L	5	NA	NA	NA	< 0.164	< 0.243	< 0.256	< 0.216	< 0.335	< 0.153	< 0.243	0.436	--	< 0.693	< 0.526
Radium-226/228	pCi/L	5	NA	2.42	5	< 0.471	< 0.634	0.919	< 0.539	< 0.548	< 0.416	< 0.554	< 2.28	--	< 1.43	< 1.32
Radium-228	pCi/L	5	NA	NA	NA	< 0.471	< 0.634	0.827	< 0.539	< 0.548	< 0.416	< 0.554	< 2.08	--	< 0.733	< 0.789
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1.2	--	1.2	3.3
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2013.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15013												
					Sample Date:	12/1/2015	2/18/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	9/13/2017	4/17/2018	4/17/2018	6/13/2018	6/13/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient												
Appendix III																Field Dup		Field Dup
Boron	ug/L	NC	NA	1,320	NA	1,140	1,290	1,180	1,080	1,090	1,050	1,120	916	1,270	--	--	1,130	1,100
Calcium	mg/L	NC	NA	259	NA	65.2	58.3	47.5	48.4	59.7	52.5	50.9	43.9	34.4	--	--	47.3	48.9
Chloride	mg/L	250*	NA	5,980	NA	21	20.9	21.5	21	22.9	19.8	19.9	23.4	21.2	--	--	21.5	21.6
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.6	7.2	7.4	7.3	7.4	7.7	7.4	7.4	7.9	7.6	--	7.7	--
Sulfate	mg/L	250*	NA	200	NA	89	44.3	34.3	27.5	31.3	23.1	15.1	8.7	59.9	--	--	8.7	7.9
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	330	290	260	250	250	260	250	240	192	--	--	324	268
Appendix IV																		
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	71	58	49	47	51	52	48	41.9	--	43.3	44.7	43.9	41.1
Beryllium	ug/L	4	NA	1	**4**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	< 1	2	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	2	**40**	17.5	19.9	18	17	18	18	17	23	--	27	28	24	24
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	17	20	21	12	11	10	9	7.7	--	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	5	NA	NA	NA	0.272	< 0.299	0.173	< 0.181	< 0.215	< 0.23	< 0.215	0.731	--	< 0.505	< 0.506	< 0.546	< 0.585
Radium-226/228	pCi/L	5	NA	2.42	**5**	1.19	< 0.527	0.9	0.596	< 0.598	< 0.481	< 0.516	< 1.56	--	< 1.14	< 1.29	< 1.30	< 1.49
Radium-228	pCi/L	5	NA	NA	NA	0.914	< 0.527	0.727	0.483	< 0.598	< 0.481	< 0.516	< 0.940	--	< 0.633	< 0.780	< 0.754	< 0.903
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15014										
					Sample Date:	12/1/2015	2/18/2016	4/18/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	9/13/2017	4/17/2018	6/13/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient										
Appendix III																
Boron	ug/L	NC	NA	1,320	NA	2,560	2,230	1,840	1,630	1,690	1,530	1,560	1,300	1,410	--	1,370
Calcium	mg/L	NC	NA	259	NA	75.6	75.3	63.9	73.5	64.7	66.3	65.3	61.8	57.8	--	50.8
Chloride	mg/L	250*	NA	5,980	NA	21	21.9	21.9	22	22.7	18.6	22.1	22.4	22.5	--	21.3
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	11.5	11.6	11.2	11.0	11.1	11.5	11.3	11.5	12.0	11.6	11.4
Sulfate	mg/L	250*	NA	200	NA	43	34.7	31.4	35.6	23.7	27.8	23.9	24.9	19.2	--	2.4
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	350	310	270	290	250	280	270	292	282	--	338
Appendix IV																
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1.7	--	1.1	< 1.0
Arsenic	ug/L	10	NA	10	**10**	**15**	**11**	**11**	8	9	7	7	8.4	--	6.2	5.5
Barium	ug/L	2,000	NA	340	2,000	329	376	257	508	357	571	546	732	--	779	607
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	2	1	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	2	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	19	--	27	16
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	**119**	76	58	69	81	80	77	70.9	--	94.7	100
Radium-226	pCi/L	5	NA	NA	NA	< 0.176	< 0.175	< 0.177	0.214	< 0.218	< 0.211	< 0.289	< 0.511	--	< 1.11	< 1.17
Radium-226/228	pCi/L	5	NA	2.42	5	1.31	< 0.735	< 0.562	< 0.606	< 0.485	0.883	< 0.423	< 1.58	--	< 2.08	< 3.02
Radium-228	pCi/L	5	NA	NA	NA	1.23	< 0.735	< 0.562	< 0.606	< 0.485	0.81	< 0.423	< 1.07	--	< 0.972	< 1.85
Selenium	ug/L	50	NA	3	50	< 1	1	< 1	< 1	< 1	1	8	2.3	--	1.2	1.2
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2013.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15015												
					Sample Date:	12/1/2015	2/18/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	7/12/2017	9/13/2017	9/13/2017	4/17/2018	6/13/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient												
Appendix III														Field Dup		Field Dup		
Boron	ug/L	NC	NA	1,320	NA	1,190	1,170	963	614	656	662	599	489	678	433	374	--	398
Calcium	mg/L	NC	NA	259	NA	32.8	33	30.6	36.2	40.1	38.4	37.6	29.4	32.3	36.9	38.8	--	45
Chloride	mg/L	250*	NA	5,980	NA	21	22	21.6	20.4	19.5	19.2	22.7	20.1	20	20.3	20.3	--	19.5
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.8	7.4	7.4	7.4	7.8	7.7	7.6	8.4	--	8.7	--	8.3	7.9
Sulfate	mg/L	250*	NA	200	NA	7.8	6.56	8.34	13.9	9.26	10.4	13.8	18.8	17.9	16.1	15.6	--	12.6
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	220	200	190	180	180	200	190	166	190	192	274	--	316
Appendix IV																		
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	2	2	2	6	5	5	6	6.4	7.6	--	--	4.7	5.5
Barium	ug/L	2,000	NA	340	2,000	23	22	21	25	28	30	28	30.1	33.6	--	--	39.9	37.9
Beryllium	ug/L	4	NA	1	**4**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	--	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	< 1	1	1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	2	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	12	11	--	--	16	13
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	17	14	17	11	10	9	11	11.9	13.0	--	--	9.4	7.0
Radium-226	pCi/L	5	NA	NA	NA	< 0.193	< 0.157	< 0.242	< 0.133	< 0.378	< 0.166	< 0.34	< 0.832	< 0.698	--	--	< 0.467	< 0.475
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.578	< 0.577	< 0.521	< 0.467	0.85	< 0.408	< 0.42	< 1.63	< 1.45	--	--	< 1.20	< 1.24
Radium-228	pCi/L	5	NA	NA	NA	< 0.578	< 0.577	< 0.521	< 0.467	0.85	< 0.408	< 0.42	< 0.799	< 0.748	--	--	< 0.730	< 0.763
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	--	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15016										
					Sample Date:	12/1/2015	2/18/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	9/13/2017	4/17/2018	6/12/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient										
Appendix III																
Boron	ug/L	NC	NA	1,320	NA	108	119	86	100	88	92	83	85.9	83	--	76.6
Calcium	mg/L	NC	NA	259	NA	172	184	164	172	181	176	172	170	182	--	168
Chloride	mg/L	250*	NA	5,980	NA	200	204	203	165	204	196	200	10.4	226	--	197
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	6.6	6.5	6.4	6.3	6.4	6.4	6.6	6.4	6.6	6.8	6.5
Sulfate	mg/L	250*	NA	200	NA	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	980	1,000	980	920	930	990	1,000	1,050	995	--	986
Appendix IV																
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	2	2	3	3	2	2	2	1.5	--	1.5	1.3
Barium	ug/L	2,000	NA	340	2,000	656	647	614	619	621	666	613	596	--	649	652
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	2	3	3	4	3	3	3	1.9	--	2.1	2.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	2	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0
Radium-226	pCi/L	5	NA	NA	NA	< 0.263	1.51	1.31	1.5	1.06	1.17	1.6	1.3	--	1.56	< 0.810
Radium-226/228	pCi/L	5	NA	2.42	5	2.29	3.83	3	3.18	2.74	3.54	3.66	2.36	--	3.64	2.50
Radium-228	pCi/L	5	NA	NA	NA	2.29	2.32	1.69	1.68	1.68	2.37	2.06	1.06	--	2.08	1.81
Selenium	ug/L	50	NA	3	50	2	4	2	7	1	2	2	3.6	--	1.5	1.4
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2013.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
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[DRAFT - ELECTRONIC REVIEW]

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15017											
					Sample Date:	12/1/2015	2/18/2016	4/18/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	9/13/2017	4/17/2018	6/12/2018	6/12/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient											
Appendix III																	Field Dup
Boron	ug/L	NC	NA	1,320	NA	59	90	66	76	78	76	75	75	82.8	--	83.8	79
Calcium	mg/L	NC	NA	259	NA	225	247	220	232	252	232	232	203	245	--	243	232
Chloride	mg/L	250*	NA	5,980	NA	200	201	184	204	182	192	187	199	224	--	224	224
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	6.5	6.4	6.4	6.4	6.4	6.6	6.5	6.4	6.5	6.8	6.5	--
Sulfate	mg/L	250*	NA	200	NA	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	850	1,100	1,200	1,100	1,100	1,200	1,100	1,230	1,130	--	1,120	1,170
Appendix IV																	
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	**13**	7	5	**12**	**12**	5	4	3	--	2.3	2.1	2.1
Barium	ug/L	2,000	NA	340	2,000	1,030	981	924	985	955	968	876	772	--	955	936	953
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	4	4	4	9	11	5	5	5.3	--	3.4	3.4	3.3
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	2	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	5	NA	NA	NA	1.61	2.38	2.18	1.91	1.94	1.82	1.56	1.97	--	2.23	2.13	2.87
Radium-226/228	pCi/L	5	NA	2.42	**5**	4.3	**5.35**	**5.68**	**5.89**	4.44	4.97	4.34	4.75	--	**5.16**	**5.43**	**5.59**
Radium-228	pCi/L	5	NA	NA	NA	2.69	2.97	3.5	3.98	2.5	3.15	2.78	2.78	--	2.93	3.3	2.72
Selenium	ug/L	50	NA	3	50	3	4	3	8	2	2	3	2.7	--	1.7	2.4	2.5
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15018													
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	9/29/2016	2/14/2017	4/5/2017	7/11/2017	7/11/2017	9/13/2017	9/13/2017	4/18/2018	4/18/2018	6/12/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient													
Appendix III														Field Dup		Field Dup		Field Dup	
Boron	ug/L	NC	NA	1,320	NA	487	526	478	399	438	479	493	538	446	492	502	--	--	559
Calcium	mg/L	NC	NA	259	NA	88.6	100	87.9	86.8	98.5	100	92.1	84.8	81.1	90.7	89.1	--	--	87.6
Chloride	mg/L	250*	NA	5,980	NA	38	38	40.8	39.3	37.5	43.6	44.4	53.4	52.6	49.1	50.2	--	--	48.9
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.0	6.9	6.8	6.5	6.5	6.7	6.8	6.8	--	6.8	--	6.9	--	6.8
Sulfate	mg/L	250*	NA	200	NA	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	< 2.0	< 2.0	--	--	< 2.0
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	290	400	430	390	410	450	410	420	438	392	380	--	--	598
Appendix IV																			
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	1	< 1	< 1	2	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	155	149	139	133	143	171	149	153	143	--	--	139	141	156
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	1	1	1	1	< 1	1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	--	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	2	**40**	21.4	23.1	24	12	14	21	21	26	26	--	--	29	27	26
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	5	NA	NA	NA	0.227	0.394	0.43	0.234	0.522	0.363	< 0.314	< 0.479	< 1.02	--	--	< 0.843	0.290	< 0.756
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.586	1.17	1.08	1.08	1.33	1.36	1.37	< 1.25	< 1.97	--	--	1.59	0.912	1.77
Radium-228	pCi/L	5	NA	NA	NA	< 0.586	0.778	0.649	0.845	0.803	0.996	1.08	< 0.767	< 0.950	--	--	0.869	0.622	1.39
Selenium	ug/L	50	NA	3	50	< 1	< 1	1	4	< 1	< 1	< 1	< 1.0	1	--	--	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	--	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15019										
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/13/2016	9/30/2016	2/15/2017	4/5/2017	7/11/2017	9/13/2017	4/18/2018	6/12/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient										
Appendix III																
Boron	ug/L	NC	NA	1,320	NA	1,530	1,590	1,440	1,320	1,260	1,370	1,410	1,430	1,010	--	1,170
Calcium	mg/L	NC	NA	259	NA	84.6	93.6	83	90	92.6	91.8	92.8	90.1	107	--	97.7
Chloride	mg/L	250*	NA	5,980	NA	34	32.4	33.7	37.7	35.6	34.5	33.6	52.5	73.9	--	67.7
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.0	6.8	6.9	6.7	6.4	6.8	6.9	6.8	6.7	7.0	6.7
Sulfate	mg/L	250*	NA	200	NA	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	340	390	440	410	370	410	420	470	618	--	524
Appendix IV																
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	91	94	88	88	96	93	90	109	--	161	187
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	< 1	1	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	2	**40**	23.7	27.9	26	24	22	23	22	27	--	25	23
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0
Radium-226	pCi/L	5	NA	NA	NA	0.333	0.279	0.465	0.282	0.315	0.329	< 0.36	< 0.620	--	< 0.717	< 0.594
Radium-226/228	pCi/L	5	NA	2.42	5	0.674	0.798	0.997	0.969	< 0.739	2.13	0.974	< 1.64	--	< 1.46	1.75
Radium-228	pCi/L	5	NA	NA	NA	< 0.484	< 0.567	0.532	< 0.718	< 0.739	1.8	0.872	< 1.02	--	< 0.742	1.36
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	2	< 1	< 1	< 1	1.2	--	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2013.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15020											
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	9/30/2016	2/15/2017	4/5/2017	7/11/2017	9/13/2017	4/18/2018	6/12/2018	6/12/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient											
Appendix III																	Field Dup
Boron	ug/L	NC	NA	1,320	NA	630	738	638	603	608	621	667	618	745	--	708	699
Calcium	mg/L	NC	NA	259	NA	61	67.6	59.1	60.7	66.5	67	66.6	68.1	107	--	96.3	91.6
Chloride	mg/L	250*	NA	5,980	NA	39	35.4	34.3	69.6	33.5	33.3	33.9	45.7	87.8	--	92.1	92
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.3	7.2	7.0	6.9	6.9	7.0	7.1	7.0	6.8	7.0	6.7	--
Sulfate	mg/L	250*	NA	200	NA	2.2	2.34	< 2	< 2	< 2	< 2	< 2	< 2.0	3	--	< 2.0	< 2.0
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	320	310	320	310	310	330	320	388	608	--	622	508
Appendix IV																	
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	48	52	51	47	54	53	52	60.4	--	148	197	196
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	2	< 1	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	2	**40**	15.1	17.8	16	14	14	14	14	18	--	16	16	16
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	5	NA	NA	NA	< 0.269	< 0.24	< 0.341	< 0.19	< 0.276	< 0.294	< 0.29	< 0.761	--	0.744	< 0.899	< 0.774
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.467	0.847	0.73	< 0.598	0.724	< 0.591	0.652	< 1.39	--	1.56	2.64	2.00
Radium-228	pCi/L	5	NA	NA	NA	< 0.467	0.731	0.474	< 0.598	0.682	< 0.591	0.543	< 0.627	--	0.813	1.75	1.47
Selenium	ug/L	50	NA	3	50	< 1	1	< 1	2	< 1	< 1	< 1	1.4	--	< 1.0	< 1.0	1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15021										
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/13/2016	10/5/2016	2/15/2017	4/6/2017	7/12/2017	9/13/2017	4/18/2018	6/12/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient										
Appendix III																
Boron	ug/L	NC	NA	1,320	NA	362	489	400	425	491	465	519	519	602	--	809
Calcium	mg/L	NC	NA	259	NA	86.4	98.5	89.6	97.4	96.9	97.9	96.3	86.8	91.3	--	89.4
Chloride	mg/L	250*	NA	5,980	NA	88	82.7	87.2	98.3	98.9	94.6	93.9	97	108	--	112
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	6.8	6.8	6.8	6.7	6.8	6.9	6.9	6.8	6.8	7.1	6.8
Sulfate	mg/L	250*	NA	200	NA	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	610	540	570	590	620	570	560	548	490	--	576
Appendix IV																
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	3	1	1	2	2	2	2	1.0	--	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	274	244	236	233	252	240	228	211	--	236	238
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	2	2	2	1	2	2	< 1.0	--	< 1.0	1.1
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	2	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0
Radium-226	pCi/L	5	NA	NA	NA	0.569	0.629	0.563	0.429	0.483	0.524	< 0.215	< 0.768	--	< 0.461	< 0.689
Radium-226/228	pCi/L	5	NA	2.42	5	1.55	1.41	1.41	1.3	2	0.966	< 0.354	< 1.47	--	< 1.96	1.97
Radium-228	pCi/L	5	NA	NA	NA	0.984	0.782	0.846	0.871	1.52	< 0.582	< 0.354	< 0.697	--	< 1.50	1.60
Selenium	ug/L	50	NA	3	50	1	2	1	4	< 1	< 1	1	1.6	--	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2013.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15022										
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	10/5/2016	2/15/2017	4/6/2017	7/12/2017	9/13/2017	4/18/2018	6/11/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient										
Appendix III																
Boron	ug/L	NC	NA	1,320	NA	250	388	387	362	391	394	434	478	833	--	1,170
Calcium	mg/L	NC	NA	259	NA	46.7	46.4	47.8	43	43.7	54.1	49.3	51.8	35.2	--	38.2
Chloride	mg/L	250*	NA	5,980	NA	25	18.7	17.6	16.8	17.1	18.2	18.6	22.1	23.3	--	21.5
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	8.3	8.5	8.2	8.2	8.1	7.8	8.1	8.4	7.6	7.8	8.3
Sulfate	mg/L	250*	NA	200	NA	39	38.3	29.9	34.3	32.8	34.1	32.8	45.9	44.1	--	24.1
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	270	210	250	250	210	250	230	254	266	--	210
Appendix IV																
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	1.9	< 1.0
Arsenic	ug/L	10	NA	10	**10**	6	7	8	8	6	4	4	5.8	--	< 1.0	1.1
Barium	ug/L	2,000	NA	340	2,000	139	119	155	116	119	137	129	138	--	102	104
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	1	2	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	2	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	13	11
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	22	16	11	17	19	12	14	13.6	--	< 5.0	< 5.0
Radium-226	pCi/L	5	NA	NA	NA	0.246	< 0.242	< 0.247	< 0.15	< 0.346	< 0.217	< 0.291	< 0.468	--	0.666	< 0.708
Radium-226/228	pCi/L	5	NA	2.42	5	< 0.484	< 0.45	0.812	< 0.472	< 0.514	< 0.477	0.862	< 1.27	--	1.13	< 1.45
Radium-228	pCi/L	5	NA	NA	NA	< 0.484	< 0.45	0.74	< 0.472	< 0.514	< 0.477	0.709	< 0.799	--	< 0.644	< 0.742
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2013.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15023										
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	10/5/2016	2/15/2017	4/5/2017	7/11/2017	9/13/2017	4/18/2018	6/11/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient										
Appendix III																
Boron	ug/L	NC	NA	1,320	NA	414	284	267	308	526	484	1,590	701	504	--	1,650
Calcium	mg/L	NC	NA	259	NA	59.7	59.4	53.3	54.1	64	59.9	74.5	50.8	60.9	--	98.9
Chloride	mg/L	250*	NA	5,980	NA	30	26.9	24.6	28.7	24.8	23.8	24.6	26.8	25.5	--	19.4
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.4	7.5	7.5	7.5	7.4	7.6	7.6	7.6	7.6	7.6	7.4
Sulfate	mg/L	250*	NA	200	NA	20	26.5	28.9	25	24.3	21	22.5	22.6	36.2	--	139
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	240	270	270	290	290	280	300	290	408	--	474
Appendix IV																
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	2	2	1	3	2	2	< 1	1.9	--	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	57	48	43	40	47	42	46	38.0	--	97.1	87.8
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	< 1	2	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	2	**40**	12.1	10.6	< 10	< 10	< 10	< 10	11	< 10	--	19	18
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	8	6	< 5	7	6	6	< 5	6.0	--	< 5.0	7.1
Radium-226	pCi/L	5	NA	NA	NA	0.232	< 0.237	< 0.242	0.226	< 0.309	0.257	0.455	< 0.889	--	< 0.572	< 0.958
Radium-226/228	pCi/L	5	NA	2.42	5	< 0.53	0.599	< 0.456	< 0.545	< 0.355	0.426	1.42	< 1.53	--	< 1.32	< 1.85
Radium-228	pCi/L	5	NA	NA	NA	< 0.53	0.426	< 0.456	< 0.545	< 0.355	< 0.4	0.963	< 0.636	--	< 0.749	< 0.891
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2013.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-17001				BCC-MW-17002				BCC-MW-17003				
					Sample Date:	12/7/2017	2/20/2018	6/15/2018	8/6/2018	12/7/2017	2/20/2018	6/15/2018	8/6/2018	12/7/2017	2/20/2018	6/15/2018	8/7/2018	8/7/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	GSI												
Appendix III																		Field Dup
Boron	ug/L	NC	NA	1,320	NA	991	827	1,100	1,220	8,280	12,800	13,300	9,440	413	394	369	383	377
Calcium	mg/L	NC	NA	259	NA	118	118	124	117	178	201	224	194	74.3	55.7	63.2	74.6	76.9
Chloride	mg/L	250*	NA	5,980	NA	27.3	28.5	29.1	29.1	15.3	14.2	13.2	15.4	18.3	21.5	22.7	21.9	21.8
Fluoride	ug/L	4,000	NA	1,000	NA	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.1	7.0	7.2	6.9	7.0	7.1	7.2	7.1	7.0	7.2	7.4	7.3	--
Sulfate	mg/L	250*	NA	200	NA	156	135	90.8	18.7	330	325	332	226	48.4	< 2.0	< 2.0	17.7	25.9
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	558	552	566	476	726	892	936	740	324	330	412	326	324
Appendix IV																		
Antimony	ug/L	6	NA	1	6	< 1.0	< 1.0	< 1.0	< 2.0	1.5	< 1.0	< 1.0	< 2.0	1.1	< 1.0	< 1.0	< 2.0	< 2.0
Arsenic	ug/L	10	NA	10	**10**	5.2	< 1.0	< 1.0	< 1.0	**45.5**	2	2.6	3.8	**26**	< 1.0	< 1.0	1	1.1
Barium	ug/L	2,000	NA	340	2,000	85.6	71.3	65.8	73.8	148	76.7	62.8	57.6	128	78.1	66.5	77.9	83.3
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000
Lead	ug/L	NC	15	2	15	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	2	**40**	**55**	**73**	**65**	**62**	**75**	**160**	**150**	**130**	19	17	13	18	18
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	< 5.0	< 5.0	< 5.0	< 5.0	30.1	< 5.0	< 5.0	< 5.0	48.8	6.3	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	5	NA	NA	NA	< 0.509	< 0.890	< 0.766	< 0.616	< 1.03	< 1.07	< 0.757	0.306	< 0.889	< 0.755	< 0.594	< 0.687	0.353
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.830	< 0.901	< 0.947	< 0.822	< 0.996	< 3.77	< 2.35	1.25	< 0.663	< 0.707	< 0.828	0.932	< 0.871
Radium-228	pCi/L	5	NA	NA	NA	< 1.34	< 1.79	< 1.71	< 1.44	< 2.03	< 4.84	< 3.11	1.56	< 1.55	< 1.46	< 1.42	< 1.49	< 1.03
Selenium	ug/L	50	NA	3	50	< 1.0	< 1.0	< 1.0	< 2.0	1.1	< 1.0	< 1.0	< 2.0	< 1.0	2.2	< 1.0	< 2.0	< 2.0
Thallium	ug/L	2	NA	2	2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-17004				BCC-MW-17005							BCC-MW-17006			
					Sample Date:	12/6/2017	2/20/2018	6/15/2018	8/7/2018	12/6/2017	12/6/2017	2/20/2018	2/20/2018	6/15/2018	6/15/2018	8/7/2018	12/6/2017	2/20/2018	6/15/2018	8/7/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	GSI														
Appendix III											Field Dup		Field Dup		Field Dup					
Boron	ug/L	NC	NA	1,320	NA	367	429	525	425	191	208	238	228	377	353	342	669	594	653	765
Calcium	mg/L	NC	NA	259	NA	53.7	48.1	73.1	68.9	51.9	54	54.2	53.1	71.2	71.1	68.1	106	95	97.5	90.4
Chloride	mg/L	250*	NA	5,980	NA	21.3	21.3	21.4	21.2	19.4	19.4	21.6	21.3	20.5	20.5	19.6	19	20.3	20.9	21.5
Fluoride	ug/L	4,000	NA	1,000	NA	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.2	7.3	7.4	7.3	7.3	--	7.3	--	7.4	--	7.3	7.7	7.3	7.5	7.5
Sulfate	mg/L	250*	NA	200	NA	< 2.0	< 2.0	8.3	< 2.0	11.5	11	< 2.0	< 2.0	9.6	9	4.3	129	93.1	69.8	46.2
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	228	238	410	320	262	220	310	266	358	416	318	474	472	478	438
Appendix IV																				
Antimony	ug/L	6	NA	1	6	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 2.0
Arsenic	ug/L	10	NA	10	**10**	2.5	1.8	1.1	< 1.0	2.9	2.8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	4.9	2.4	4.6	< 1.0
Barium	ug/L	2,000	NA	340	2,000	145	116	175	148	168	167	123	128	161	149	179	83.3	79	70.3	73
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1.0	< 1.0	1.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000
Lead	ug/L	NC	15	2	15	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	2	**40**	< 10	< 10	< 10	< 10	10	12	11	11	< 10	< 10	13	38	37	31	36
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	9.9	5.9	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	5	NA	NA	NA	< 0.945	< 0.723	< 0.441	< 0.519	< 0.863	1.56	< 0.804	0.91	< 0.692	< 0.610	0.44	< 0.930	< 0.766	< 0.862	< 0.582
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.804	< 0.719	< 0.810	1.03	< 0.722	< 0.649	< 0.904	< 0.945	< 0.796	< 0.853	< 0.741	< 0.833	< 0.716	< 0.888	< 0.757
Radium-228	pCi/L	5	NA	NA	NA	< 1.75	< 1.44	< 1.25	< 1.46	< 1.59	< 1.61	< 1.71	< 1.80	< 1.49	< 1.46	< 1.15	< 1.76	< 1.48	< 1.75	< 1.34
Selenium	ug/L	50	NA	3	50	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 2.0
Thallium	ug/L	2	NA	2	2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
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[DRAFT - ELECTRONIC REVIEW]

Table 2

Summary of Groundwater Protection Standard Exceedances – June & August 2018

BC Cobb – RCRA CCR Monitoring Program

Muskegon, Michigan

Constituent	Units	GWPS	BCC-MW-15009		BCC-MW-15010		BCC-MW-15017		BCC-MW-17001		BCC-MW-17002		BCC-MW-17003	
			LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL
Arsenic	ug/L	10	6.0	15	NA	NA	NA	NA	NA	NA	2	46	0.5	26
Lithium	ug/L	40	NA	NA	-6.0	76	NA	NA	47	81	43	210	NA	NA
Radium 226/228	pCi/L	5	NA	NA	NA	NA	3.8	6.1	NA	NA	NA	NA	NA	NA

Notes:

ug/L - micrograms per Liter.

GWPS - Groundwater Protection Standard as established in TRC's Technical Memorandum dated October 15, 2018.

UTL - Upper Confidence Limit ($\alpha = 0.01$) of the downgradient data set.

LCL - Lower Confidence Limit ($\alpha = 0.01$) of the downgradient data set.

Indicates a statistically significant exceedance of the GWPS. An exceedance occurs when the LCL is greater than the GWPS.

Figures

BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

1" = 3,000'
1:36,000

0 3,000 6,000 FEET

TRC

1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080

TRC - GIS

PROJECT:

CONSUMERS ENERGY COMPANY
BC COBB BOTTOM ASH POND AND PONDS 0-8 AREA
MUSKEGON, MICHIGAN

TITLE:

SITE LOCATION MAP

DRAWN BY:	J. PAPEZ
CHECKED BY:	S. HOLMSTROM
APPROVED BY:	G. CROCKFORD
DATE:	NOVEMBER 2018
PROJ. NO.:	269767-001
FILE:	269767-001-020slm.mxd

FIGURE 1

E:\ConsumersEnergy\CCR_GW\2017_269767\269767-001-020slm.mxd -- Saved By: SMAJOR on 11/30/2018, 12:01:46 PM

[DRAFT - ELECTRONIC REVIEW]

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- APPROXIMATE POND BOUNDARY

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.
3. MONITORING WELLS BCC-MW-17001 THROUGH BCC-MW-17006 SURVEYED BY CONSUMERS ENERGY CO. ON 1/16/2018.
4. DEEP SCREENED WELLS (DEEP) ARE CHARACTERIZED BY WELL SCREENS SET BELOW 555 FEET MSL.

N

0 300 600 Feet

1" = 300'
1:3,600

PROJECT:
CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:
SITE PLAN
WITH CCR MONITORING WELL LOCATIONS

DRAWN BY:	S. MAJOR	PROJ NO.:	284111-001
CHECKED BY:	C. SCIESZKA		FIGURE 2
APPROVED BY:	S. HOLMSTROM		
DATE:	OCTOBER 2018		

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 284111-001-011.mxd

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

Plot Date: 10/16/2018, 11:13:29 AM by SMAJOR – LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\284111-001-011.mxd

TRC - GIS

[DRAFT - ELECTRONIC REVIEW]

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- APPROXIMATE POND BOUNDARY
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)
- GROUNDWATER ELEVATION CONTOUR (0.5' INTERVAL, DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.
3. MONITORING WELLS BCC-MW-17001 THROUGH BCC-MW-17006 SURVEYED BY CONSUMERS ENERGY CO. ON 1/16/2018.
4. DEEP SCREENED WELLS (DEEP) ARE CHRACTERIZED BY WELL SCREENS SET BELOW 555 FEET MSL, AND WERE NOT USED TO CONSTRUCT CONTOUR MAP.

N

0 300 600 Feet

1" = 300'
1:3,600

PROJECT:
CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:
SHALLOW GROUNDWATER CONTOUR MAP
JUNE 11, 2018

DRAWN BY:	S. MAJOR	PROJ NO.:	284111-001
CHECKED BY:	C. SCIESZKA		
APPROVED BY:	S. HOLMSTROM		FIGURE 3
DATE:	OCTOBER 2018		

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 284111-001-009.mxd

Plot Date: 10/16/2018, 11:24:41 AM by SMAJOR – LAYOUT, ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_2697672\284111-001-009.mxd

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

TRC - GIS

[DRAFT - ELECTRONIC REVIEW]

Attachment A
Sanitas™ Output

Summary Report

Constituent: Antimony, Total Analysis Run 11/16/2018 11:47 AM
Client: Consumers Energy Data: BCC_Sanitas

For observations made between 12/1/2015 and 8/8/2018, a summary of the selected data set:

Observations = 174
ND/Trace = 168
Wells = 21
Minimum Value = 1
Maximum Value = 2
Mean Value = 1.048
Median Value = 1
Standard Deviation = 0.2036
Coefficient of Variation = 0.1944
Skewness = 4.224

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	10	9	1	1	1	1	0	0	NaN
BCC-MW-15010	10	10	1	1	1	1	0	0	NaN
BCC-MW-15011	10	10	1	1	1	1	0	0	NaN
BCC-MW-15012	10	10	1	1	1	1	0	0	NaN
BCC-MW-15013	10	10	1	1	1	1	0	0	NaN
BCC-MW-15014	10	8	1	1.7	1.08	1	0.2201	0.2038	2.573
BCC-MW-15015	10	10	1	1	1	1	0	0	NaN
BCC-MW-15016	10	10	1	1	1	1	0	0	NaN
BCC-MW-15017	10	10	1	1	1	1	0	0	NaN
BCC-MW-15018	10	10	1	1	1	1	0	0	NaN
BCC-MW-15019	10	10	1	1	1	1	0	0	NaN
BCC-MW-15020	10	10	1	1	1	1	0	0	NaN
BCC-MW-15021	10	10	1	1	1	1	0	0	NaN
BCC-MW-15022	10	9	1	1.9	1.09	1	0.2846	0.2611	2.667
BCC-MW-15023	10	10	1	1	1	1	0	0	NaN
BCC-MW-17001	4	4	1	2	1.25	1	0.5	0.4	1.155
BCC-MW-17002	4	3	1	2	1.375	1.25	0.4787	0.3482	0.4934
BCC-MW-17003	4	3	1	2	1.275	1.05	0.4856	0.3809	1.123
BCC-MW-17004	4	4	1	2	1.25	1	0.5	0.4	1.155
BCC-MW-17005	4	4	1	2	1.25	1	0.5	0.4	1.155
BCC-MW-17006	4	4	1	2	1.25	1	0.5	0.4	1.155

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Arsenic, Total Analysis Run 11/16/2018 11:47 AM
Client: Consumers Energy Data: BCC_Sanitas

For observations made between 12/1/2015 and 8/8/2018, a summary of the selected data set:

Observations = 174
ND/Trace = 66
Wells = 21
Minimum Value = 1
Maximum Value = 45.5
Mean Value = 4.389
Median Value = 2
Standard Deviation = 6.578
Coefficient of Variation = 1.499
Skewness = 3.817

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	10	0	8.5	45	20.03	17	11.46	0.572	1.018
BCC-MW-15010	10	10	1	1	1	1	0	0	NaN
BCC-MW-15011	10	1	1	8	4.49	4.5	2.371	0.5281	-0.05597
BCC-MW-15012	10	1	1	12	4.83	3.2	3.738	0.7738	0.7552
BCC-MW-15013	10	10	1	1	1	1	0	0	NaN
BCC-MW-15014	10	0	5.5	15	8.81	8.2	2.85	0.3235	0.9701
BCC-MW-15015	10	0	2	7	4.52	5	1.857	0.4108	-0.4591
BCC-MW-15016	10	0	1.3	3	2.03	2	0.5755	0.2835	0.6995
BCC-MW-15017	10	0	2.1	13	6.54	5	4.256	0.6507	0.5523
BCC-MW-15018	10	8	1	2	1.1	1	0.3162	0.2875	2.667
BCC-MW-15019	10	10	1	1	1	1	0	0	NaN
BCC-MW-15020	10	10	1	1	1	1	0	0	NaN
BCC-MW-15021	10	2	1	3	1.6	1.5	0.6992	0.437	0.6578
BCC-MW-15022	10	1	1	8	5.09	5.9	2.534	0.4977	-0.5503
BCC-MW-15023	10	3	1	3	1.69	1.95	0.6707	0.3969	0.4124
BCC-MW-17001	4	3	1	5.2	2.05	1	2.1	1.024	1.155
BCC-MW-17002	4	0	2	45.5	13.48	3.2	21.36	1.585	1.15
BCC-MW-17003	4	2	1	26	7.263	1.025	12.49	1.72	1.155
BCC-MW-17004	4	1	1	2.5	1.6	1.45	0.6976	0.436	0.4489
BCC-MW-17005	4	3	1	2.85	1.463	1	0.925	0.6325	1.155
BCC-MW-17006	4	1	1	4.9	3.225	3.5	1.855	0.5753	-0.2578

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Barium, Total Analysis Run 11/16/2018 11:47 AM
Client: Consumers Energy Data: BCC_Sanitas

For observations made between 12/1/2015 and 8/8/2018, a summary of the selected data set:

Observations = 174
ND/Trace = 0
Wells = 21
Minimum Value = 9
Maximum Value = 1030
Mean Value = 189.5
Median Value = 84.45
Standard Deviation = 253
Coefficient of Variation = 1.335
Skewness = 1.956

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	10	0	9	16.5	12.23	11.5	2.471	0.2021	0.659
BCC-MW-15010	10	0	28	64.8	43.74	43.5	13.46	0.3078	0.3599
BCC-MW-15011	10	0	15.2	36	27.65	30.35	6.765	0.2447	-0.9512
BCC-MW-15012	10	0	14.3	109	50.83	37	34.18	0.6725	0.7471
BCC-MW-15013	10	0	41.9	71	50.44	48.5	8.692	0.1723	1.37
BCC-MW-15014	10	0	257	779	506.2	527	174.5	0.3447	0.1456
BCC-MW-15015	10	0	21	39.9	28.67	28	6.438	0.2246	0.5541
BCC-MW-15016	10	0	596	666	633.3	634	23.33	0.03684	-0.1161
BCC-MW-15017	10	0	772	1030	939.1	955	71.2	0.07582	-1.285
BCC-MW-15018	10	0	133	171	148.3	148.5	10.74	0.07242	0.6948
BCC-MW-15019	10	0	88	187	109.7	93.5	34.96	0.3187	1.511
BCC-MW-15020	10	0	47	196.5	76.19	52.5	52.03	0.6829	1.657
BCC-MW-15021	10	0	211	274	239.2	237	16.26	0.06798	0.5507
BCC-MW-15022	10	0	102	155	125.8	124	16.8	0.1336	0.1244
BCC-MW-15023	10	0	38	97.1	54.59	46.5	20.74	0.3799	1.324
BCC-MW-17001	4	0	65.8	85.6	74.13	72.55	8.348	0.1126	0.603
BCC-MW-17002	4	0	57.6	148	86.28	69.75	41.93	0.486	1.032
BCC-MW-17003	4	0	66.5	128	88.3	79.35	27.17	0.3077	0.9728
BCC-MW-17004	4	0	116	175	146	146.5	24.12	0.1652	-0.07138
BCC-MW-17005	4	0	125.5	179	156.8	161.3	23.02	0.1469	-0.5761
BCC-MW-17006	4	0	70.3	83.3	76.4	76	5.863	0.07675	0.1524

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Beryllium, Total Analysis Run 11/16/2018 11:47 AM
Client: Consumers Energy Data: BCC_Sanitas

For observations made between 12/1/2015 and 8/8/2018, a summary of the selected data set:

Observations = 174
ND/Trace = 174
Wells = 21
Minimum Value = 1
Maximum Value = 1
Mean Value = 1
Median Value = 1
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	10	10	1	1	1	1	0	0	NaN
BCC-MW-15010	10	10	1	1	1	1	0	0	NaN
BCC-MW-15011	10	10	1	1	1	1	0	0	NaN
BCC-MW-15012	10	10	1	1	1	1	0	0	NaN
BCC-MW-15013	10	10	1	1	1	1	0	0	NaN
BCC-MW-15014	10	10	1	1	1	1	0	0	NaN
BCC-MW-15015	10	10	1	1	1	1	0	0	NaN
BCC-MW-15016	10	10	1	1	1	1	0	0	NaN
BCC-MW-15017	10	10	1	1	1	1	0	0	NaN
BCC-MW-15018	10	10	1	1	1	1	0	0	NaN
BCC-MW-15019	10	10	1	1	1	1	0	0	NaN
BCC-MW-15020	10	10	1	1	1	1	0	0	NaN
BCC-MW-15021	10	10	1	1	1	1	0	0	NaN
BCC-MW-15022	10	10	1	1	1	1	0	0	NaN
BCC-MW-15023	10	10	1	1	1	1	0	0	NaN
BCC-MW-17001	4	4	1	1	1	1	0	0	NaN
BCC-MW-17002	4	4	1	1	1	1	0	0	NaN
BCC-MW-17003	4	4	1	1	1	1	0	0	NaN
BCC-MW-17004	4	4	1	1	1	1	0	0	NaN
BCC-MW-17005	4	4	1	1	1	1	0	0	NaN
BCC-MW-17006	4	4	1	1	1	1	0	0	NaN

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Cadmium, Total Analysis Run 11/16/2018 11:47 AM
Client: Consumers Energy Data: BCC_Sanitas

For observations made between 12/1/2015 and 8/8/2018, a summary of the selected data set:

Observations = 174
ND/Trace = 174
Wells = 21
Minimum Value = 0.2
Maximum Value = 0.2
Mean Value = 0.2
Median Value = 0.2
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15010	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15011	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15012	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15013	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15014	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15015	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15016	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15017	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15018	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15019	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15020	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15021	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15022	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15023	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17001	4	4	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17002	4	4	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17003	4	4	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17004	4	4	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17005	4	4	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17006	4	4	0.2	0.2	0.2	0.2	0	0	NaN

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Chromium, Total Analysis Run 11/16/2018 11:47 AM
Client: Consumers Energy Data: BCC_Sanitas

For observations made between 12/1/2015 and 8/8/2018, a summary of the selected data set:

Observations = 174
ND/Trace = 116
Wells = 21
Minimum Value = 1
Maximum Value = 11
Mean Value = 1.427
Median Value = 1
Standard Deviation = 1.242
Coefficient of Variation = 0.8705
Skewness = 4.701

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	10	8	1	2	1.1	1	0.3162	0.2875	2.667
BCC-MW-15010	10	8	1	2	1.1	1	0.3162	0.2875	2.667
BCC-MW-15011	10	7	1	2	1.1	1	0.3162	0.2875	2.667
BCC-MW-15012	10	8	1	1	1	1	0	0	NaN
BCC-MW-15013	10	8	1	2	1.1	1	0.3162	0.2875	2.667
BCC-MW-15014	10	7	1	2	1.1	1	0.3162	0.2875	2.667
BCC-MW-15015	10	8	1	1	1	1	0	0	NaN
BCC-MW-15016	10	0	1.9	4	2.7	3	0.6766	0.2506	0.3471
BCC-MW-15017	10	0	3.35	11	5.405	4.5	2.555	0.4726	1.38
BCC-MW-15018	10	5	1	1	1	1	0	0	NaN
BCC-MW-15019	10	8	1	1	1	1	0	0	NaN
BCC-MW-15020	10	8	1	2	1.1	1	0.3162	0.2875	2.667
BCC-MW-15021	10	3	1	2	1.51	1.55	0.5174	0.3426	-0.00954
BCC-MW-15022	10	7	1	2	1.1	1	0.3162	0.2875	2.667
BCC-MW-15023	10	8	1	2	1.1	1	0.3162	0.2875	2.667
BCC-MW-17001	4	4	1	1	1	1	0	0	NaN
BCC-MW-17002	4	4	1	1	1	1	0	0	NaN
BCC-MW-17003	4	4	1	1	1	1	0	0	NaN
BCC-MW-17004	4	3	1	1.2	1.05	1	0.1	0.09524	1.155
BCC-MW-17005	4	4	1	1	1	1	0	0	NaN
BCC-MW-17006	4	4	1	1	1	1	0	0	NaN

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Cobalt, Total Analysis Run 11/16/2018 11:47 AM
Client: Consumers Energy Data: BCC_Sanitas

For observations made between 12/1/2015 and 8/8/2018, a summary of the selected data set:

Observations = 174
ND/Trace = 174
Wells = 21
Minimum Value = 15
Maximum Value = 15
Mean Value = 15
Median Value = 15
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	10	10	15	15	15	15	0	0	NaN
BCC-MW-15010	10	10	15	15	15	15	0	0	NaN
BCC-MW-15011	10	10	15	15	15	15	0	0	NaN
BCC-MW-15012	10	10	15	15	15	15	0	0	NaN
BCC-MW-15013	10	10	15	15	15	15	0	0	NaN
BCC-MW-15014	10	10	15	15	15	15	0	0	NaN
BCC-MW-15015	10	10	15	15	15	15	0	0	NaN
BCC-MW-15016	10	10	15	15	15	15	0	0	NaN
BCC-MW-15017	10	10	15	15	15	15	0	0	NaN
BCC-MW-15018	10	10	15	15	15	15	0	0	NaN
BCC-MW-15019	10	10	15	15	15	15	0	0	NaN
BCC-MW-15020	10	10	15	15	15	15	0	0	NaN
BCC-MW-15021	10	10	15	15	15	15	0	0	NaN
BCC-MW-15022	10	10	15	15	15	15	0	0	NaN
BCC-MW-15023	10	10	15	15	15	15	0	0	NaN
BCC-MW-17001	4	4	15	15	15	15	0	0	NaN
BCC-MW-17002	4	4	15	15	15	15	0	0	NaN
BCC-MW-17003	4	4	15	15	15	15	0	0	NaN
BCC-MW-17004	4	4	15	15	15	15	0	0	NaN
BCC-MW-17005	4	4	15	15	15	15	0	0	NaN
BCC-MW-17006	4	4	15	15	15	15	0	0	NaN

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Fluoride Analysis Run 11/16/2018 11:47 AM
Client: Consumers Energy Data: BCC_Sanitas

For observations made between 12/1/2015 and 8/8/2018, a summary of the selected data set:

Observations = 189
ND/Trace = 185
Wells = 21
Minimum Value = 1000
Maximum Value = 1200
Mean Value = 1003
Median Value = 1000
Standard Deviation = 21.72
Coefficient of Variation = 0.02166
Skewness = 8.482

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	11	11	1000	1000	1000	1000	0	0	NaN
BCC-MW-15010	11	11	1000	1000	1000	1000	0	0	NaN
BCC-MW-15011	11	9	1000	1200	1018	1000	60.3	0.05923	2.846
BCC-MW-15012	11	9	1000	1200	1027	1000	64.67	0.06295	2.077
BCC-MW-15013	11	11	1000	1000	1000	1000	0	0	NaN
BCC-MW-15014	11	11	1000	1000	1000	1000	0	0	NaN
BCC-MW-15015	11	11	1000	1000	1000	1000	0	0	NaN
BCC-MW-15016	11	11	1000	1000	1000	1000	0	0	NaN
BCC-MW-15017	11	11	1000	1000	1000	1000	0	0	NaN
BCC-MW-15018	11	11	1000	1000	1000	1000	0	0	NaN
BCC-MW-15019	11	11	1000	1000	1000	1000	0	0	NaN
BCC-MW-15020	11	11	1000	1000	1000	1000	0	0	NaN
BCC-MW-15021	11	11	1000	1000	1000	1000	0	0	NaN
BCC-MW-15022	11	11	1000	1000	1000	1000	0	0	NaN
BCC-MW-15023	11	11	1000	1000	1000	1000	0	0	NaN
BCC-MW-17001	4	4	1000	1000	1000	1000	0	0	NaN
BCC-MW-17002	4	4	1000	1000	1000	1000	0	0	NaN
BCC-MW-17003	4	4	1000	1000	1000	1000	0	0	NaN
BCC-MW-17004	4	4	1000	1000	1000	1000	0	0	NaN
BCC-MW-17005	4	4	1000	1000	1000	1000	0	0	NaN
BCC-MW-17006	4	4	1000	1000	1000	1000	0	0	NaN

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Lead, Total Analysis Run 11/16/2018 11:47 AM
Client: Consumers Energy Data: BCC_Sanitas

For observations made between 12/1/2015 and 8/8/2018, a summary of the selected data set:

Observations = 174
ND/Trace = 174
Wells = 21
Minimum Value = 1
Maximum Value = 1
Mean Value = 1
Median Value = 1
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	10	10	1	1	1	1	0	0	NaN
BCC-MW-15010	10	10	1	1	1	1	0	0	NaN
BCC-MW-15011	10	10	1	1	1	1	0	0	NaN
BCC-MW-15012	10	10	1	1	1	1	0	0	NaN
BCC-MW-15013	10	10	1	1	1	1	0	0	NaN
BCC-MW-15014	10	10	1	1	1	1	0	0	NaN
BCC-MW-15015	10	10	1	1	1	1	0	0	NaN
BCC-MW-15016	10	10	1	1	1	1	0	0	NaN
BCC-MW-15017	10	10	1	1	1	1	0	0	NaN
BCC-MW-15018	10	10	1	1	1	1	0	0	NaN
BCC-MW-15019	10	10	1	1	1	1	0	0	NaN
BCC-MW-15020	10	10	1	1	1	1	0	0	NaN
BCC-MW-15021	10	10	1	1	1	1	0	0	NaN
BCC-MW-15022	10	10	1	1	1	1	0	0	NaN
BCC-MW-15023	10	10	1	1	1	1	0	0	NaN
BCC-MW-17001	4	4	1	1	1	1	0	0	NaN
BCC-MW-17002	4	4	1	1	1	1	0	0	NaN
BCC-MW-17003	4	4	1	1	1	1	0	0	NaN
BCC-MW-17004	4	4	1	1	1	1	0	0	NaN
BCC-MW-17005	4	4	1	1	1	1	0	0	NaN
BCC-MW-17006	4	4	1	1	1	1	0	0	NaN

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Lithium, Total Analysis Run 11/16/2018 11:47 AM
Client: Consumers Energy Data: BCC_Sanitas

For observations made between 12/1/2015 and 8/8/2018, a summary of the selected data set:

Observations = 174
ND/Trace = 62
Wells = 21
Minimum Value = 10
Maximum Value = 160
Mean Value = 19.48
Median Value = 14
Standard Deviation = 20.3
Coefficient of Variation = 1.042
Skewness = 4.791

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	10	0	13	24	16.42	14.8	3.657	0.2227	1.094
BCC-MW-15010	10	0	14	54	26.68	21.5	13.85	0.5191	1.021
BCC-MW-15011	10	0	11	21	16.42	16.5	2.842	0.1731	-0.1714
BCC-MW-15012	10	0	11	20.8	14.74	14	3.533	0.2397	0.4891
BCC-MW-15013	10	0	17	27.5	19.99	18	3.613	0.1808	1.05
BCC-MW-15014	10	7	10	27	13.2	10	5.808	0.44	1.564
BCC-MW-15015	10	7	10	16	11.05	10	2.006	0.1816	1.75
BCC-MW-15016	10	10	10	10	10	10	0	0	NaN
BCC-MW-15017	10	10	10	10	10	10	0	0	NaN
BCC-MW-15018	10	0	12	28	21.65	22.25	5.146	0.2377	-0.7822
BCC-MW-15019	10	0	22	27.9	24.36	23.85	2.055	0.08436	0.483
BCC-MW-15020	10	0	14	18	15.49	15.55	1.544	0.09966	0.4854
BCC-MW-15021	10	10	10	10	10	10	0	0	NaN
BCC-MW-15022	10	8	10	13	10.4	10	0.9661	0.09289	2.245
BCC-MW-15023	10	5	10	19	12.07	10.3	3.463	0.2869	1.389
BCC-MW-17001	4	0	55	73	63.75	63.5	7.455	0.1169	0.1097
BCC-MW-17002	4	0	75	160	128.8	140	37.94	0.2947	-0.8116
BCC-MW-17003	4	0	13	19	16.75	17.5	2.63	0.157	-0.8332
BCC-MW-17004	4	4	10	10	10	10	0	0	NaN
BCC-MW-17005	4	1	10	13	11.25	11	1.258	0.1118	0.652
BCC-MW-17006	4	0	31	38	35.5	36.5	3.109	0.08758	-0.9221

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Mercury, Total Analysis Run 11/16/2018 11:47 AM
Client: Consumers Energy Data: BCC_Sanitas

For observations made between 12/1/2015 and 8/8/2018, a summary of the selected data set:

Observations = 174
ND/Trace = 174
Wells = 21
Minimum Value = 0.2
Maximum Value = 0.2
Mean Value = 0.2
Median Value = 0.2
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15010	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15011	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15012	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15013	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15014	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15015	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15016	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15017	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15018	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15019	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15020	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15021	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15022	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15023	10	10	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17001	4	4	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17002	4	4	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17003	4	4	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17004	4	4	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17005	4	4	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17006	4	4	0.2	0.2	0.2	0.2	0	0	NaN

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Molybdenum, Total Analysis Run 11/16/2018 11:47 AM
Client: Consumers Energy Data: BCC_Sanitas

For observations made between 12/1/2015 and 8/8/2018, a summary of the selected data set:

Observations = 174
ND/Trace = 88
Wells = 21
Minimum Value = 5
Maximum Value = 119
Mean Value = 17.16
Median Value = 5
Standard Deviation = 21.97
Coefficient of Variation = 1.281
Skewness = 2.313

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	10	0	11.6	60	41.34	45.88	16.08	0.389	-0.8644
BCC-MW-15010	10	2	5	33	16.62	15.6	10.35	0.6228	0.3141
BCC-MW-15011	10	0	5.8	35	22.01	23.5	8.859	0.4025	-0.6355
BCC-MW-15012	10	0	9	94.5	43.26	36	24.24	0.5602	0.8904
BCC-MW-15013	10	2	5	21	11.77	10.5	5.773	0.4905	0.4697
BCC-MW-15014	10	0	58	119	82.56	78.5	17.59	0.2131	0.7769
BCC-MW-15015	10	0	7	17	11.79	11	3.342	0.2836	0.4502
BCC-MW-15016	10	10	5	5	5	5	0	0	NaN
BCC-MW-15017	10	10	5	5	5	5	0	0	NaN
BCC-MW-15018	10	10	5	5	5	5	0	0	NaN
BCC-MW-15019	10	10	5	5	5	5	0	0	NaN
BCC-MW-15020	10	10	5	5	5	5	0	0	NaN
BCC-MW-15021	10	10	5	5	5	5	0	0	NaN
BCC-MW-15022	10	2	5	22	13.46	13.8	5.52	0.4101	-0.2613
BCC-MW-15023	10	3	5	8	6.11	6	1.005	0.1645	0.4984
BCC-MW-17001	4	4	5	5	5	5	0	0	NaN
BCC-MW-17002	4	3	5	30.1	11.28	5	12.55	1.113	1.155
BCC-MW-17003	4	2	5	48.8	16.28	5.65	21.69	1.333	1.152
BCC-MW-17004	4	2	5	9.9	6.45	5.45	2.339	0.3626	1.047
BCC-MW-17005	4	4	5	5	5	5	0	0	NaN
BCC-MW-17006	4	4	5	5	5	5	0	0	NaN

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Radium-226 Analysis Run 11/16/2018 11:47 AM
Client: Consumers Energy Data: BCC_Sanitas

For observations made between 12/1/2015 and 8/8/2018, a summary of the selected data set:

Observations = 174
ND/Trace = 118
Wells = 21
Minimum Value = 0.133
Maximum Value = 2.5
Mean Value = 0.5879
Median Value = 0.438
Standard Deviation = 0.4831
Coefficient of Variation = 0.8219
Skewness = 1.786

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	10	10	0.157	0.934	0.3866	0.239	0.3055	0.7902	0.9972
BCC-MW-15010	10	9	0.145	0.869	0.3772	0.2705	0.251	0.6655	0.951
BCC-MW-15011	10	9	0.141	1.12	0.3777	0.29	0.3133	0.8296	1.588
BCC-MW-15012	10	9	0.153	0.693	0.3265	0.2495	0.1744	0.5342	1.018
BCC-MW-15013	10	7	0.173	0.731	0.3407	0.251	0.1953	0.5732	1.007
BCC-MW-15014	10	9	0.175	1.17	0.4251	0.216	0.3901	0.9176	1.299
BCC-MW-15015	10	10	0.133	0.832	0.3383	0.291	0.2149	0.6353	1.196
BCC-MW-15016	10	2	0.263	1.6	1.208	1.305	0.4147	0.3432	-1.238
BCC-MW-15017	10	0	1.56	2.5	2.01	1.955	0.3108	0.1546	0.07986
BCC-MW-15018	10	3	0.227	1.02	0.4826	0.412	0.2478	0.5134	1.053
BCC-MW-15019	10	4	0.279	0.717	0.4294	0.3465	0.1595	0.3715	0.7176
BCC-MW-15020	10	9	0.19	0.899	0.4304	0.292	0.2619	0.6086	0.881
BCC-MW-15021	10	4	0.215	0.768	0.533	0.5435	0.153	0.2871	-0.5248
BCC-MW-15022	10	8	0.15	0.708	0.3581	0.269	0.1931	0.5392	0.9254
BCC-MW-15023	10	6	0.226	0.958	0.4377	0.283	0.2804	0.6406	1.027
BCC-MW-17001	4	4	0.509	0.89	0.6952	0.691	0.1672	0.2405	0.06435
BCC-MW-17002	4	3	0.306	1.07	0.7908	0.8935	0.3518	0.4449	-0.6936
BCC-MW-17003	4	3	0.52	0.889	0.6895	0.6745	0.1653	0.2397	0.2115
BCC-MW-17004	4	4	0.441	0.945	0.657	0.621	0.2258	0.3437	0.3833
BCC-MW-17005	4	1	0.44	1.211	0.8001	0.7745	0.3234	0.4042	0.2483
BCC-MW-17006	4	4	0.582	0.93	0.785	0.814	0.1511	0.1925	-0.5427

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Radium-226/228 Analysis Run 11/16/2018 11:47 AM
Client: Consumers Energy Data: BCC_Sanitas

For observations made between 12/1/2015 and 8/8/2018, a summary of the selected data set:

Observations = 174
ND/Trace = 107
Wells = 21
Minimum Value = 0.354
Maximum Value = 5.89
Mean Value = 1.483
Median Value = 1.26
Standard Deviation = 1.211
Coefficient of Variation = 0.8164
Skewness = 1.799

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	10	9	0.451	3.85	1.332	0.565	1.396	1.048	1.221
BCC-MW-15010	10	7	0.363	1.75	0.8736	0.661	0.542	0.6204	0.5819
BCC-MW-15011	10	9	0.394	2.07	0.8713	0.5475	0.5943	0.6821	0.9697
BCC-MW-15012	10	9	0.416	2.28	0.9111	0.594	0.5985	0.6569	1.311
BCC-MW-15013	10	7	0.481	1.56	0.9148	0.749	0.4299	0.47	0.3906
BCC-MW-15014	10	8	0.423	3.02	1.168	0.809	0.8449	0.7231	1.153
BCC-MW-15015	10	9	0.408	1.63	0.7891	0.5775	0.4255	0.5392	0.8795
BCC-MW-15016	10	0	2.29	3.83	3.074	3.09	0.5807	0.1889	-0.09311
BCC-MW-15017	10	0	4.3	5.89	5.039	5.065	0.5725	0.1136	0.01966
BCC-MW-15018	10	2	0.586	1.97	1.297	1.291	0.3808	0.2937	0.06467
BCC-MW-15019	10	3	0.674	2.13	1.213	0.9855	0.497	0.4097	0.6156
BCC-MW-15020	10	4	0.467	2.32	0.9879	0.727	0.5881	0.5953	1.311
BCC-MW-15021	10	3	0.354	2	1.439	1.44	0.5059	0.3516	-0.8293
BCC-MW-15022	10	7	0.45	1.45	0.7921	0.663	0.3759	0.4746	0.6129
BCC-MW-15023	10	7	0.355	1.85	0.9031	0.572	0.5596	0.6197	0.5462
BCC-MW-17001	4	4	1.34	1.79	1.57	1.575	0.2143	0.1365	-0.038
BCC-MW-17002	4	3	1.56	4.84	2.885	2.57	1.456	0.5047	0.5652
BCC-MW-17003	4	4	1.42	1.55	1.48	1.475	0.05477	0.03701	0.2811
BCC-MW-17004	4	4	1.25	1.75	1.475	1.45	0.2063	0.1399	0.4102
BCC-MW-17005	4	4	1.15	1.8	1.512	1.55	0.2733	0.1807	-0.4328
BCC-MW-17006	4	4	1.34	1.76	1.583	1.615	0.2073	0.131	-0.2181

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Radium-228 Analysis Run 11/16/2018 11:47 AM
Client: Consumers Energy Data: BCC_Sanitas

For observations made between 12/1/2015 and 8/8/2018, a summary of the selected data set:

Observations = 174
ND/Trace = 111
Wells = 21
Minimum Value = 0.354
Maximum Value = 3.98
Mean Value = 0.9987
Median Value = 0.753
Standard Deviation = 0.7379
Coefficient of Variation = 0.7389
Skewness = 2.061

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	10	9	0.451	3.27	1.085	0.565	1.084	0.9987	1.446
BCC-MW-15010	10	7	0.363	0.978	0.65	0.615	0.2516	0.3871	0.1242
BCC-MW-15011	10	9	0.394	0.956	0.6478	0.5475	0.2473	0.3818	0.2906
BCC-MW-15012	10	9	0.416	2.08	0.7591	0.594	0.4833	0.6367	2.293
BCC-MW-15013	10	7	0.481	0.94	0.6869	0.6625	0.1883	0.2742	0.2086
BCC-MW-15014	10	8	0.423	1.85	0.8743	0.7725	0.4314	0.4934	1.136
BCC-MW-15015	10	9	0.408	0.85	0.6113	0.5775	0.1628	0.2663	0.1671
BCC-MW-15016	10	0	1.06	2.37	1.904	1.935	0.403	0.2117	-0.7056
BCC-MW-15017	10	0	2.5	3.98	3.029	2.95	0.4312	0.1424	1.092
BCC-MW-15018	10	2	0.586	1.39	0.8823	0.824	0.2342	0.2655	0.8883
BCC-MW-15019	10	6	0.484	1.8	0.8834	0.7405	0.4133	0.4679	1.214
BCC-MW-15020	10	4	0.467	1.61	0.7136	0.6125	0.333	0.4666	2.168
BCC-MW-15021	10	4	0.354	1.6	0.9736	0.8585	0.4276	0.4392	0.3379
BCC-MW-15022	10	8	0.45	0.799	0.6031	0.579	0.1366	0.2265	0.1735
BCC-MW-15023	10	8	0.355	0.963	0.5951	0.5375	0.2105	0.3537	0.6309
BCC-MW-17001	4	4	0.822	0.947	0.875	0.8655	0.0597	0.06823	0.2728
BCC-MW-17002	4	3	0.996	3.77	2.091	1.8	1.264	0.6043	0.5406
BCC-MW-17003	4	3	0.663	0.9015	0.7749	0.7675	0.1095	0.1413	0.1369
BCC-MW-17004	4	3	0.719	1.03	0.8408	0.807	0.1328	0.158	0.8038
BCC-MW-17005	4	4	0.722	0.945	0.8152	0.797	0.104	0.1276	0.348
BCC-MW-17006	4	4	0.716	0.888	0.7985	0.795	0.07687	0.09627	0.1059

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Selenium, Total Analysis Run 11/16/2018 11:47 AM
Client: Consumers Energy Data: BCC_Sanitas

For observations made between 12/1/2015 and 8/8/2018, a summary of the selected data set:

Observations = 174
ND/Trace = 121
Wells = 21
Minimum Value = 1
Maximum Value = 8
Mean Value = 1.392
Median Value = 1
Standard Deviation = 1.056
Coefficient of Variation = 0.7587
Skewness = 4.204

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	10	9	1	2	1.1	1	0.3162	0.2875	2.667
BCC-MW-15010	10	8	1	1	1	1	0	0	NaN
BCC-MW-15011	10	9	1	1	1	1	0	0	NaN
BCC-MW-15012	10	7	1	3.3	1.27	1	0.7181	0.5654	2.602
BCC-MW-15013	10	9	1	1	1	1	0	0	NaN
BCC-MW-15014	10	4	1	8	1.87	1	2.191	1.172	2.515
BCC-MW-15015	10	9	1	1	1	1	0	0	NaN
BCC-MW-15016	10	0	1	7	2.65	2	1.793	0.6767	1.555
BCC-MW-15017	10	0	1.7	8	3.185	2.85	1.818	0.5707	2.048
BCC-MW-15018	10	7	1	4	1.3	1	0.9487	0.7298	2.667
BCC-MW-15019	10	8	1	2	1.12	1	0.3155	0.2817	2.491
BCC-MW-15020	10	6	1	2	1.14	1	0.3273	0.2871	2.11
BCC-MW-15021	10	4	1	4	1.46	1	0.9571	0.6555	2.12
BCC-MW-15022	10	10	1	1	1	1	0	0	NaN
BCC-MW-15023	10	9	1	1	1	1	0	0	NaN
BCC-MW-17001	4	4	1	2	1.25	1	0.5	0.4	1.155
BCC-MW-17002	4	3	1	2	1.275	1.05	0.4856	0.3809	1.123
BCC-MW-17003	4	3	1	2.2	1.55	1.5	0.6403	0.4131	0.04838
BCC-MW-17004	4	4	1	2	1.25	1	0.5	0.4	1.155
BCC-MW-17005	4	4	1	2	1.25	1	0.5	0.4	1.155
BCC-MW-17006	4	4	1	2	1.25	1	0.5	0.4	1.155

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Thallium, Total Analysis Run 11/16/2018 11:47 AM
Client: Consumers Energy Data: BCC_Sanitas

For observations made between 12/1/2015 and 8/8/2018, a summary of the selected data set:

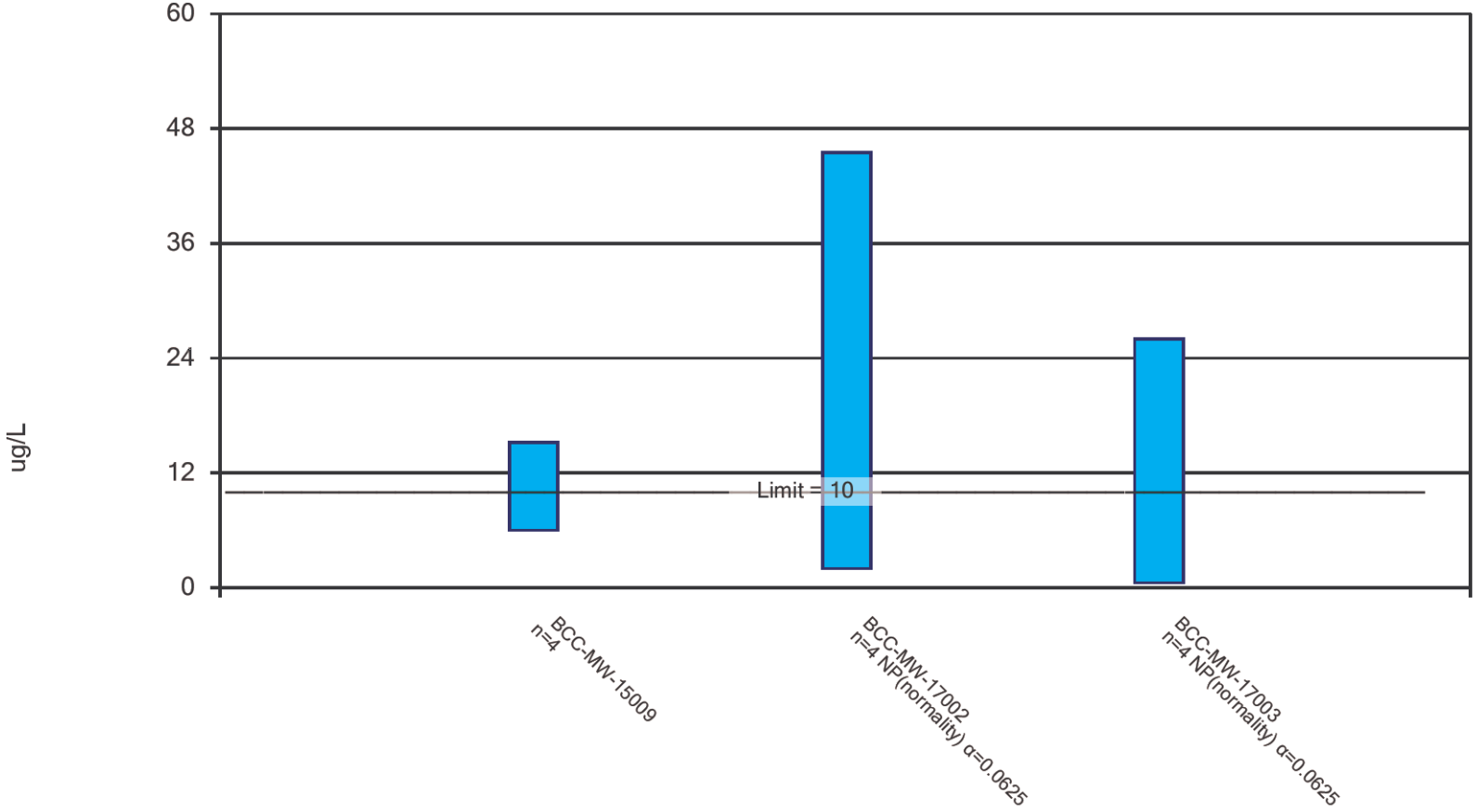
Observations = 174
ND/Trace = 174
Wells = 21
Minimum Value = 2
Maximum Value = 2
Mean Value = 2
Median Value = 2
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	10	10	2	2	2	2	0	0	NaN
BCC-MW-15010	10	10	2	2	2	2	0	0	NaN
BCC-MW-15011	10	10	2	2	2	2	0	0	NaN
BCC-MW-15012	10	10	2	2	2	2	0	0	NaN
BCC-MW-15013	10	10	2	2	2	2	0	0	NaN
BCC-MW-15014	10	10	2	2	2	2	0	0	NaN
BCC-MW-15015	10	10	2	2	2	2	0	0	NaN
BCC-MW-15016	10	10	2	2	2	2	0	0	NaN
BCC-MW-15017	10	10	2	2	2	2	0	0	NaN
BCC-MW-15018	10	10	2	2	2	2	0	0	NaN
BCC-MW-15019	10	10	2	2	2	2	0	0	NaN
BCC-MW-15020	10	10	2	2	2	2	0	0	NaN
BCC-MW-15021	10	10	2	2	2	2	0	0	NaN
BCC-MW-15022	10	10	2	2	2	2	0	0	NaN
BCC-MW-15023	10	10	2	2	2	2	0	0	NaN
BCC-MW-17001	4	4	2	2	2	2	0	0	NaN
BCC-MW-17002	4	4	2	2	2	2	0	0	NaN
BCC-MW-17003	4	4	2	2	2	2	0	0	NaN
BCC-MW-17004	4	4	2	2	2	2	0	0	NaN
BCC-MW-17005	4	4	2	2	2	2	0	0	NaN
BCC-MW-17006	4	4	2	2	2	2	0	0	NaN

[DRAFT - ELECTRONIC REVIEW]

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Arsenic, Total Analysis Run 11/27/2018 5:02 PM

Client: Consumers Energy Data: BCC_Sanitas

Confidence Interval

Constituent: Arsenic, Total (ug/L) Analysis Run 11/27/2018 5:03 PM

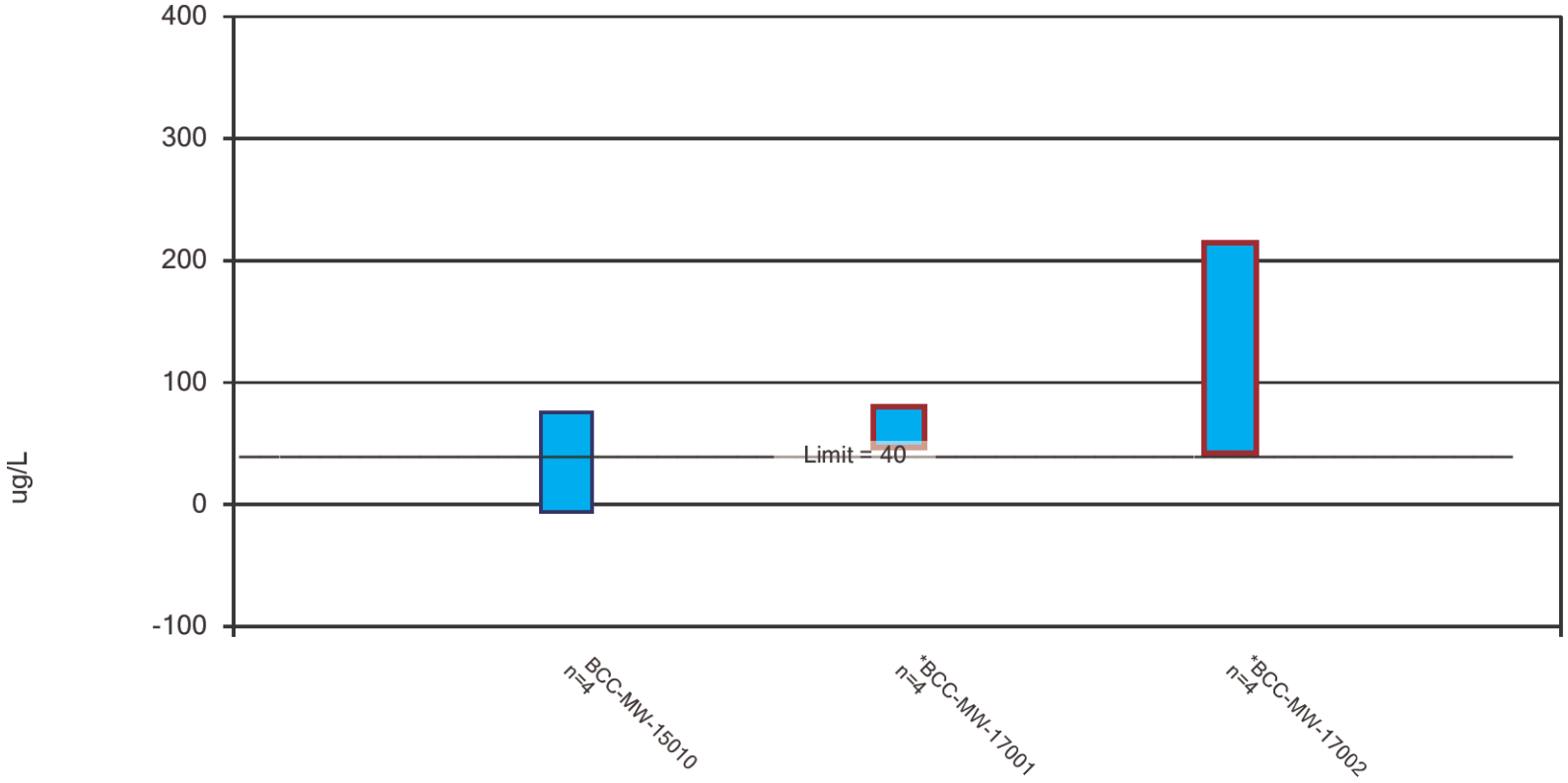
Client: Consumers Energy Data: BCC_Sanitas

	BCC-MW-15009	BCC-MW-17002	BCC-MW-17003
4/5/2017	13		
7/12/2017	11.4 (D)		
12/7/2017		45.5	26
2/20/2018		2	
2/21/2018			<1
4/17/2018	9.4		
6/14/2018	8.5		
6/16/2018		2.6	<1
8/7/2018		3.8	1.05 (D)
Mean	10.58	13.48	7.013
Std. Dev.	2.021	21.36	12.66
Upper Lim.	15.16	45.5	26
Lower Lim.	5.988	2	0.5

[DRAFT - ELECTRONIC REVIEW]

Parametric Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Lithium, Total Analysis Run 11/27/2018 4:57 PM

Client: Consumers Energy Data: BCC_Sanitas

Confidence Interval

Constituent: Lithium, Total (ug/L) Analysis Run 11/27/2018 4:58 PM

Client: Consumers Energy Data: BCC_Sanitas

	BCC-MW-15010	BCC-MW-17001	BCC-MW-17002
4/5/2017	18		
7/12/2017	21		
12/7/2017		55	75
2/20/2018		73	160
4/17/2018	46		
6/14/2018	54		
6/16/2018		65	150
8/7/2018		62	130
Mean	34.75	63.75	128.8
Std. Dev.	17.95	7.455	37.94
Upper Lim.	75.51	80.68	214.9
Lower Lim.	-6.006	46.82	42.61

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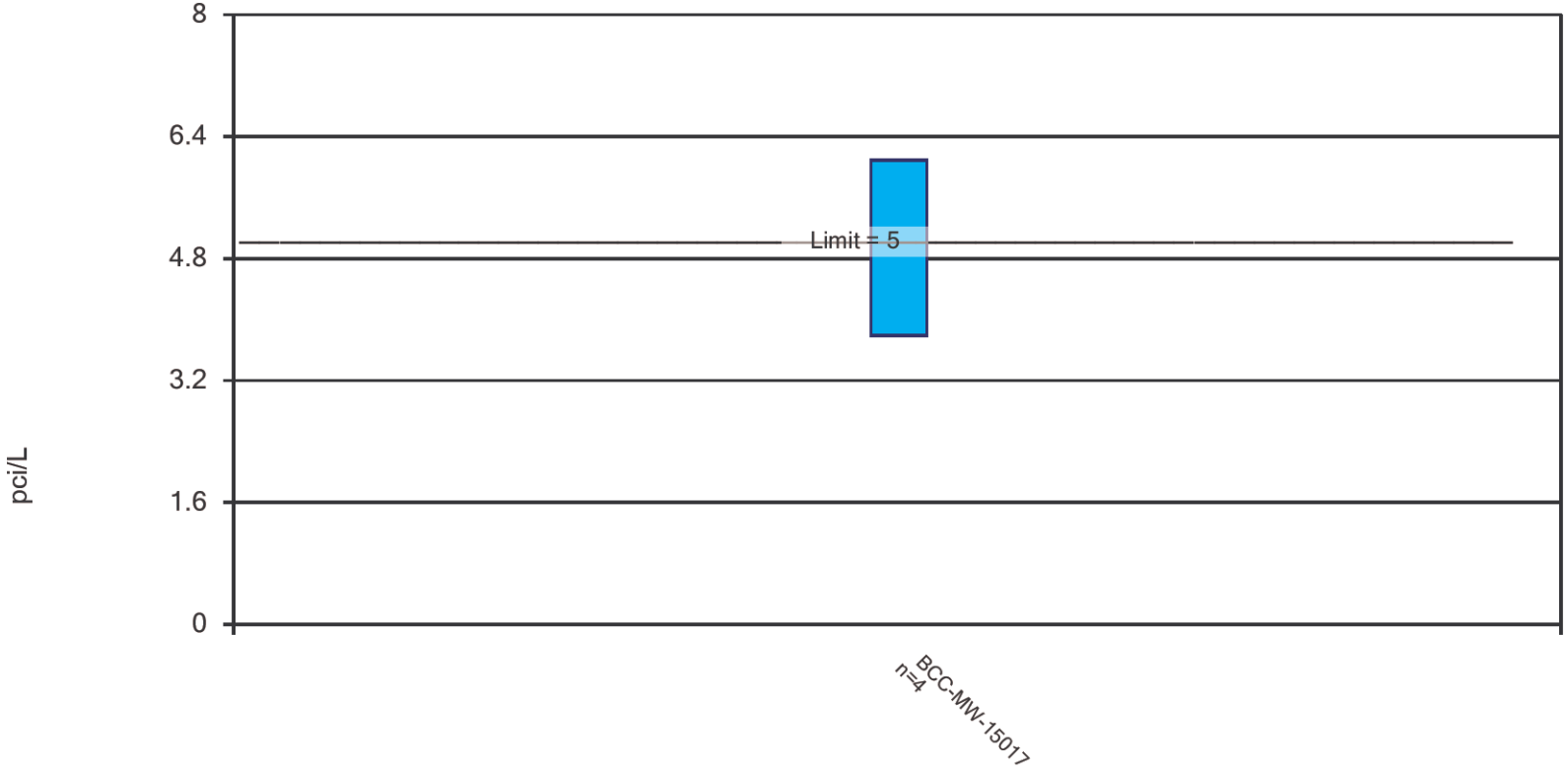
Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Radium-226/228 Analysis Run 11/27/2018 5:00 PM

Client: Consumers Energy Data: BCC_Sanitas

Confidence Interval

Constituent: Radium-226/228 (pci/L) Analysis Run 11/27/2018 5:01 PM

Client: Consumers Energy Data: BCC_Sanitas

	BCC-MW-15017
4/6/2017	4.34
7/12/2017	4.75
4/18/2018	5.16
6/12/2018	5.51 (D)
Mean	4.94
Std. Dev.	0.5064
Upper Lim.	6.09
Lower Lim.	3.79

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Appendix D
April 2019 Assessment Monitoring Statistical Evaluation

[DRAFT - ELECTRONIC REVIEW]

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Technical Memorandum

Date: July 19, 2019

To: Michelle Marion, CEC

From: Darby Litz, TRC
Sarah Holmstrom, TRC
Kristin Lowery, TRC

cc: Brad Runkel, CEC
JR Register, CEC
Bethany Swanberg, CEC

Project No.: 322176.0000 Phase 001, Task 003

Subject: Statistical Evaluation of April 2019 Assessment Monitoring Sampling Event
BC Cobb Bottom Ash Pond & Ponds 0-8 CCR Unit, Consumers Energy Company, Essexville, Michigan

During the statistical evaluation of the initial assessment monitoring event (June 2018), lithium was present in one or more downgradient monitoring wells at statistically significant levels exceeding the Groundwater Protection Standards (GWPSs). Therefore, Consumers Energy Company (CEC) initiated an Assessment of Corrective Measures (ACM) within 90 days from when the Appendix IV exceedance was determined. Currently, CEC is continuing semiannual assessment monitoring in accordance with §257.95 of the CCR Rule[1] at the BC Cobb Power Plant (BCC) Bottom Ash Pond and Ponds 0-8 (collectively the BCC Ponds). The first semiannual assessment monitoring event for 2019 was conducted on April 8 through April 12, 2019. In accordance with §257.95, the assessment monitoring data must be compared to GWPSs to determine whether or not Appendix IV constituents are detected at statistically significant levels above the GWPSs. GWPSs were established in accordance with §257.95(h), as detailed in the October 15, 2018 *Groundwater Protection Standards* technical memorandum, which was also included in the *2018 Annual Groundwater Monitoring Report* (TRC, January 2019). The following narrative describes the methods employed and the results obtained and the Sanitas™ output files are included as an attachment.

[1] USEPA final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) published April 17, 2015, as amended per Phase One, Part One of the CCR Rule (83 FR 36435).

[DRAFT - ELECTRONIC REVIEW]

The statistical evaluation of the third semiannual assessment monitoring event data indicates that the following constituent is present at statistically significant levels exceeding the GWPS in downgradient monitoring wells at the BCC Ponds:

Constituent	GWPS	# Downgradient Wells Observed
Lithium	40 ug/L	2 of 21

These results are consistent with the results of the initial assessment monitoring data statistical evaluation and CEC will continue to initiate an assessment of corrective measures per §257.95(g). CEC will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Assessment Monitoring Statistical Evaluation

The compliance monitoring wells BCC-MW-15009 through BCC-MW-15014 encircle the BAP, while BCC-MW-15015 through BCC-MW-15023 and BCC-MW-17001 through BCC-MW-17006 are located at the outer edge of the peninsula formed by the bottom ash pond system. Because the perimeter and interior berms within the ash management area were constructed in part with ash and bodies of water surround the ash management area, wells could not be installed entirely beyond the CCR material boundary.

Following the first semiannual assessment monitoring event for 2019, compliance well data for the BCC Ponds were evaluated in accordance with the *Groundwater Statistical Evaluation Plan* (Stats Plan) (TRC, October 2017). An assessment monitoring program was developed to evaluate concentrations of CCR constituents present in the uppermost aquifer relative to acceptable levels (i.e. GWPSs). In order to decide as to whether or not the GWPSs have been exceeded, the change in concentration observed at the downgradient wells during a given assessment monitoring event must be large enough, after accounting for variability in the sample data, that the result is unlikely to have occurred merely by chance. Consistent with the Unified Guidance[2], the preferred method for comparisons to a fixed standard are confidence limits. Based on the number of historical observations in the representative sample population, the population mean, the population standard deviation, and a selected confidence level (i.e. 99 percent), an upper and lower confidence limit is calculated. The true concentration, with 99 percent confidence, will fall between and lower and upper confidence limits.

The concentrations observed in the downgradient wells are deemed to be a statistically significant exceedance when the 99 percent lower confidence limit of the downgradient data exceeds the GWPS. If the confidence interval straddles the GWPS (i.e. the lower confidence level is below the GWPS but the upper confidence level is above), the statistical test results are inconclusive and there is not compelling evidence that the measured concentration is a result of a release from the CCR unit versus the inherent variability of the sample data. This statistical approach is consistent with the statistical

[2] USEPA. 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance*. Office of Conservation and Recovery. EPA 530/R-09-007.

[DRAFT - ELECTRONIC REVIEW]

methods for assessment monitoring presented in §257.93(f) and (g). Statistical evaluation methodologies built into the CCR Rule, and numerous other federal rules, are key in determining whether or not individually measured data points represent a concentration increase over the baseline or a fixed standard (such as a GWPS in an assessment monitoring program).

For each detected Appendix IV constituent, the concentrations for each well were first compared directly to the GWPS, as shown on Table A1. Due to the significant operational changes that occurred within the ash management area and immediately adjacent to it during the CCR Rule baseline period, where groundwater flow rates and directions were changed drastically over relatively short periods of time, the data set used for statistical evaluation was limited to the five most recent events relative to the timeline of other factors that could be affecting observations of constituents in groundwater that are unrelated to releases from the ponds. Limiting the data set to the five most recent data points is appropriate for the BCC Ponds to allow for evaluation of groundwater quality that is representative of current conditions that excludes variability in the sample data set caused by the observed changes in site conditions that would not be indicative of a release from the BCC Ponds. Those observed changes are attributed to several possibilities including cessation of hydraulic loading in the BCC Ponds in April 2016, changes in the analytical laboratory being used, and pumping from Veteran's Memorial Pond (pumping influence observed from July 2017 through September 2017; construction completed in December 2017). These activities have the potential to influence the results of the statistical analysis by including data that may have different reporting limits or may have been biased low or high due to changing site conditions, introducing additional variability and uncertainty in the results that is inconsistent with the natural groundwater data distribution. Use of the five most recent data points relative to the timeline of other site factors is adequate in providing the minimum density of data for the statistical analysis as recommended per the Unified Guidance; therefore, no less than four data points are used to minimize bias from external influences.

For the BCC-MW-15000-series monitoring wells, the confidence interval tests included data collected between July 2017 and April 2019. For the BCC-MW-17000-series wells, the confidence interval tests included data collected between February 2018 and April 2019 (five out of the six data points accumulated since wells were installed in December 2017). Parameter-well combinations that included a direct exceedance of the GWPS during these timeframes were retained for further analysis. Arsenic in BCC-MW-15009, lithium in BCC-MW-15010, BCC-MW-17001, and BCC-MW-17002, molybdenum in BCC-MW-15014, and radium 226/228 in BCC-MW-15017 had individual results exceeding the GWPS.

Groundwater data were then evaluated utilizing Sanitas™ statistical software. Sanitas™ is a software tool that is commercially available for performing statistical evaluation consistent with procedures outlined in the Unified Guidance. Within the Sanitas™ statistical program, confidence limits were selected to perform the statistical comparison of compliance data to a fixed standard. Parametric and non-parametric confidence intervals were calculated, as appropriate, for each of the CCR Appendix IV parameters using a 99 percent confidence level, i.e., a significance level (α) of 0.01. The following

[DRAFT - ELECTRONIC REVIEW]

narrative describes the methods employed, the results obtained and the Sanitas™ output files are included as an attachment.

The statistical data evaluation included the following steps:

- Review of data quality checklists for the data sets;
- Graphical representation of the monitoring data as time versus concentration by well-constituent pair;
- Outlier testing of individual data points that appear from the graphical representations as potential outliers;
- Evaluation of visual trends apparent in the graphical representations for statistical significance;
- Evaluation of percentage of non-detects for each well-constituent pair;
- Distribution of the data; and
- Calculation of the confidence intervals for each cumulative dataset.

The results of these evaluations are presented and discussed below.

Data from each round were evaluated for completeness, overall quality, and usability and were deemed appropriate for the purposes of the CCR assessment monitoring program. Initially, the recent baseline for the BCC-MW-15000-series monitoring wells (from July 2017 to April 2019) and for the BCC-MW-17000-series wells (February 2018 to April 2019) were observed visually for potential trends. No outliers or significant trends were identified.

The Sanitas™ software was then used to test compliance at the downgradient monitoring wells using the confidence interval method for the most recent five sampling events. The software outputs are included in Attachment 1 along with data reports showing the values used for the evaluation. The percentage of non-detect observations are also included in Attachment 1. Non-detect data was handled in accordance with the Stats Plan for the purposes of calculating the confidence intervals. The tests were run with a per-well significance of $\alpha = 0.01$. The Sanitas™ software generates an output that includes graphs of the parametric or non-parametric confidence intervals for each well along with notes on data transformations, as appropriate. The data sets with direct exceedances of the GWPS were found to be normally distributed. The confidence interval test compares the lower confidence limit to the GWPS.

The statistical evaluation of the Appendix IV parameters shows exceedances for lithium at BCC-MW-17001 and BCC-MW-17002. The lower confidence limits for the other Appendix IV constituents statistically evaluated at BCC-MW-15009, BCC-MW-15010, BCC-MW-15014, and BCC-MW-15017 were below their respective GWPSs. These results are consistent with the results of the initial assessment monitoring data statistical evaluation and CEC will continue the assessment of corrective measures per §257.95(g). CEC will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

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Attachments

Table A1	Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
Attachment 1	Sanitas™ Output Files

[DRAFT - ELECTRONIC REVIEW]

Table

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15009													
					Sample Date:	12/1/2015	2/17/2016	4/18/2016	7/12/2016	9/28/2016	2/14/2017	4/5/2017	7/11/2017	7/11/2017	9/13/2017	4/16/2018	6/13/2018	11/28/2018	4/9/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient													
Appendix III														Field Dup					
Boron	ug/L	NC	NA	1,320	NA	2,380	2,520	2,170	2,070	2,190	2,110	2,190	2,210	1,690	2,120	--	1,670	1,690	1,600
Calcium	mg/L	NC	NA	259	NA	42.7	44.1	40.1	44.1	46.7	37.7	38.2	37.6	36.5	34.9	--	42.4	27.9	33
Chloride	mg/L	250*	NA	5,980	NA	24	24.0	27.1	26.9	24.3	22.8	24.9	26.3	26.3	26	--	95.7	51.1	32
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	63	39.3	49.5	55.2	49.1	31.6	39.8	43.0	47.2	41.7	--	< 2.0	19.2	49
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	240	230	220	220	230	200	190	216	246	188	--	456	454	300
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	10.6	10.8	10.3	10.0	10.0	10.2	10.1	9.6	--	10.2	9.8	9.8	9.8	9.4
Appendix IV																			
Antimony	ug/L	6	NA	1	6	1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	**45**	**31**	**24**	**24**	**20**	**14**	**13**	**12.0**	**10.8**	--	9.4	8.5	4.1	3.9
Barium	ug/L	2,000	NA	340	2,000	16	12	11	11	11	9	10	13.2	10.8	--	16.5	13.8	10.2	16
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	< 1	1	2	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	15.6	14.6	15	14	14	13	14	19	19	--	24	21	20	21
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	57	60	50	49	49	40	38	43.7	41.8	--	16.0	11.6	5.2	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.166	< 0.157	< 0.209	< 0.158	< 0.269	< 0.159	< 0.347	< 0.756	< 0.887	--	< 0.934	< 0.580	< 0.567	< 0.153
Radium-228	pCi/L	NC	NA	NA	NA	< 0.451	< 0.475	< 0.467	< 0.461	< 0.628	0.678	< 0.502	< 1.96	< 2.96	--	< 0.957	< 3.27	< 0.903	< 0.583
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.451	< 0.475	< 0.467	< 0.461	< 0.628	0.747	< 0.502	< 2.72	< 3.85	--	< 1.89	< 3.85	< 1.47	< 0.583
Selenium	ug/L	50	NA	3	50	< 1	< 1	2	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

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Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15010													
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/13/2016	9/28/2016	2/14/2017	4/5/2017	7/11/2017	9/13/2017	9/13/2017	4/16/2018	6/14/2018	11/28/2018	4/9/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient													
Appendix III															Field Dup				
Boron	ug/L	NC	NA	1,320	NA	1,970	1,510	1,340	1,270	1,570	1,440	1,760	1,340	1,770	1,770	–	2,100	1,850	1,700
Calcium	mg/L	NC	NA	259	NA	71.2	51.9	37.4	58.2	66.4	49.8	80.5	40.7	129	133	–	133	115	110
Chloride	mg/L	250*	NA	5,980	NA	23	22.5	21.5	22.7	25.1	22.3	24.2	25.5	24.5	24.4	–	29.3	39.6	22
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	120	52.6	31.0	50.7	69.7	24.2	53.5	24.8	143	143	–	73.7	48.3	49
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	410	270	220	260	320	250	360	288	570	618	–	636	590	490
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.7	7.8	7.8	7.8	8.0	8.0	7.8	7.8	7.8	–	7.8	7.4	7.5	7.6
Appendix IV																			
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	–	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	–	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	49	34	28	42	45	31	51	29.2	--	--	63.4	64.8	68.1	78
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	–	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	–	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	< 1	2	< 1	< 1	1	< 1	< 1.0	--	–	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	–	< 15.0	< 15.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	36.1	22.7	18	15	22	14	18	21	--	--	**46**	**54**	**51**	**41**
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	--	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	33	29	27	15	20	9	7	16.2	--	--	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.302	< 0.217	< 0.244	< 0.145	< 0.297	< 0.179	< 0.216	< 0.642	--	--	< 0.869	0.661	< 0.820	< 0.185
Radium-228	pCi/L	NC	NA	NA	NA	0.849	< 0.502	< 0.447	0.420	0.728	< 0.363	< 0.380	< 0.956	--	--	< 0.877	< 0.978	< 0.805	< 0.516
Radium-226/228	pCi/L	5	NA	2.42	**5**	0.973	< 0.502	< 0.447	0.451	0.82	< 0.363	< 0.38	< 1.60	--	--	< 1.75	< 1.45	< 1.63	< 0.516
Selenium	ug/L	50	NA	3	50	< 1	< 1	1	1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	--	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
– - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location	BCC-MW-15011												
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/12/2016	9/28/2016	2/14/2017	4/5/2017	7/11/2017	9/13/2017	4/16/2018	6/13/2018	11/28/2018	4/10/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient												
Appendix III																		
Boron	ug/L	NC	NA	1,320	NA	1,680	1,420	1,340	1,210	1,180	1,280	1,340	1,060	1,490	--	1,630	1,650	1,600
Calcium	mg/L	NC	NA	259	NA	53	47.6	36.9	47.3	48.0	47.9	52.0	42.2	23.9	--	22.6	29.5	41
Chloride	mg/L	250*	NA	5,980	NA	22	20.7	22.1	24.8	21.0	19.5	22.2	22.9	24.0	--	23.2	26.3	38
Fluoride	ug/L	4,000	NA	1,000	NA	1,200	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	50	30.8	35.8	43.8	38.5	37.2	42.8	29.1	6.4	--	12.3	21.9	38
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	270	230	210	240	230	230	240	224	140	--	244	182	260
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	8.7	8.5	8.2	8.5	8.7	9.2	9.0	8.2	8.5	9.1	8.5	8.9	8.8
Appendix IV																		
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	5	3	3	4	6	7	8	< 1.0	–	6.4	1.5	7.3	9.3
Barium	ug/L	2,000	NA	340	2,000	36	29	25	30	31	31	32	30.7	–	15.2	16.6	18.5	31
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	–	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	1	< 1	2	1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	–	< 15.0	< 15.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	1,200	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	17.2	16	14	15	16	17	17	20	–	21	11	18	18
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	–	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	20	29	35	26	27	25	22	21.4	–	8.9	5.8	13.9	15
Radium-226	pCi/L	NC	NA	NA	NA	< 0.199	< 0.141	< 0.319	< 0.166	< 0.284	< 0.160	< 0.296	< 1.12	–	< 0.742	0.350	< 0.771	0.226
Radium-228	pCi/L	NC	NA	NA	NA	0.956	< 0.447	< 0.435	< 0.402	< 0.496	< 0.394	< 0.599	< 0.954	–	< 0.872	< 0.923	< 0.747	< 0.532
Radium-226/228	pCi/L	5	NA	2.42	**5**	1.01	< 0.447	< 0.435	< 0.402	< 0.496	< 0.394	< 0.599	< 2.07	–	< 1.61	< 1.25	< 1.52	< 0.532
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	–	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15012													
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	9/13/2017	4/17/2018	6/13/2018	11/28/2018	4/10/2019	4/10/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient													
Appendix III																			Field Dup
Boron	ug/L	NC	NA	1,320	NA	961	1,390	1,830	1,450	1,470	1,380	1,500	1,340	1,140	–	1,450	1,280	1,300	1,300
Calcium	mg/L	NC	NA	259	NA	49.5	82.1	65.5	44.5	43.5	32.0	34.9	24.6	48.7	–	95.1	55.7	61	60
Chloride	mg/L	250*	NA	5,980	NA	20	20.4	23.7	23.0	22.6	19.7	22.7	24.1	23.3	–	22.7	21.5	20	20
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,200	1,100	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	69	111	106	65.6	50.9	55.7	57.2	21.8	59.6	–	355	137	190	180
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	300	370	340	250	210	190	200	168	318	–	902	302	380	380
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	8.0	8.1	8.1	8.9	9.2	8.6	8.5	9.9	11.4	9.7	10.2	9.8	9.4	–
Appendix IV																			
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	< 1	2	8	**12**	9	2	3	6.1	--	1.8	3.4	1.3	1.4	1.4
Barium	ug/L	2,000	NA	340	2,000	40	63	68	34	22	25	28	14.3	--	109	105	51.7	79	79
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	< 1	1	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,200	1,100	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	15.6	20.8	19	18	15	11	12	12	--	13	11	10	12	12
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	29	9	35	37	44	35	27	94.5	--	50.8	71.3	28.3	26	26
Radium-226	pCi/L	NC	NA	NA	NA	< 0.164	< 0.243	< 0.256	< 0.216	< 0.335	< 0.153	< 0.243	0.436	--	< 0.693	< 0.526	0.700	< 0.142	0.219
Radium-228	pCi/L	NC	NA	NA	NA	< 0.471	< 0.634	0.827	< 0.539	< 0.548	< 0.416	< 0.554	< 2.08	--	< 0.733	< 0.789	< 0.992	< 0.485	< 0.481
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.471	< 0.634	0.919	< 0.539	< 0.548	< 0.416	< 0.554	< 2.28	--	< 1.43	< 1.32	1.27	< 0.485	0.514
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1.2	--	1.2	3.3	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
– - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15013														
					Sample Date:	12/1/2015	2/18/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	9/13/2017	4/17/2018	4/17/2018	6/13/2018	6/13/2018	11/29/2018	4/11/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient														
Appendix III																Field Dup		Field Dup		
Boron	ug/L	NC	NA	1,320	NA	1,140	1,290	1,180	1,080	1,090	1,050	1,120	916	1,270	–	--	1,130	1,100	1,070	1,200
Calcium	mg/L	NC	NA	259	NA	65.2	58.3	47.5	48.4	59.7	52.5	50.9	43.9	34.4	–	--	47.3	48.9	50.8	50
Chloride	mg/L	250*	NA	5,980	NA	21	20.9	21.5	21.0	22.9	19.8	19.9	23.4	21.2	–	--	21.5	21.6	21.3	21
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	89	44.3	34.3	27.5	31.3	23.1	15.1	8.7	59.9	–	--	8.7	7.9	5.9	4.8
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	330	290	260	250	250	260	250	240	192	–	--	324	268	210	260
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.6	7.2	7.4	7.3	7.4	7.7	7.4	7.4	7.9	7.6	--	7.7	–	7.0	7.3
Appendix IV																				
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	71	58	49	47	51	52	48	41.9	–	43.3	44.7	43.9	41.1	39.5	45
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	–	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	< 1	2	1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	–	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	17.5	19.9	18	17	18	18	17	23	--	27	28	24	24	23	17
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	–	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	17	20	21	12	11	10	9	7.7	--	< 5.0	< 5.0	< 5.0	< 5.0	5.0	5.7
Radium-226	pCi/L	NC	NA	NA	NA	0.272	< 0.299	0.173	< 0.181	< 0.215	< 0.230	< 0.215	0.731	--	< 0.505	< 0.506	< 0.546	< 0.585	< 0.696	< 0.232
Radium-228	pCi/L	NC	NA	NA	NA	0.914	< 0.527	0.727	0.483	< 0.598	< 0.481	< 0.516	< 0.940	--	< 0.633	< 0.780	< 0.754	< 0.903	< 0.728	< 0.450
Radium-226/228	pCi/L	5	NA	2.42	**5**	1.19	< 0.527	0.9	0.596	< 0.598	< 0.481	< 0.516	< 1.56	--	< 1.14	< 1.29	< 1.30	< 1.49	< 1.42	< 0.450
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	–	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15014													
					Sample Date:	12/1/2015	2/18/2016	4/18/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	9/13/2017	4/17/2018	6/13/2018	11/29/2018	4/11/2019	4/11/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient													
Appendix III																			Field Dup
Boron	ug/L	NC	NA	1,320	NA	2,560	2,230	1,840	1,630	1,690	1,530	1,560	1,300	1,410	--	1,370	1,400	1,500	1,600
Calcium	mg/L	NC	NA	259	NA	75.6	75.3	63.9	73.5	64.7	66.3	65.3	61.8	57.8	--	50.8	51.1	49	53
Chloride	mg/L	250*	NA	5,980	NA	21	21.9	21.9	22.0	22.7	18.6	22.1	22.4	22.5	--	21.3	20.5	20	22
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	43	34.7	31.4	35.6	23.7	27.8	23.9	24.9	19.2	--	2.4	12.4	12	14
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	350	310	270	290	250	280	270	292	282	--	338	224	260	290
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	11.5	11.6	11.2	11.0	11.1	11.5	11.3	11.5	12.0	11.6	11.4	11.5	11.3	--
Appendix IV																			
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1.7	--	1.1	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	**15**	**11**	**11**	8	9	7	7	8.4	--	6.2	5.5	4.0	3.8	4.0
Barium	ug/L	2,000	NA	340	2,000	329	376	257	508	357	571	546	732	--	779	607	604	620	630
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	2	1	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	1.4
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	19	--	27	16	21	12	11
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	**119**	76	58	69	81	80	77	70.9	--	94.7	100	**106**	**120**	**110**
Radium-226	pCi/L	NC	NA	NA	NA	< 0.176	< 0.175	< 0.177	0.214	< 0.218	< 0.211	< 0.289	< 0.511	--	< 1.11	< 1.17	< 1.52	< 0.192	< 0.182
Radium-228	pCi/L	NC	NA	NA	NA	1.23	< 0.735	< 0.562	< 0.606	< 0.485	0.810	< 0.423	< 1.07	--	< 0.972	< 1.85	< 1.73	< 0.538	< 0.379
Radium-226/228	pCi/L	5	NA	2.42	**5**	1.31	< 0.735	< 0.562	< 0.606	< 0.485	0.883	< 0.423	< 1.58	--	< 2.08	< 3.02	< 3.25	< 0.538	< 0.379
Selenium	ug/L	50	NA	3	50	< 1	1	< 1	< 1	< 1	1	8	2.3	--	1.2	1.2	2.6	5.2	2.6
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15015														
					Sample Date:	12/1/2015	2/18/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	7/12/2017	9/13/2017	9/13/2017	4/17/2018	6/13/2018	11/29/2018	4/11/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient														
Appendix III														Field Dup		Field Dup				
Boron	ug/L	NC	NA	1,320	NA	1,190	1,170	963	614	656	662	599	489	678	433	374	--	398	505	630
Calcium	mg/L	NC	NA	259	NA	32.8	33.0	30.6	36.2	40.1	38.4	37.6	29.4	32.3	36.9	38.8	--	45.0	50.8	68
Chloride	mg/L	250*	NA	5,980	NA	21	22.0	21.6	20.4	19.5	19.2	22.7	20.1	20.0	20.3	20.3	--	19.5	17.8	20
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	7.8	6.56	8.34	13.9	9.26	10.4	13.8	18.8	17.9	16.1	15.6	--	12.6	13.2	88
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	220	200	190	180	180	200	190	166	190	192	274	--	316	238	360
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.6	7.4	7.4	7.4	7.8	7.7	7.6	8.4	–	8.7	--	8.3	7.9	7.8	7.6
Appendix IV																				
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	–	--	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	2	2	2	6	5	5	6	6.4	7.6	–	--	4.7	5.5	4.3	4.3
Barium	ug/L	2,000	NA	340	2,000	23	22	21	25	28	30	28	30.1	33.6	–	--	39.9	37.9	41.0	63
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	–	--	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	–	--	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	< 1	1	1	< 1	< 1	< 1	< 1.0	< 1.0	–	--	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	–	--	< 15.0	< 15.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	–	–	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	12	11	–	–	16	13	14	11
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	–	–	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	17	14	17	11	10	9	11	11.9	13.0	–	–	9.4	7.0	7.2	11
Radium-226	pCi/L	NC	NA	NA	NA	< 0.193	< 0.157	< 0.242	< 0.133	< 0.378	< 0.166	< 0.340	< 0.832	< 0.698	–	–	< 0.467	< 0.475	< 0.677	< 0.224
Radium-228	pCi/L	NC	NA	NA	NA	< 0.578	< 0.577	< 0.521	< 0.467	0.850	< 0.408	< 0.420	< 0.799	< 0.748	–	–	< 0.730	< 0.763	< 1.07	< 0.518
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.578	< 0.577	< 0.521	< 0.467	0.85	< 0.408	< 0.42	< 1.63	< 1.45	–	–	< 1.20	< 1.24	< 1.75	< 0.518
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1.0	< 1.0	–	–	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	–	–	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location	BCC-MW-15016												
					Sample Date:	12/1/2015	2/18/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	9/13/2017	4/17/2018	6/12/2018	11/29/2018	4/11/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient												
Appendix III																		
Boron	ug/L	NC	NA	1,320	NA	108	119	86	100	88	92	83	85.9	83	--	76.6	80.8	110
Calcium	mg/L	NC	NA	259	NA	172	184	164	172	181	176	172	170	182	--	168	169	170
Chloride	mg/L	250*	NA	5,980	NA	200	204	203	165	204	196	200	10.4	226	--	197	201	190
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	980	1,000	980	920	930	990	1,000	1,050	995	--	986	968	1,000
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	6.6	6.5	6.4	6.3	6.4	6.4	6.6	6.4	6.6	6.8	6.5	6.6	6.4
Appendix IV																		
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	2	2	3	3	2	2	2	1.5	–	1.5	1.3	1.3	1.6
Barium	ug/L	2,000	NA	340	2,000	656	647	614	619	621	666	613	596	–	649	652	548	700
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	–	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	2	3	3	4	3	3	3	1.9	–	2.1	2.0	2.3	2.3
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	–	< 15.0	< 15.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	–	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	–	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	–	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.263	1.51	1.31	1.50	1.06	1.17	1.60	1.30	–	1.56	< 0.810	1.75	1.18
Radium-228	pCi/L	NC	NA	NA	NA	2.29	2.32	1.69	1.68	1.68	2.37	2.06	1.06	–	2.08	1.81	2.20	1.76
Radium-226/228	pCi/L	5	NA	2.42	**5**	2.29	3.83	3	3.18	2.74	3.54	3.66	2.36	–	3.64	2.50	3.95	2.94
Selenium	ug/L	50	NA	3	50	2	4	2	7	1	2	2	3.6	–	1.5	1.4	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	–	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15017													
					Sample Date:	12/1/2015	2/18/2016	4/18/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	9/13/2017	4/17/2018	6/12/2018	6/12/2018	11/29/2018	4/11/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient													
Appendix III																	Field Dup		
Boron	ug/L	NC	NA	1,320	NA	59	90	66	76	78	76	75	75	82.8	--	83.8	79.0	73.2	100
Calcium	mg/L	NC	NA	259	NA	225	247	220	232	252	232	232	203	245	--	243	232	242	220
Chloride	mg/L	250*	NA	5,980	NA	200	201	184	204	182	192	187	199	224	--	224	224	193	210
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	850	1,100	1,200	1,100	1,100	1,200	1,100	1,230	1,130	--	1,120	1,170	1,110	1,200
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	6.5	6.4	6.4	6.4	6.4	6.6	6.5	6.4	6.5	6.8	6.5	--	6.7	6.4
Appendix IV																			
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	**13**	7	5	**12**	**12**	5	4	3	--	2.3	2.1	2.1	1.8	1.9
Barium	ug/L	2,000	NA	340	2,000	1,030	981	924	985	955	968	876	772	--	955	936	953	824	960
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	4	4	4	9	11	5	5	5.3	--	3.4	3.4	3.3	3.1	2.9
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	1.61	2.38	2.18	1.91	1.94	1.82	1.56	1.97	--	2.23	2.13	2.87	1.93	1.52
Radium-228	pCi/L	NC	NA	NA	NA	2.69	2.97	3.50	3.98	2.50	3.15	2.78	2.78	--	2.93	3.30	2.72	3.19	3.93
Radium-226/228	pCi/L	5	NA	2.42	**5**	4.3	**5.35**	**5.68**	**5.89**	4.44	4.97	4.34	4.75	--	**5.16**	**5.43**	**5.59**	**5.12**	**5.46**
Selenium	ug/L	50	NA	3	50	3	4	3	8	2	2	3	2.7	--	1.7	2.4	2.5	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15018															
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	9/29/2016	2/14/2017	4/5/2017	7/11/2017	7/11/2017	9/13/2017	9/13/2017	4/18/2018	4/18/2018	6/12/2018	11/29/2018	4/11/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient															
Appendix III														Field Dup		Field Dup		Field Dup			
Boron	ug/L	NC	NA	1,320	NA	487	526	478	399	438	479	493	538	446	492	502	--	--	559	488	640
Calcium	mg/L	NC	NA	259	NA	88.6	100	87.9	86.8	98.5	100	92.1	84.8	81.1	90.7	89.1	--	--	87.6	101	96
Chloride	mg/L	250*	NA	5,980	NA	38.0	38.0	40.8	39.3	37.5	43.6	44.4	53.4	52.6	49.1	50.2	--	--	48.9	49.1	59
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	< 2.0	< 2.0	--	--	< 2.0	< 2.0	< 2.0
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	290	400	430	390	410	450	410	420	438	392	380	--	--	598	426	480
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.0	6.9	6.8	6.5	6.5	6.7	6.8	6.8	--	6.8	--	6.9	--	6.8	6.9	6.8
Appendix IV																					
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	1	< 1	< 1	2	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	155	149	139	133	143	171	149	153	143	--	--	139	141	156	127	150
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	1	1	1	1	< 1	1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	--	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	21.4	23.1	24	12	14	21	21	26	26	--	--	29	27	26	22	24
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	0.227	0.394	0.430	0.234	0.522	0.363	< 0.314	< 0.479	< 1.02	--	--	< 0.843	0.290	< 0.756	< 0.842	0.316
Radium-228	pCi/L	NC	NA	NA	NA	< 0.586	0.778	0.649	0.845	0.803	0.996	1.08	< 0.767	< 0.950	--	--	0.869	0.622	1.39	< 0.997	0.598
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.586	1.17	1.08	1.08	1.33	1.36	1.37	< 1.25	< 1.97	--	--	1.59	0.912	1.77	< 1.84	0.915
Selenium	ug/L	50	NA	3	50	< 1	< 1	1	4	< 1	< 1	< 1	< 1.0	1	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15019													
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/13/2016	9/30/2016	2/15/2017	4/5/2017	7/11/2017	9/13/2017	4/18/2018	6/12/2018	11/30/2018	4/12/2019	4/12/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient													
Appendix III																			Field Dup
Boron	ug/L	NC	NA	1,320	NA	1,530	1,590	1,440	1,320	1,260	1,370	1,410	1,430	1,010	–	1,170	1,540	1,600	1,500
Calcium	mg/L	NC	NA	259	NA	84.6	93.6	83.0	90.0	92.6	91.8	92.8	90.1	107	–	97.7	98.2	97	94
Chloride	mg/L	250*	NA	5,980	NA	34	32.4	33.7	37.7	35.6	34.5	33.6	52.5	73.9	–	67.7	42.6	39	39
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	–	< 2.0	< 2.0	< 2.0	< 2.0
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	340	390	440	410	370	410	420	470	618	–	524	556	430	440
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.0	6.8	6.9	6.7	6.4	6.8	6.9	6.8	6.7	7.0	6.7	6.9	6.7	--
Appendix IV																			
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	91	94	88	88	96	93	90	109	--	161	187	114	110	120
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	< 1	1	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	23.7	27.9	26	24	22	23	22	27	--	25	23	26	22	22
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	0.333	0.279	0.465	0.282	0.315	0.329	< 0.36	< 0.620	--	< 0.717	< 0.594	< 0.880	0.246	< 0.197
Radium-228	pCi/L	NC	NA	NA	NA	< 0.484	< 0.567	0.532	< 0.718	< 0.739	1.80	0.872	< 1.02	--	< 0.742	1.36	1.16	0.548	< 0.513
Radium-226/228	pCi/L	5	NA	2.42	**5**	0.674	0.798	0.997	0.969	< 0.739	2.13	0.974	< 1.64	--	< 1.46	1.75	< 1.77	0.794	0.669
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	2	< 1	< 1	< 1	1.2	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
– - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15020														
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	9/30/2016	2/15/2017	4/5/2017	7/11/2017	9/13/2017	4/18/2018	6/12/2018	6/12/2018	11/30/2018	11/30/2018	4/12/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient														
Appendix III																	Field Dup		Field Dup	
Boron	ug/L	NC	NA	1,320	NA	630	738	638	603	608	621	667	618	745	–	708	699	721	930	700
Calcium	mg/L	NC	NA	259	NA	61	67.6	59.1	60.7	66.5	67.0	66.6	68.1	107	–	96.3	91.6	81.5	81.7	76
Chloride	mg/L	250*	NA	5,980	NA	39	35.4	34.3	69.6	33.5	33.3	33.9	45.7	87.8	–	92.1	92.0	49.6	49.6	45
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	2.2	2.34	< 2	< 2	< 2	< 2	< 2	< 2.0	3	–	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	320	310	320	310	310	330	320	388	608	–	622	508	428	382	400
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.3	7.2	7.0	6.9	6.9	7.0	7.1	7.0	6.8	7.0	6.7	--	6.9	–	6.8
Appendix IV																				
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	48	52	51	47	54	53	52	60.4	–	148	197	196	119	115	120
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	–	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	2	< 1	1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	–	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	15.1	17.8	16	14	14	14	14	18	–	16	16	16	20	20	15
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	–	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	–	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.269	< 0.240	< 0.341	< 0.190	< 0.276	< 0.294	< 0.290	< 0.761	--	0.744	< 0.899	< 0.774	1.14	< 1.06	0.226
Radium-228	pCi/L	NC	NA	NA	NA	< 0.467	0.731	0.474	< 0.598	0.682	< 0.591	0.543	< 0.627	--	0.813	1.75	1.47	0.925	1.30	< 0.558
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.467	0.847	0.73	< 0.598	0.724	< 0.591	0.652	< 1.39	--	1.56	2.64	2.00	2.07	1.79	< 0.558
Selenium	ug/L	50	NA	3	50	< 1	1	< 1	2	< 1	< 1	< 1	1.4	–	< 1.0	< 1.0	1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	–	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location	BCC-MW-15021												
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/13/2016	10/5/2016	2/15/2017	4/6/2017	7/12/2017	9/13/2017	4/18/2018	6/12/2018	11/30/2018	4/12/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient												
Appendix III																		
Boron	ug/L	NC	NA	1,320	NA	362	489	400	425	491	465	519	519	602	--	809	798	940
Calcium	mg/L	NC	NA	259	NA	86.4	98.5	89.6	97.4	96.9	97.9	96.3	86.8	91.3	--	89.4	96.6	93
Chloride	mg/L	250*	NA	5,980	NA	88	82.7	87.2	98.3	98.9	94.6	93.9	97.0	108	--	112	120	110
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	610	540	570	590	620	570	560	548	490	--	576	534	590
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	6.8	6.8	6.8	6.7	6.8	6.9	6.9	6.8	6.8	7.1	6.8	6.7	6.7
Appendix IV																		
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	3	1	1	2	2	2	2	1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	274	244	236	233	252	240	228	211	--	236	238	224	250
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	2	2	2	1	2	2	< 1.0	--	< 1.0	1.1	< 1.0	1.2
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 8.0
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	0.569	0.629	0.563	0.429	0.483	0.524	< 0.215	< 0.768	--	< 0.461	< 0.689	1.49	0.531
Radium-228	pCi/L	NC	NA	NA	NA	0.984	0.782	0.846	0.871	1.52	< 0.582	< 0.354	< 0.697	--	< 1.50	1.60	1.12	0.783
Radium-226/228	pCi/L	5	NA	2.42	**5**	1.55	1.41	1.41	1.3	2	0.966	< 0.354	< 1.47	--	< 1.96	1.97	2.61	1.31
Selenium	ug/L	50	NA	3	50	1	2	1	4	< 1	< 1	1	1.6	--	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location	BCC-MW-15022												
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	10/5/2016	2/15/2017	4/6/2017	7/12/2017	9/13/2017	4/18/2018	6/11/2018	11/27/2018	4/12/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient												
Appendix III																		
Boron	ug/L	NC	NA	1,320	NA	250	388	387	362	391	394	434	478	833	--	1,170	3,840	6,800
Calcium	mg/L	NC	NA	259	NA	46.7	46.4	47.8	43.0	43.7	54.1	49.3	51.8	35.2	--	38.2	265	310
Chloride	mg/L	250*	NA	5,980	NA	25	18.7	17.6	16.8	17.1	18.2	18.6	22.1	23.3	--	21.5	23.1	19
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	39	38.3	29.9	34.3	32.8	34.1	32.8	45.9	44.1	--	24.1	953	1,100
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	270	210	250	250	210	250	230	254	266	--	210	1,670	1,900
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	8.3	8.5	8.2	8.2	8.1	7.8	8.1	8.4	7.6	7.8	8.3	7.8	7.7
Appendix IV																		
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	1.9	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	6	7	8	8	6	4	4	5.8	--	< 1.0	1.1	< 1.0	1.4
Barium	ug/L	2,000	NA	340	2,000	139	119	155	116	119	137	129	138	--	102	104	242	190
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	1	2	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	13	11	25	23
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	22	16	11	17	19	12	14	13.6	--	< 5.0	< 5.0	47.6	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	0.246	< 0.242	< 0.247	< 0.150	< 0.346	< 0.217	< 0.291	< 0.468	--	0.666	< 0.708	< 0.596	< 0.182
Radium-228	pCi/L	NC	NA	NA	NA	< 0.484	< 0.450	0.740	< 0.472	< 0.514	< 0.477	0.709	< 0.799	--	< 0.644	< 0.742	< 0.807	< 0.470
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.484	< 0.45	0.812	< 0.472	< 0.514	< 0.477	0.862	< 1.27	--	1.13	< 1.45	< 1.40	< 0.470
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location	BCC-MW-15023												
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	10/5/2016	2/15/2017	4/5/2017	7/11/2017	9/13/2017	4/18/2018	6/11/2018	11/29/2018	4/12/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient												
Appendix III																		
Boron	ug/L	NC	NA	1,320	NA	414	284	267	308	526	484	1,590	701	504	--	1,650	1,350	2,600
Calcium	mg/L	NC	NA	259	NA	59.7	59.4	53.3	54.1	64.0	59.9	74.5	50.8	60.9	--	98.9	116	120
Chloride	mg/L	250*	NA	5,980	NA	30	26.9	24.6	28.7	24.8	23.8	24.6	26.8	25.5	--	19.4	17.0	16
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	20	26.5	28.9	25.0	24.3	21.0	22.5	22.6	36.2	--	139	156	140
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	240	270	270	290	290	280	300	290	408	--	474	530	600
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.4	7.5	7.5	7.5	7.4	7.6	7.6	7.6	7.6	7.6	7.4	7.5	7.0
Appendix IV																		
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	2	2	1	3	2	2	< 1	1.9	–	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	57	48	43	40	47	42	46	38.0	–	97.1	87.8	90.4	100
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	–	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1	< 1	2	1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	–	< 15.0	< 15.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	12.1	10.6	< 10	< 10	< 10	< 10	11	< 10	–	19	18	20	31
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	–	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	8	6	< 5	7	6	6	< 5	6.0	–	< 5.0	7.1	6.6	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	0.232	< 0.237	< 0.242	0.226	< 0.309	0.257	0.455	< 0.889	–	< 0.572	< 0.958	< 0.537	0.181
Radium-228	pCi/L	NC	NA	NA	NA	< 0.530	0.426	< 0.456	< 0.545	< 0.355	< 0.400	0.963	< 0.636	–	< 0.749	< 0.891	< 1.18	0.771
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.53	0.599	< 0.456	< 0.545	< 0.355	0.426	1.42	< 1.53	–	< 1.32	< 1.85	< 1.72	0.952
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	–	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location	BCC-MW-17001							BCC-MW-17002					
					Sample Date:	12/7/2017	2/20/2018	6/15/2018	8/6/2018	11/29/2018	11/29/2018	4/11/2019	12/7/2017	2/20/2018	6/15/2018	8/6/2018	11/29/2018	4/11/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	Shallow 2017 Wells												
Appendix III											Field Dup							
Boron	ug/L	NC	NA	1,320	NA	991	827	1,100	1,220	1,480	1,550	1,700	8,280	12,800	13,300	9,440	9,030	9,200
Calcium	mg/L	NC	NA	259	NA	118	118	124	117	135	134	130	178	201	224	194	197	220
Chloride	mg/L	250*	NA	5,980	NA	27.3	28.5	29.1	29.1	29.0	29.2	31	15.3	14.2	13.2	15.4	16.8	15
Fluoride	ug/L	4,000	NA	1,000	NA	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	< 1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	156	135	90.8	18.7	148	140	64	330	325	332	226	402	690
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	558	552	566	476	568	554	570	726	892	936	740	800	1,000
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.1	7.0	7.2	6.9	7.3	--	6.9	7.0	7.1	7.2	7.1	7.0	6.6
Appendix IV																		
Antimony	ug/L	6	NA	1	6	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	1.5	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	5.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**45.5**	2.0	2.6	3.8	2.0	1.6
Barium	ug/L	2,000	NA	340	2,000	85.6	71.3	65.8	73.8	74.4	70.6	82	148	76.7	62.8	57.6	97.7	130
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	< 1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	**55**	**73**	**65**	**62**	**64**	**63**	**43**	**75**	**160**	**150**	**130**	**120**	**100**
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	30.1	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.509	< 0.890	< 0.766	< 0.616	< 0.942	< 0.754	0.314	< 1.03	< 1.07	< 0.757	0.306	< 0.968	0.233
Radium-228	pCi/L	NC	NA	NA	NA	< 0.830	< 0.901	< 0.947	< 0.822	0.989	1.20	< 0.413	< 0.996	< 3.77	< 2.35	1.25	2.01	< 0.598
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 1.34	< 1.79	< 1.71	< 1.44	< 1.69	< 1.45	0.721	< 2.03	< 4.84	< 3.11	1.56	2.29	0.688
Selenium	ug/L	50	NA	3	50	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	1.1	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-17003							BCC-MW-17004						
					Sample Date:	12/7/2017	2/20/2018	6/15/2018	8/7/2018	8/7/2018	11/29/2018	4/12/2019	12/6/2017	2/20/2018	6/15/2018	8/7/2018	11/30/2018	4/12/2019	4/12/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	Shallow 2017 Wells													
Appendix III										Field Dup									Field Dup
Boron	ug/L	NC	NA	1,320	NA	413	394	369	383	377	410	380	367	429	525	425	601	440	450
Calcium	mg/L	NC	NA	259	NA	74.3	55.7	63.2	74.6	76.9	88.7	78	53.7	48.1	73.1	68.9	116	67	71
Chloride	mg/L	250*	NA	5,980	NA	18.3	21.5	22.7	21.9	21.8	19.1	17	21.3	21.3	21.4	21.2	18.7	19	20
Fluoride	ug/L	4,000	NA	1,000	NA	<1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	48.4	< 2.0	< 2.0	17.7	25.9	49.6	12	< 2.0	< 2.0	8.3	< 2.0	166	7.8	7.5
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	324	330	412	326	324	362	360	228	238	410	320	500	330	340
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.0	7.2	7.4	7.3	--	7.3	7.1	7.2	7.3	7.4	7.3	7.3	7.5	--
Appendix IV																			
Antimony	ug/L	6	NA	1	6	1.1	< 1.0	< 1.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	**26**	< 1.0	< 1.0	1.0	1.1	< 1.0	3.8	2.5	1.8	1.1	< 1.0	2.1	1.7	1.7
Barium	ug/L	2,000	NA	340	2,000	128	78.1	66.5	77.9	83.3	92.7	83	145	116	175	148	252	150	150
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.2	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	<1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	19	17	13	18	18	19	15	< 10	< 10	< 10	< 10	14	< 8.0	8.0
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	48.8	6.3	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	9.9	5.9	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.889	< 0.755	< 0.594	< 0.687	0.353	< 0.685	0.205	< 0.945	< 0.723	< 0.441	< 0.519	< 0.766	0.182	< 0.203
Radium-228	pCi/L	NC	NA	NA	NA	< 0.663	< 0.707	< 0.828	0.932	< 0.871	< 0.695	< 0.483	< 0.804	< 0.719	< 0.810	1.03	< 0.790	0.539	< 0.623
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 1.55	< 1.46	< 1.42	< 1.49	< 1.03	< 1.38	0.539	< 1.75	< 1.44	< 1.25	< 1.46	< 1.56	0.721	0.638
Selenium	ug/L	50	NA	3	50	< 1.0	2.2	< 1.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-17005									BCC-MW-17006					
					Sample Date:	12/6/2017	12/6/2017	2/20/2018	2/20/2018	6/15/2018	6/15/2018	8/7/2018	11/30/2018	4/12/2019	12/6/2017	2/20/2018	6/15/2018	8/7/2018	11/30/2018	4/12/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	Shallow 2017 Wells														
Appendix III							Field Dup		Field Dup		Field Dup									
Boron	ug/L	NC	NA	1,320	NA	191	208	238	228	377	353	342	350	400	669	594	653	765	630	650
Calcium	mg/L	NC	NA	259	NA	51.9	54.0	54.2	53.1	71.2	71.1	68.1	68.1	69	106	95.0	97.5	90.4	99.8	150
Chloride	mg/L	250*	NA	5,980	NA	19.4	19.4	21.6	21.3	20.5	20.5	19.6	18.5	15	19.0	20.3	20.9	21.5	20.4	19
Fluoride	ug/L	4,000	NA	1,000	NA	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	11.5	11.00	< 2.0	< 2.0	9.6	9.0	4.3	42.1	120	129	93.1	69.8	46.2	102	290
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	262	220	310	266	358	416	318	318	380	474	472	478	438	432	800
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.3	--	7.3	--	7.4	--	7.3	7.6	7.5	7.7	7.3	7.5	7.5	7.7	7.5
Appendix IV																				
Antimony	ug/L	6	NA	1	6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	10	**10**	2.9	2.8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	4.9	2.4	4.6	< 1.0	6.6	5.9
Barium	ug/L	2,000	NA	340	2,000	168	167	123	128	161	149	179	131	84	83.3	79.0	70.3	73	68.6	120
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	3	100	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	28	**40**	10	12	11	11	< 10	< 10	13	11	< 8.0	38	37	31	36	32	35
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	9	**100**	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.863	1.56	< 0.804	0.910	< 0.692	< 0.610	0.440	< 0.592	0.270	< 0.930	< 0.766	< 0.862	< 0.582	1.13	< 0.225
Radium-228	pCi/L	NC	NA	NA	NA	< 0.722	< 0.649	< 0.904	< 0.945	< 0.796	< 0.853	< 0.741	< 0.656	< 0.479	< 0.833	< 0.716	< 0.888	< 0.757	1.06	< 0.556
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 1.59	< 1.61	< 1.71	< 1.80	< 1.49	< 1.46	< 1.15	< 1.25	0.700	< 1.76	< 1.48	< 1.75	< 1.34	2.19	< 0.556
Selenium	ug/L	50	NA	3	50	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

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Technical Memorandum

Sanitas™ Output Files

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Summary Report

Constituent: Antimony, Total Analysis Run 7/12/2019 8:29 AM
Client: Consumers Energy Data: BCC_Sanitas_19.07.11

For observations made between 12/1/2015 and 4/12/2019, a summary of the selected data set:

Observations = 216
ND/Trace = 210
Wells = 21
Minimum Value = 1
Maximum Value = 2
Mean Value = 1.038
Median Value = 1
Standard Deviation = 0.1836
Coefficient of Variation = 0.1769
Skewness = 4.78

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	12	11	1	1	1	1	0	0	NaN
BCC-MW-15010	12	12	1	1	1	1	0	0	NaN
BCC-MW-15011	12	12	1	1	1	1	0	0	NaN
BCC-MW-15012	12	12	1	1	1	1	0	0	NaN
BCC-MW-15013	12	12	1	1	1	1	0	0	NaN
BCC-MW-15014	12	10	1	1.7	1.067	1	0.2015	0.1889	2.914
BCC-MW-15015	12	12	1	1	1	1	0	0	NaN
BCC-MW-15016	12	12	1	1	1	1	0	0	NaN
BCC-MW-15017	12	12	1	1	1	1	0	0	NaN
BCC-MW-15018	12	12	1	1	1	1	0	0	NaN
BCC-MW-15019	12	12	1	1	1	1	0	0	NaN
BCC-MW-15020	12	12	1	1	1	1	0	0	NaN
BCC-MW-15021	12	12	1	1	1	1	0	0	NaN
BCC-MW-15022	12	11	1	1.9	1.075	1	0.2598	0.2417	3.015
BCC-MW-15023	12	12	1	1	1	1	0	0	NaN
BCC-MW-17001	6	6	1	2	1.167	1	0.4082	0.3499	1.789
BCC-MW-17002	6	5	1	2	1.25	1	0.4183	0.3347	1.122
BCC-MW-17003	6	5	1	2	1.183	1	0.4021	0.3398	1.751
BCC-MW-17004	6	6	1	2	1.167	1	0.4082	0.3499	1.789
BCC-MW-17005	6	6	1	2	1.167	1	0.4082	0.3499	1.789
BCC-MW-17006	6	6	1	2	1.167	1	0.4082	0.3499	1.789

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Arsenic, Total Analysis Run 7/12/2019 8:29 AM
Client: Consumers Energy Data: BCC_Sanitas_19.07.11

For observations made between 12/1/2015 and 4/12/2019, a summary of the selected data set:

Observations = 216
ND/Trace = 86
Wells = 21
Minimum Value = 1
Maximum Value = 45.5
Mean Value = 3.977
Median Value = 1.85
Standard Deviation = 6.024
Coefficient of Variation = 1.515
Skewness = 4.183

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	12	0	3.9	45	17.36	13.5	12.1	0.6969	0.9634
BCC-MW-15010	12	12	1	1	1	1	0	0	NaN
BCC-MW-15011	12	1	1	9.3	5.125	5.5	2.642	0.5156	-0.1147
BCC-MW-15012	12	1	1	12	4.25	2.5	3.642	0.857	0.9995
BCC-MW-15013	12	12	1	1	1	1	0	0	NaN
BCC-MW-15014	12	0	3.9	15	8	7.5	3.197	0.3997	0.702
BCC-MW-15015	12	0	2	7	4.483	4.85	1.682	0.3751	-0.4331
BCC-MW-15016	12	0	1.3	3	1.933	2	0.571	0.2954	0.8776
BCC-MW-15017	12	0	1.8	13	5.758	4.5	4.26	0.7398	0.7748
BCC-MW-15018	12	10	1	2	1.083	1	0.2887	0.2665	3.015
BCC-MW-15019	12	12	1	1	1	1	0	0	NaN
BCC-MW-15020	12	12	1	1	1	1	0	0	NaN
BCC-MW-15021	12	4	1	3	1.5	1	0.6742	0.4495	0.9295
BCC-MW-15022	12	2	1	8	4.442	4.9	2.748	0.6187	-0.1383
BCC-MW-15023	12	5	1	3	1.575	1.45	0.6635	0.4213	0.6808
BCC-MW-17001	6	5	1	5.2	1.7	1	1.715	1.009	1.789
BCC-MW-17002	6	0	1.6	45.5	9.583	2.3	17.61	1.838	1.781
BCC-MW-17003	6	3	1	26	5.642	1.025	10.04	1.779	1.742
BCC-MW-17004	6	1	1	2.5	1.7	1.75	0.5762	0.3389	0.02062
BCC-MW-17005	6	5	1	2.85	1.308	1	0.7553	0.5773	1.789
BCC-MW-17006	6	1	1	6.6	4.233	4.75	2.134	0.5041	-0.4899

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Summary Report

Constituent: Barium, Total Analysis Run 7/12/2019 8:29 AM
Client: Consumers Energy Data: BCC_Sanitas_19.07.11

For observations made between 12/1/2015 and 4/12/2019, a summary of the selected data set:

Observations = 216
ND/Trace = 0
Wells = 21
Minimum Value = 9
Maximum Value = 1030
Mean Value = 189.7
Median Value = 89
Standard Deviation = 248
Coefficient of Variation = 1.308
Skewness = 1.971

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	12	0	9	16.5	12.38	11.5	2.577	0.2082	0.5456
BCC-MW-15010	12	0	28	78	48.63	47	16.82	0.3459	0.3025
BCC-MW-15011	12	0	15.2	36	27.17	30.35	6.769	0.2492	-0.7686
BCC-MW-15012	12	0	14.3	109	53.25	45.85	31.97	0.6003	0.5679
BCC-MW-15013	12	0	39.5	71	49.08	47.5	8.564	0.1745	1.442
BCC-MW-15014	12	0	257	779	524.3	558.5	163.4	0.3118	-0.1471
BCC-MW-15015	12	0	21	63	32.55	29	11.76	0.3614	1.466
BCC-MW-15016	12	0	548	700	631.8	634	38.84	0.06148	-0.4201
BCC-MW-15017	12	0	772	1030	931.2	955	72.97	0.07836	-0.9997
BCC-MW-15018	12	0	127	171	146.7	148.5	11.53	0.07862	0.304
BCC-MW-15019	12	0	88	187	110.5	95	31.68	0.2867	1.568
BCC-MW-15020	12	0	47	196.5	83.24	53.5	49.86	0.599	1.196
BCC-MW-15021	12	0	211	274	238.8	237	15.74	0.06591	0.5103
BCC-MW-15022	12	0	102	242	140.8	133	39.83	0.2828	1.518
BCC-MW-15023	12	0	38	100	61.36	47.5	24.62	0.4012	0.6451
BCC-MW-17001	6	0	65.8	85.6	75.17	73.15	7.31	0.09726	0.3105
BCC-MW-17002	6	0	57.6	148	95.47	87.2	36.91	0.3866	0.394
BCC-MW-17003	6	0	66.5	128	88.15	81.8	21.27	0.2413	1.176
BCC-MW-17004	6	0	116	252	164.3	149	46.86	0.2852	1.165
BCC-MW-17005	6	0	84	179	140.3	143	34.43	0.2454	-0.5464
BCC-MW-17006	6	0	68.6	120	82.37	76	19.24	0.2336	1.478

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Summary Report

Constituent: Beryllium, Total Analysis Run 7/12/2019 8:29 AM
Client: Consumers Energy Data: BCC_Sanitas_19.07.11

For observations made between 12/1/2015 and 4/12/2019, a summary of the selected data set:

Observations = 216
ND/Trace = 216
Wells = 21
Minimum Value = 1
Maximum Value = 1
Mean Value = 1
Median Value = 1
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	12	12	1	1	1	1	0	0	NaN
BCC-MW-15010	12	12	1	1	1	1	0	0	NaN
BCC-MW-15011	12	12	1	1	1	1	0	0	NaN
BCC-MW-15012	12	12	1	1	1	1	0	0	NaN
BCC-MW-15013	12	12	1	1	1	1	0	0	NaN
BCC-MW-15014	12	12	1	1	1	1	0	0	NaN
BCC-MW-15015	12	12	1	1	1	1	0	0	NaN
BCC-MW-15016	12	12	1	1	1	1	0	0	NaN
BCC-MW-15017	12	12	1	1	1	1	0	0	NaN
BCC-MW-15018	12	12	1	1	1	1	0	0	NaN
BCC-MW-15019	12	12	1	1	1	1	0	0	NaN
BCC-MW-15020	12	12	1	1	1	1	0	0	NaN
BCC-MW-15021	12	12	1	1	1	1	0	0	NaN
BCC-MW-15022	12	12	1	1	1	1	0	0	NaN
BCC-MW-15023	12	12	1	1	1	1	0	0	NaN
BCC-MW-17001	6	6	1	1	1	1	0	0	NaN
BCC-MW-17002	6	6	1	1	1	1	0	0	NaN
BCC-MW-17003	6	6	1	1	1	1	0	0	NaN
BCC-MW-17004	6	6	1	1	1	1	0	0	NaN
BCC-MW-17005	6	6	1	1	1	1	0	0	NaN
BCC-MW-17006	6	6	1	1	1	1	0	0	NaN

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Summary Report

Constituent: Cadmium, Total Analysis Run 7/12/2019 8:29 AM
Client: Consumers Energy Data: BCC_Sanitas_19.07.11

For observations made between 12/1/2015 and 4/12/2019, a summary of the selected data set:

Observations = 216
ND/Trace = 216
Wells = 21
Minimum Value = 0.2
Maximum Value = 0.2
Mean Value = 0.2
Median Value = 0.2
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15010	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15011	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15012	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15013	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15014	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15015	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15016	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15017	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15018	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15019	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15020	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15021	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15022	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15023	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17001	6	6	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17002	6	6	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17003	6	6	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17004	6	6	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17005	6	6	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17006	6	6	0.2	0.2	0.2	0.2	0	0	NaN

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Summary Report

Constituent: Chromium, Total Analysis Run 7/12/2019 8:29 AM
Client: Consumers Energy Data: BCC_Sanitas_19.07.11

For observations made between 12/1/2015 and 4/12/2019, a summary of the selected data set:

Observations = 216
ND/Trace = 151
Wells = 21
Minimum Value = 1
Maximum Value = 11
Mean Value = 1.378
Median Value = 1
Standard Deviation = 1.14
Coefficient of Variation = 0.8275
Skewness = 5.041

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	12	10	1	2	1.083	1	0.2887	0.2665	3.015
BCC-MW-15010	12	10	1	2	1.083	1	0.2887	0.2665	3.015
BCC-MW-15011	12	9	1	2	1.083	1	0.2887	0.2665	3.015
BCC-MW-15012	12	10	1	1	1	1	0	0	NaN
BCC-MW-15013	12	10	1	2	1.083	1	0.2887	0.2665	3.015
BCC-MW-15014	12	8	1	2	1.1	1	0.2892	0.2629	2.826
BCC-MW-15015	12	10	1	1	1	1	0	0	NaN
BCC-MW-15016	12	0	1.9	4	2.633	2.65	0.6315	0.2398	0.63
BCC-MW-15017	12	0	2.9	11	5.004	4	2.493	0.4983	1.54
BCC-MW-15018	12	7	1	1	1	1	0	0	NaN
BCC-MW-15019	12	10	1	1	1	1	0	0	NaN
BCC-MW-15020	12	10	1	2	1.083	1	0.2887	0.2665	3.015
BCC-MW-15021	12	4	1	2	1.442	1.15	0.4963	0.3442	0.2995
BCC-MW-15022	12	9	1	2	1.083	1	0.2887	0.2665	3.015
BCC-MW-15023	12	10	1	2	1.083	1	0.2887	0.2665	3.015
BCC-MW-17001	6	5	1	1.3	1.05	1	0.1225	0.1166	1.789
BCC-MW-17002	6	6	1	1	1	1	0	0	NaN
BCC-MW-17003	6	6	1	1	1	1	0	0	NaN
BCC-MW-17004	6	5	1	1.2	1.033	1	0.08165	0.07902	1.789
BCC-MW-17005	6	6	1	1	1	1	0	0	NaN
BCC-MW-17006	6	6	1	1	1	1	0	0	NaN

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Cobalt, Total Analysis Run 7/12/2019 8:29 AM
Client: Consumers Energy Data: BCC_Sanitas_19.07.11

For observations made between 12/1/2015 and 4/12/2019, a summary of the selected data set:

Observations = 216
ND/Trace = 216
Wells = 21
Minimum Value = 6
Maximum Value = 15
Mean Value = 13.25
Median Value = 15
Standard Deviation = 3.57
Coefficient of Variation = 0.2695
Skewness = -1.544

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	12	12	6	15	13.5	15	3.503	0.2595	-1.789
BCC-MW-15010	12	12	6	15	13.5	15	3.503	0.2595	-1.789
BCC-MW-15011	12	12	6	15	13.5	15	3.503	0.2595	-1.789
BCC-MW-15012	12	12	6	15	13.5	15	3.503	0.2595	-1.789
BCC-MW-15013	12	12	6	15	13.5	15	3.503	0.2595	-1.789
BCC-MW-15014	12	12	6	15	13.5	15	3.503	0.2595	-1.789
BCC-MW-15015	12	12	6	15	13.5	15	3.503	0.2595	-1.789
BCC-MW-15016	12	12	6	15	13.5	15	3.503	0.2595	-1.789
BCC-MW-15017	12	12	6	15	13.5	15	3.503	0.2595	-1.789
BCC-MW-15018	12	12	6	15	13.5	15	3.503	0.2595	-1.789
BCC-MW-15019	12	12	6	15	13.5	15	3.503	0.2595	-1.789
BCC-MW-15020	12	12	6	15	13.5	15	3.503	0.2595	-1.789
BCC-MW-15021	12	12	6	15	13.5	15	3.503	0.2595	-1.789
BCC-MW-15022	12	12	6	15	13.5	15	3.503	0.2595	-1.789
BCC-MW-15023	12	12	6	15	13.5	15	3.503	0.2595	-1.789
BCC-MW-17001	6	6	6	15	12	15	4.648	0.3873	-0.7071
BCC-MW-17002	6	6	6	15	12	15	4.648	0.3873	-0.7071
BCC-MW-17003	6	6	6	15	12	15	4.648	0.3873	-0.7071
BCC-MW-17004	6	6	6	15	12	15	4.648	0.3873	-0.7071
BCC-MW-17005	6	6	6	15	12	15	4.648	0.3873	-0.7071
BCC-MW-17006	6	6	6	15	12	15	4.648	0.3873	-0.7071

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Fluoride Analysis Run 7/12/2019 8:29 AM
Client: Consumers Energy Data: BCC_Sanitas_19.07.11

For observations made between 12/1/2015 and 4/12/2019, a summary of the selected data set:

Observations = 231
ND/Trace = 227
Wells = 21
Minimum Value = 1000
Maximum Value = 1200
Mean Value = 1002
Median Value = 1000
Standard Deviation = 19.66
Coefficient of Variation = 0.01962
Skewness = 9.412

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	13	13	1000	1000	1000	1000	0	0	NaN
BCC-MW-15010	13	13	1000	1000	1000	1000	0	0	NaN
BCC-MW-15011	13	11	1000	1200	1015	1000	55.47	0.05463	3.175
BCC-MW-15012	13	11	1000	1200	1023	1000	59.91	0.05856	2.362
BCC-MW-15013	13	13	1000	1000	1000	1000	0	0	NaN
BCC-MW-15014	13	13	1000	1000	1000	1000	0	0	NaN
BCC-MW-15015	13	13	1000	1000	1000	1000	0	0	NaN
BCC-MW-15016	13	13	1000	1000	1000	1000	0	0	NaN
BCC-MW-15017	13	13	1000	1000	1000	1000	0	0	NaN
BCC-MW-15018	13	13	1000	1000	1000	1000	0	0	NaN
BCC-MW-15019	13	13	1000	1000	1000	1000	0	0	NaN
BCC-MW-15020	13	13	1000	1000	1000	1000	0	0	NaN
BCC-MW-15021	13	13	1000	1000	1000	1000	0	0	NaN
BCC-MW-15022	13	13	1000	1000	1000	1000	0	0	NaN
BCC-MW-15023	13	13	1000	1000	1000	1000	0	0	NaN
BCC-MW-17001	6	6	1000	1000	1000	1000	0	0	NaN
BCC-MW-17002	6	6	1000	1000	1000	1000	0	0	NaN
BCC-MW-17003	6	6	1000	1000	1000	1000	0	0	NaN
BCC-MW-17004	6	6	1000	1000	1000	1000	0	0	NaN
BCC-MW-17005	6	6	1000	1000	1000	1000	0	0	NaN
BCC-MW-17006	6	6	1000	1000	1000	1000	0	0	NaN

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Lead, Total Analysis Run 7/12/2019 8:29 AM
Client: Consumers Energy Data: BCC_Sanitas_19.07.11

For observations made between 12/1/2015 and 4/12/2019, a summary of the selected data set:

Observations = 216
ND/Trace = 216
Wells = 21
Minimum Value = 1
Maximum Value = 1
Mean Value = 1
Median Value = 1
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	12	12	1	1	1	1	0	0	NaN
BCC-MW-15010	12	12	1	1	1	1	0	0	NaN
BCC-MW-15011	12	12	1	1	1	1	0	0	NaN
BCC-MW-15012	12	12	1	1	1	1	0	0	NaN
BCC-MW-15013	12	12	1	1	1	1	0	0	NaN
BCC-MW-15014	12	12	1	1	1	1	0	0	NaN
BCC-MW-15015	12	12	1	1	1	1	0	0	NaN
BCC-MW-15016	12	12	1	1	1	1	0	0	NaN
BCC-MW-15017	12	12	1	1	1	1	0	0	NaN
BCC-MW-15018	12	12	1	1	1	1	0	0	NaN
BCC-MW-15019	12	12	1	1	1	1	0	0	NaN
BCC-MW-15020	12	12	1	1	1	1	0	0	NaN
BCC-MW-15021	12	12	1	1	1	1	0	0	NaN
BCC-MW-15022	12	12	1	1	1	1	0	0	NaN
BCC-MW-15023	12	12	1	1	1	1	0	0	NaN
BCC-MW-17001	6	6	1	1	1	1	0	0	NaN
BCC-MW-17002	6	6	1	1	1	1	0	0	NaN
BCC-MW-17003	6	6	1	1	1	1	0	0	NaN
BCC-MW-17004	6	6	1	1	1	1	0	0	NaN
BCC-MW-17005	6	6	1	1	1	1	0	0	NaN
BCC-MW-17006	6	6	1	1	1	1	0	0	NaN

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Lithium, Total Analysis Run 7/12/2019 8:29 AM
Client: Consumers Energy Data: BCC_Sanitas_19.07.11

For observations made between 12/1/2015 and 4/12/2019, a summary of the selected data set:

Observations = 216
ND/Trace = 69
Wells = 21
Minimum Value = 8
Maximum Value = 160
Mean Value = 20.52
Median Value = 15
Standard Deviation = 20.86
Coefficient of Variation = 1.017
Skewness = 4.259

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	12	0	13	24	17.1	15.3	3.675	0.2149	0.5581
BCC-MW-15010	12	0	14	54	29.9	22.35	14.77	0.4938	0.4985
BCC-MW-15011	12	0	11	21	16.68	17	2.643	0.1584	-0.4455
BCC-MW-15012	12	0	10	20.8	14.12	12.5	3.537	0.2506	0.6808
BCC-MW-15013	12	0	17	27.5	19.99	18	3.51	0.1756	0.9281
BCC-MW-15014	12	7	10	27	13.71	10	5.754	0.4198	1.26
BCC-MW-15015	12	7	10	16	11.29	10	2.005	0.1776	1.344
BCC-MW-15016	12	12	10	10	10	10	0	0	NaN
BCC-MW-15017	12	12	10	10	10	10	0	0	NaN
BCC-MW-15018	12	0	12	28	21.88	22.55	4.704	0.215	-0.9685
BCC-MW-15019	12	0	22	27.9	24.3	23.85	2.05	0.08436	0.3899
BCC-MW-15020	12	0	14	20	15.83	15.55	1.923	0.1215	0.8748
BCC-MW-15021	12	12	8	10	9.833	10	0.5774	0.05871	-3.015
BCC-MW-15022	12	8	10	25	12.67	10	5.382	0.4249	1.719
BCC-MW-15023	12	5	10	31	14.31	10.8	6.53	0.4564	1.531
BCC-MW-17001	6	0	43	73	60.25	62.75	10.24	0.1699	-0.6247
BCC-MW-17002	6	0	75	160	122.5	125	31.58	0.2578	-0.3103
BCC-MW-17003	6	0	13	19	16.83	17.5	2.401	0.1427	-0.6416
BCC-MW-17004	6	4	8	14	10.33	10	1.966	0.1903	1.05
BCC-MW-17005	6	2	8	13	10.67	11	1.633	0.1531	-0.3242
BCC-MW-17006	6	0	31	38	34.83	35.5	2.787	0.08001	-0.3599

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Mercury, Total Analysis Run 7/12/2019 8:29 AM
Client: Consumers Energy Data: BCC_Sanitas_19.07.11

For observations made between 12/1/2015 and 4/12/2019, a summary of the selected data set:

Observations = 216
ND/Trace = 216
Wells = 21
Minimum Value = 0.2
Maximum Value = 0.2
Mean Value = 0.2
Median Value = 0.2
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15010	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15011	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15012	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15013	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15014	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15015	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15016	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15017	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15018	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15019	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15020	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15021	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15022	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-15023	12	12	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17001	6	6	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17002	6	6	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17003	6	6	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17004	6	6	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17005	6	6	0.2	0.2	0.2	0.2	0	0	NaN
BCC-MW-17006	6	6	0.2	0.2	0.2	0.2	0	0	NaN

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Molybdenum, Total Analysis Run 7/12/2019 8:30 AM
Client: Consumers Energy Data: BCC_Sanitas_19.07.11

For observations made between 12/1/2015 and 4/12/2019, a summary of the selected data set:

Observations = 216
ND/Trace = 117
Wells = 21
Minimum Value = 5
Maximum Value = 119
Mean Value = 16.31
Median Value = 5
Standard Deviation = 22.3
Coefficient of Variation = 1.367
Skewness = 2.57

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	12	1	5	60	35.3	41.38	20.26	0.574	-0.4725
BCC-MW-15010	12	4	5	33	14.68	12	10.4	0.7081	0.5772
BCC-MW-15011	12	0	5.8	35	20.75	21.7	8.54	0.4116	-0.243
BCC-MW-15012	12	0	9	94.5	40.58	35	22.81	0.5621	1.169
BCC-MW-15013	12	2	5	21	10.7	9.5	5.791	0.5412	0.7023
BCC-MW-15014	12	0	58	119	87.22	80.5	19.37	0.2221	0.3171
BCC-MW-15015	12	0	7	17	11.34	11	3.299	0.291	0.551
BCC-MW-15016	12	12	5	5	5	5	0	0	NaN
BCC-MW-15017	12	12	5	5	5	5	0	0	NaN
BCC-MW-15018	12	12	5	5	5	5	0	0	NaN
BCC-MW-15019	12	12	5	5	5	5	0	0	NaN
BCC-MW-15020	12	12	5	5	5	5	0	0	NaN
BCC-MW-15021	12	12	5	5	5	5	0	0	NaN
BCC-MW-15022	12	3	5	47.6	15.6	13.8	11.51	0.7376	1.829
BCC-MW-15023	12	4	5	8	6.058	6	0.9784	0.1615	0.4767
BCC-MW-17001	6	6	5	5	5	5	0	0	NaN
BCC-MW-17002	6	5	5	30.1	9.183	5	10.25	1.116	1.789
BCC-MW-17003	6	4	5	48.8	12.52	5	17.78	1.421	1.785
BCC-MW-17004	6	4	5	9.9	5.967	5	1.96	0.3285	1.665
BCC-MW-17005	6	6	5	5	5	5	0	0	NaN
BCC-MW-17006	6	6	5	5	5	5	0	0	NaN

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Radium-226 Analysis Run 7/12/2019 8:30 AM
Client: Consumers Energy Data: BCC_Sanitas_19.07.11

For observations made between 12/1/2015 and 4/12/2019, a summary of the selected data set:

Observations = 216
ND/Trace = 140
Wells = 21
Minimum Value = 0.133
Maximum Value = 2.5
Mean Value = 0.5992
Median Value = 0.458
Standard Deviation = 0.4823
Coefficient of Variation = 0.8049
Skewness = 1.625

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	12	12	0.153	0.934	0.3822	0.239	0.2903	0.7595	0.9636
BCC-MW-15010	12	11	0.145	0.869	0.3981	0.2705	0.2688	0.6753	0.7735
BCC-MW-15011	12	10	0.141	1.12	0.3978	0.29	0.3099	0.779	1.309
BCC-MW-15012	12	9	0.153	0.7	0.3455	0.2495	0.1978	0.5725	0.8656
BCC-MW-15013	12	9	0.173	0.731	0.3612	0.252	0.2081	0.576	0.8235
BCC-MW-15014	12	11	0.175	1.52	0.4969	0.216	0.4825	0.9709	1.185
BCC-MW-15015	12	12	0.133	0.832	0.357	0.291	0.2214	0.6202	0.9485
BCC-MW-15016	12	2	0.263	1.75	1.251	1.305	0.4068	0.3251	-1.17
BCC-MW-15017	12	0	1.52	2.5	1.963	1.935	0.3146	0.1603	0.1791
BCC-MW-15018	12	4	0.227	1.02	0.4987	0.412	0.2534	0.5081	0.843
BCC-MW-15019	12	5	0.2215	0.88	0.4496	0.3465	0.2068	0.4599	0.8455
BCC-MW-15020	12	9	0.19	1.1	0.4692	0.292	0.3147	0.6708	0.912
BCC-MW-15021	12	4	0.215	1.49	0.6126	0.547	0.309	0.5045	1.942
BCC-MW-15022	12	10	0.15	0.708	0.3632	0.269	0.1961	0.5397	0.7352
BCC-MW-15023	12	7	0.181	0.958	0.4246	0.283	0.2665	0.6277	1.044
BCC-MW-17001	6	5	0.314	0.942	0.6728	0.691	0.2396	0.3562	-0.3221
BCC-MW-17002	6	4	0.233	1.07	0.7273	0.8625	0.3714	0.5106	-0.4861
BCC-MW-17003	6	4	0.205	0.889	0.608	0.6395	0.2353	0.387	-0.6779
BCC-MW-17004	6	5	0.1925	0.945	0.5977	0.621	0.2682	0.4486	-0.2533
BCC-MW-17005	6	2	0.27	1.211	0.6771	0.642	0.3309	0.4887	0.4661
BCC-MW-17006	6	5	0.225	1.13	0.7492	0.814	0.3141	0.4193	-0.6084

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Radium-226/228 Analysis Run 7/12/2019 8:30 AM
Client: Consumers Energy Data: BCC_Sanitas_19.07.11

For observations made between 12/1/2015 and 4/12/2019, a summary of the selected data set:

Observations = 216
ND/Trace = 130
Wells = 21
Minimum Value = 0.354
Maximum Value = 5.89
Mean Value = 1.49
Median Value = 1.28
Standard Deviation = 1.203
Coefficient of Variation = 0.8069
Skewness = 1.793

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	12	11	0.451	3.85	1.281	0.6055	1.282	1.001	1.383
BCC-MW-15010	12	9	0.363	1.75	0.9068	0.668	0.5502	0.6068	0.4819
BCC-MW-15011	12	11	0.394	2.07	0.8971	0.5655	0.5805	0.6471	0.8179
BCC-MW-15012	12	9	0.416	2.28	0.9067	0.594	0.5658	0.624	1.27
BCC-MW-15013	12	9	0.45	1.56	0.9182	0.749	0.4405	0.4798	0.3021
BCC-MW-15014	12	10	0.423	3.25	1.289	0.809	0.9991	0.7749	1.019
BCC-MW-15015	12	11	0.408	1.75	0.8466	0.5775	0.4849	0.5728	0.8306
BCC-MW-15016	12	0	2.29	3.95	3.136	3.09	0.5857	0.1868	-0.08919
BCC-MW-15017	12	0	4.3	5.89	5.081	5.14	0.532	0.1047	-0.1797
BCC-MW-15018	12	3	0.586	1.97	1.31	1.291	0.3981	0.3039	0.09745
BCC-MW-15019	12	4	0.674	2.13	1.219	0.9855	0.5014	0.4112	0.493
BCC-MW-15020	12	5	0.467	2.32	1.031	0.727	0.6152	0.597	1.019
BCC-MW-15021	12	3	0.354	2.61	1.526	1.44	0.5721	0.375	-0.1313
BCC-MW-15022	12	9	0.45	1.45	0.8159	0.663	0.3975	0.4872	0.5212
BCC-MW-15023	12	8	0.355	1.85	0.9753	0.7755	0.5581	0.5722	0.3369
BCC-MW-17001	6	5	0.721	1.79	1.449	1.565	0.3961	0.2734	-1.109
BCC-MW-17002	6	3	0.688	4.84	2.42	2.16	1.431	0.5915	0.6441
BCC-MW-17003	6	5	0.539	1.55	1.306	1.44	0.3805	0.2912	-1.694
BCC-MW-17004	6	5	0.6795	1.75	1.357	1.45	0.3698	0.2726	-1.043
BCC-MW-17005	6	5	0.7	1.8	1.333	1.37	0.39	0.2925	-0.4953
BCC-MW-17006	6	5	0.556	2.19	1.513	1.615	0.5518	0.3648	-0.7061

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Radium-228 Analysis Run 7/12/2019 8:30 AM
Client: Consumers Energy Data: BCC_Sanitas_19.07.11

For observations made between 12/1/2015 and 4/12/2019, a summary of the selected data set:

Observations = 216
ND/Trace = 138
Wells = 21
Minimum Value = 0.354
Maximum Value = 3.98
Mean Value = 0.9951
Median Value = 0.753
Standard Deviation = 0.7337
Coefficient of Variation = 0.7373
Skewness = 2.14

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	12	11	0.451	3.27	1.028	0.6055	0.9914	0.9645	1.697
BCC-MW-15010	12	9	0.363	0.978	0.6517	0.622	0.2358	0.3618	0.1086
BCC-MW-15011	12	11	0.394	0.956	0.6464	0.5655	0.2284	0.3533	0.3136
BCC-MW-15012	12	11	0.416	2.08	0.7557	0.594	0.4504	0.5961	2.312
BCC-MW-15013	12	9	0.45	0.94	0.6706	0.6625	0.1844	0.2749	0.258
BCC-MW-15014	12	10	0.423	1.85	0.9176	0.7725	0.4765	0.5193	0.9144
BCC-MW-15015	12	11	0.408	1.07	0.6418	0.5775	0.2015	0.3139	0.7052
BCC-MW-15016	12	0	1.06	2.37	1.917	1.935	0.3776	0.197	-0.7603
BCC-MW-15017	12	0	2.5	3.98	3.118	2.99	0.4688	0.1504	0.7678
BCC-MW-15018	12	3	0.586	1.39	0.8681	0.824	0.2307	0.2657	0.7801
BCC-MW-15019	12	6	0.484	1.8	0.877	0.7405	0.3975	0.4532	1.122
BCC-MW-15020	12	5	0.467	1.61	0.7339	0.6125	0.327	0.4456	1.823
BCC-MW-15021	12	4	0.354	1.6	0.9699	0.8585	0.3935	0.4057	0.3749
BCC-MW-15022	12	10	0.45	0.807	0.609	0.579	0.1436	0.2358	0.1885
BCC-MW-15023	12	9	0.355	1.18	0.6585	0.5905	0.2565	0.3895	0.6479
BCC-MW-17001	6	5	0.413	1.095	0.8346	0.8655	0.2291	0.2746	-1.014
BCC-MW-17002	6	4	0.598	3.77	1.829	1.63	1.15	0.6289	0.6941
BCC-MW-17003	6	5	0.483	0.9015	0.7129	0.701	0.1446	0.2028	-0.2938
BCC-MW-17004	6	4	0.581	1.03	0.789	0.797	0.1462	0.1853	0.3271
BCC-MW-17005	6	6	0.479	0.945	0.7327	0.7315	0.1612	0.2201	-0.2853
BCC-MW-17006	6	5	0.556	1.06	0.8017	0.795	0.1702	0.2123	0.1053

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Selenium, Total Analysis Run 7/12/2019 8:30 AM
Client: Consumers Energy Data: BCC_Sanitas_19.07.11

For observations made between 12/1/2015 and 4/12/2019, a summary of the selected data set:

Observations = 216
ND/Trace = 161
Wells = 21
Minimum Value = 1
Maximum Value = 8
Mean Value = 1.337
Median Value = 1
Standard Deviation = 0.9795
Coefficient of Variation = 0.7327
Skewness = 4.486

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	12	11	1	2	1.083	1	0.2887	0.2665	3.015
BCC-MW-15010	12	10	1	1	1	1	0	0	NaN
BCC-MW-15011	12	11	1	1	1	1	0	0	NaN
BCC-MW-15012	12	9	1	3.3	1.225	1	0.658	0.5371	2.944
BCC-MW-15013	12	11	1	1	1	1	0	0	NaN
BCC-MW-15014	12	4	1	8	2.1	1.1	2.072	0.9866	2.155
BCC-MW-15015	12	11	1	1	1	1	0	0	NaN
BCC-MW-15016	12	2	1	7	2.375	2	1.745	0.7346	1.707
BCC-MW-15017	12	2	1	8	2.821	2.575	1.851	0.6563	1.885
BCC-MW-15018	12	9	1	4	1.25	1	0.866	0.6928	3.015
BCC-MW-15019	12	10	1	2	1.1	1	0.2892	0.2629	2.826
BCC-MW-15020	12	8	1	2	1.117	1	0.301	0.2696	2.424
BCC-MW-15021	12	6	1	4	1.383	1	0.884	0.6391	2.426
BCC-MW-15022	12	12	1	1	1	1	0	0	NaN
BCC-MW-15023	12	11	1	1	1	1	0	0	NaN
BCC-MW-17001	6	6	1	2	1.167	1	0.4082	0.3499	1.789
BCC-MW-17002	6	5	1	2	1.183	1	0.4021	0.3398	1.751
BCC-MW-17003	6	5	1	2.2	1.367	1	0.5715	0.4182	0.7458
BCC-MW-17004	6	6	1	2	1.167	1	0.4082	0.3499	1.789
BCC-MW-17005	6	6	1	2	1.167	1	0.4082	0.3499	1.789
BCC-MW-17006	6	6	1	2	1.167	1	0.4082	0.3499	1.789

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Thallium, Total Analysis Run 7/12/2019 8:30 AM
Client: Consumers Energy Data: BCC_Sanitas_19.07.11

For observations made between 12/1/2015 and 4/12/2019, a summary of the selected data set:

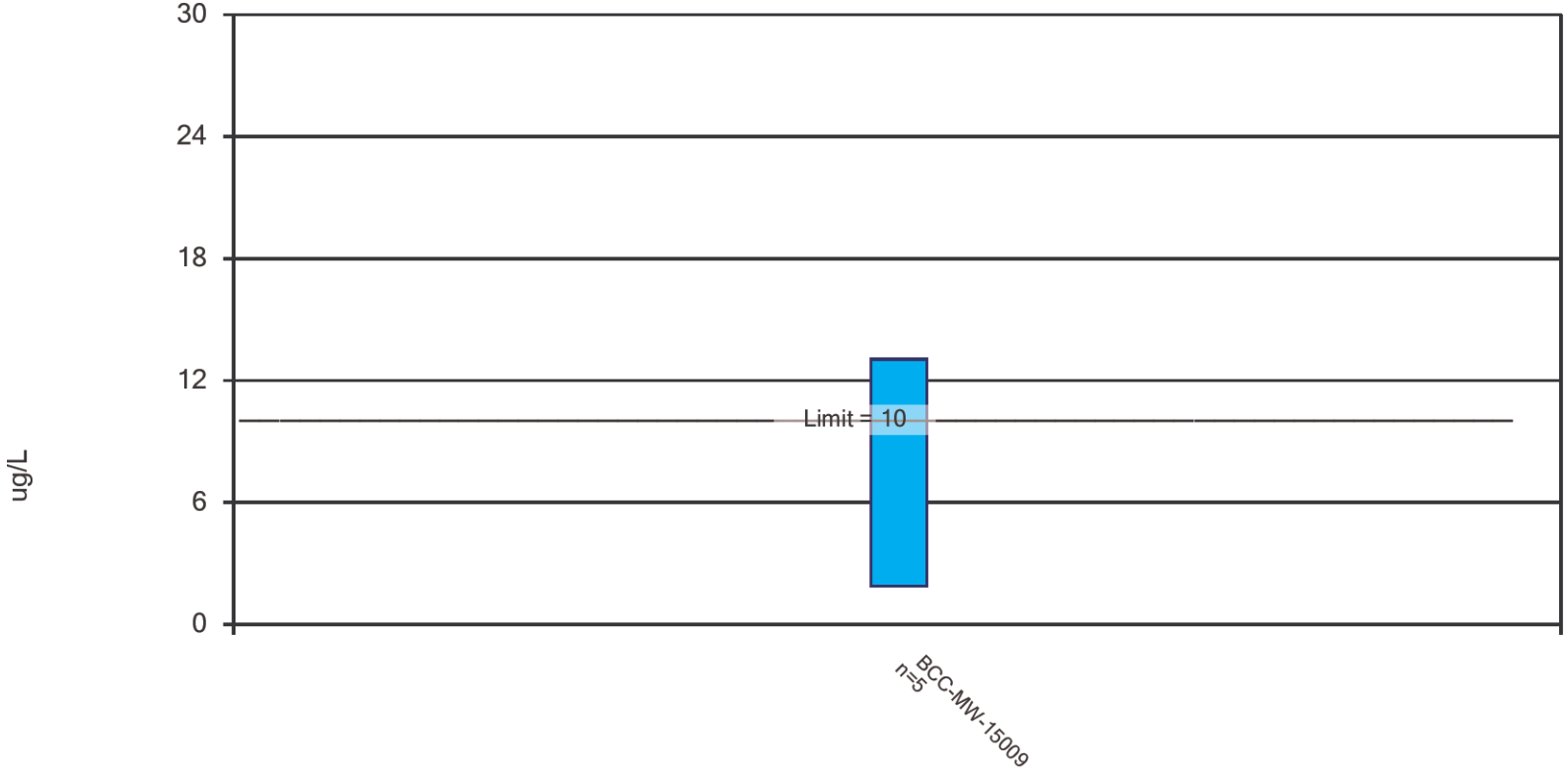
Observations = 216
ND/Trace = 216
Wells = 21
Minimum Value = 2
Maximum Value = 2
Mean Value = 2
Median Value = 2
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	12	12	2	2	2	2	0	0	NaN
BCC-MW-15010	12	12	2	2	2	2	0	0	NaN
BCC-MW-15011	12	12	2	2	2	2	0	0	NaN
BCC-MW-15012	12	12	2	2	2	2	0	0	NaN
BCC-MW-15013	12	12	2	2	2	2	0	0	NaN
BCC-MW-15014	12	12	2	2	2	2	0	0	NaN
BCC-MW-15015	12	12	2	2	2	2	0	0	NaN
BCC-MW-15016	12	12	2	2	2	2	0	0	NaN
BCC-MW-15017	12	12	2	2	2	2	0	0	NaN
BCC-MW-15018	12	12	2	2	2	2	0	0	NaN
BCC-MW-15019	12	12	2	2	2	2	0	0	NaN
BCC-MW-15020	12	12	2	2	2	2	0	0	NaN
BCC-MW-15021	12	12	2	2	2	2	0	0	NaN
BCC-MW-15022	12	12	2	2	2	2	0	0	NaN
BCC-MW-15023	12	12	2	2	2	2	0	0	NaN
BCC-MW-17001	6	6	2	2	2	2	0	0	NaN
BCC-MW-17002	6	6	2	2	2	2	0	0	NaN
BCC-MW-17003	6	6	2	2	2	2	0	0	NaN
BCC-MW-17004	6	6	2	2	2	2	0	0	NaN
BCC-MW-17005	6	6	2	2	2	2	0	0	NaN
BCC-MW-17006	6	6	2	2	2	2	0	0	NaN

[DRAFT - ELECTRONIC REVIEW]

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Arsenic, Total Analysis Run 6/7/2019 3:14 PM

Client: Consumers Energy Data: BCC_Sanitas_19.06.06

Confidence Interval

Constituent: Arsenic, Total (ug/L) Analysis Run 6/7/2019 3:15 PM

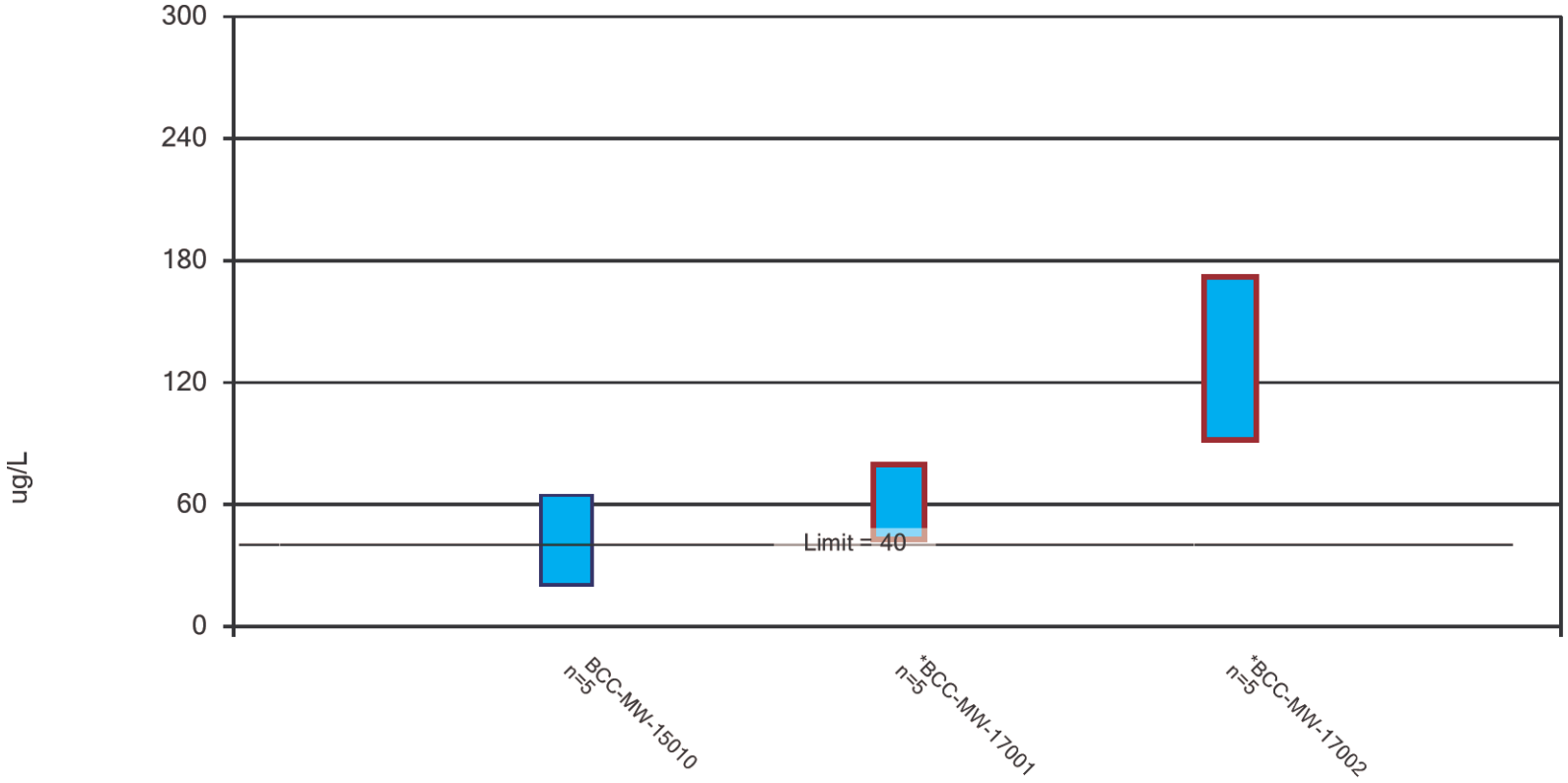
Client: Consumers Energy Data: BCC_Sanitas_19.06.06

	BCC-MW-15009
7/11/2017	11.4 (D)
4/16/2018	9.4
6/13/2018	8.5
11/28/2018	4.1
4/9/2019	3.9
Mean	7.46
Std. Dev.	3.329
Upper Lim.	13.04
Lower Lim.	1.881

[DRAFT - ELECTRONIC REVIEW]

Parametric Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Lithium, Total Analysis Run 6/7/2019 3:15 PM

Client: Consumers Energy Data: BCC_Sanitas_19.06.06

Confidence Interval

Constituent: Lithium, Total (ug/L) Analysis Run 6/7/2019 3:15 PM

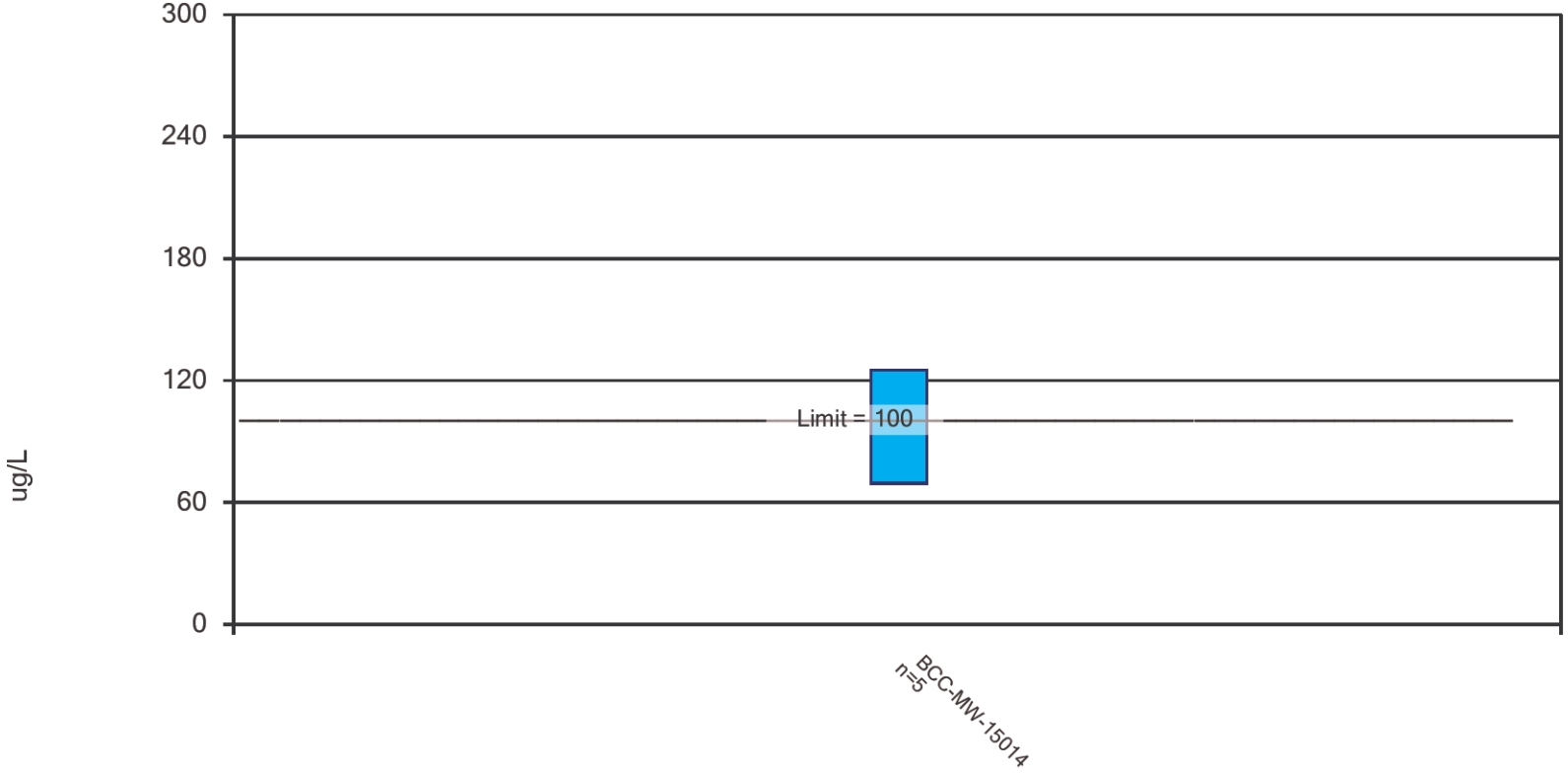
Client: Consumers Energy Data: BCC_Sanitas_19.06.06

	BCC-MW-15010	BCC-MW-17001	BCC-MW-17002
7/11/2017	21		
2/20/2018		73	160
4/16/2018	46		
6/14/2018	54		
6/15/2018		65	150
8/6/2018		62	130
11/28/2018	51		
11/29/2018		63.5 (D)	120
4/9/2019	41		
4/11/2019		43	100
Mean	42.6	61.3	132
Std. Dev.	13.05	11.08	23.87
Upper Lim.	64.47	79.86	172
Lower Lim.	20.73	42.74	91.99

[DRAFT - ELECTRONIC REVIEW]

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Molybdenum, Total Analysis Run 6/7/2019 3:16 PM

Client: Consumers Energy Data: BCC_Sanitas_19.06.06

Confidence Interval

Constituent: Molybdenum, Total (ug/L) Analysis Run 6/7/2019 3:16 PM

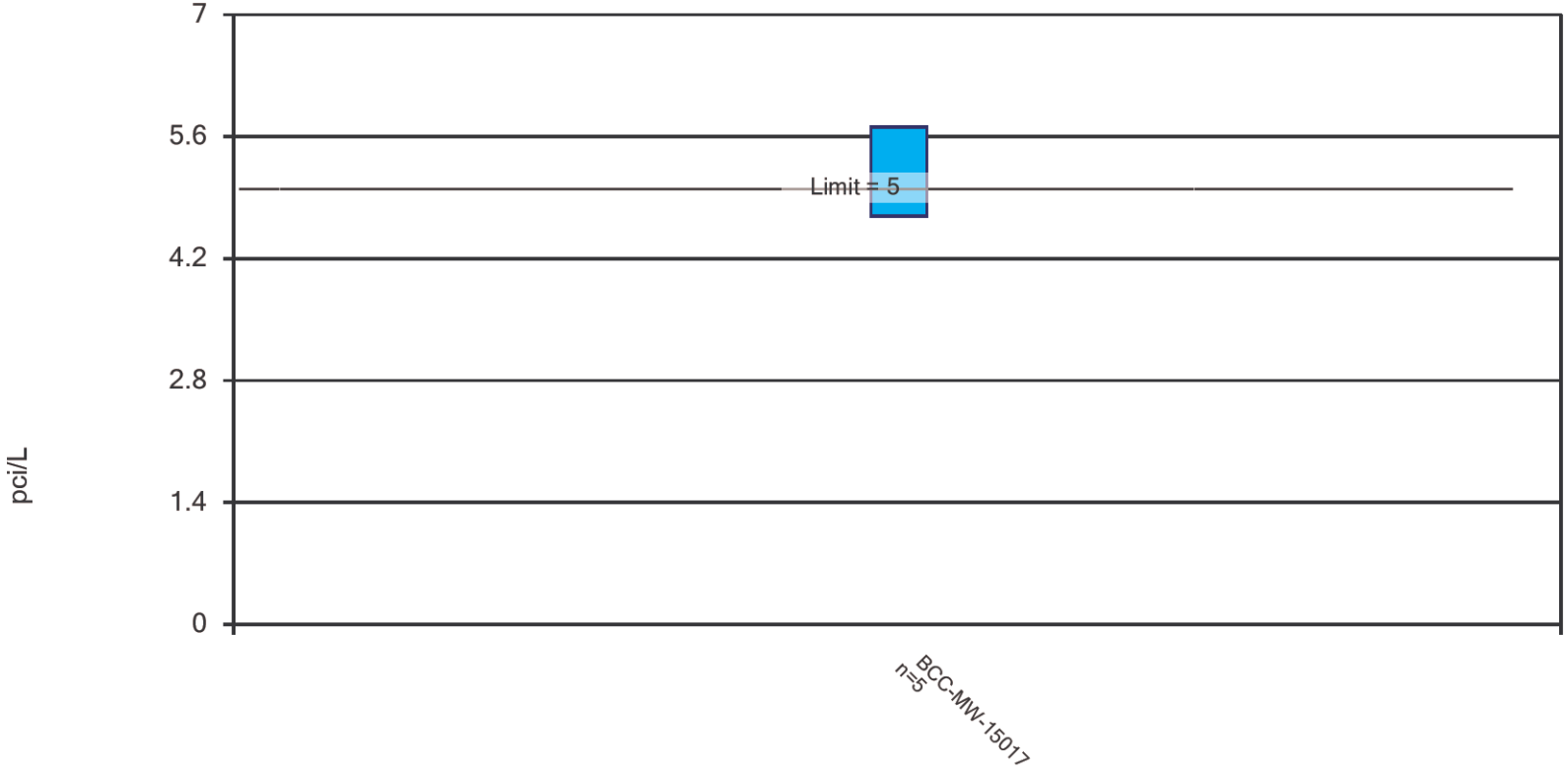
Client: Consumers Energy Data: BCC_Sanitas_19.06.06

	BCC-MW-15014
7/12/2017	70.9
4/17/2018	94.7
6/13/2018	100
11/29/2018	106
4/11/2019	115 (D)
Mean	97.32
Std. Dev.	16.58
Upper Lim.	125.1
Lower Lim.	69.53

[DRAFT - ELECTRONIC REVIEW]

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Radium-226/228 Analysis Run 7/12/2019 8:27 AM

Client: Consumers Energy Data: BCC_Sanitas_19.07.11

Confidence Interval

Constituent: Radium-226/228 (pci/L) Analysis Run 7/12/2019 8:27 AM

Client: Consumers Energy Data: BCC_Sanitas_19.07.11

	BCC-MW-15017
7/12/2017	4.75
4/17/2018	5.16
6/12/2018	5.51 (D)
11/29/2018	5.12
4/11/2019	5.46
Mean	5.2
Std. Dev.	0.3059
Upper Lim.	5.713
Lower Lim.	4.687

[DRAFT - ELECTRONIC REVIEW]

Appendix E
September 2019 Assessment Monitoring Statistical Evaluation

[DRAFT - ELECTRONIC REVIEW]

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Technical Memorandum

Date: December 13, 2019

To: Michelle Marion, Consumers Energy

From: Darby Litz, TRC
Sarah Holmstrom, TRC
Kristin Lowery, TRC

cc: Brad Runkel, Consumers Energy
JR Register, Consumers Energy
Bethany Swanberg, Consumers Energy

Project No.: 322176.0000 Phase 001, Task 003

Subject: Statistical Evaluation of September 2019 Assessment Monitoring Sampling Event BC Cobb Bottom Ash Pond & Ponds 0-8 CCR Unit, Consumers Energy Company, Essexville, Michigan

During the statistical evaluation of the initial assessment monitoring event (June 2018), lithium was present in one or more downgradient monitoring wells at statistically significant levels exceeding the Groundwater Protection Standards (GWPSs). Therefore, Consumers Energy Company (Consumers Energy) initiated an Assessment of Corrective Measures (ACM) within 90 days from when the Appendix IV exceedance was determined. The ACM was completed on September 11, 2019. Consumers Energy is continuing semiannual assessment monitoring in accordance with §257.95 of the CCR Rule[1] at the BC Cobb Power Plant Bottom Ash Pond and Ponds 0-8 (collectively the BCC Ponds). The second semiannual assessment monitoring event for 2019 was conducted on September 24 through September 27, 2019. In accordance with §257.95, the assessment monitoring data must be compared to GWPSs to determine whether or not Appendix IV constituents are detected at statistically significant levels above the GWPSs. GWPSs were established in accordance with §257.95(h), as detailed in the October 15, 2018 *Groundwater Protection Standards* technical memorandum, which was also included in the *2018 Annual Groundwater Monitoring Report* (TRC, January 2019). The following narrative describes the methods employed and the results obtained and the Sanitas™ output files are included as an attachment.

[1] USEPA final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) published April 17, 2015, as amended per Phase One, Part One of the CCR Rule (83 FR 36435).

[DRAFT - ELECTRONIC REVIEW]

The statistical evaluation of the fourth semiannual assessment monitoring event data indicates that the following constituent is present at statistically significant levels exceeding the GWPS in downgradient monitoring wells at the BCC Ponds:

Constituent	GWPS	# Downgradient Wells Observed
Lithium	40 ug/L	2 of 21

These results are consistent with the results of the initial assessment monitoring data statistical evaluation and Consumers Energy will continue to evaluate corrective measures per §257.96 and §257.97. Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Assessment Monitoring Statistical Evaluation

The compliance monitoring wells BCC-MW-15009 through BCC-MW-15014 encircle the Bottom Ash Pond, while BCC-MW-15015 through BCC-MW-15023 and BCC-MW-17001 through BCC-MW-17006 are located at the outer edge of the peninsula formed by Ponds 0-8. Because the perimeter and interior berms within the ash management area were constructed in part with ash and bodies of water surround the ash management area, wells could not be installed entirely beyond the CCR material boundary.

Following the second semiannual assessment monitoring event for 2019, compliance well data for the BCC Ponds were evaluated in accordance with the *Groundwater Statistical Evaluation Plan* (Stats Plan) (TRC, October 2017). An assessment monitoring program was developed to evaluate concentrations of CCR constituents present in the uppermost aquifer relative to acceptable levels (i.e. GWPSs). To evaluate whether or not a GWPS exceedance is statistically significant, the difference in concentration observed at the downgradient wells during a given assessment monitoring event compared to the GWPS must be large enough, after accounting for variability in the sample data, that the result is unlikely to have occurred merely by chance. Consistent with the Unified Guidance [2], the preferred method for comparisons to a fixed standard are confidence limits. Based on the number of historical observations in the representative sample population, the population mean, the population standard deviation, and a selected confidence level (i.e. 99 percent), an upper and lower confidence limit is calculated. The true concentration, with 99 percent confidence, will fall between and lower and upper confidence limits.

The concentrations observed in the downgradient wells are deemed to be a statistically significant exceedance when the 99 percent lower confidence limit of the downgradient data exceeds the GWPS. If the confidence interval straddles the GWPS (i.e. the lower confidence level is below the GWPS but the upper confidence level is above), the statistical test result indicates that there is insufficient confidence that the measured concentrations are different from the GWPS and thus no compelling

[2] USEPA. 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance*. Office of Conservation and Recovery. EPA 530/R-09-007.

[DRAFT - ELECTRONIC REVIEW]

evidence that the measured concentration is a result of a release from the CCR unit versus the inherent variability of the sample data. This statistical approach is consistent with the statistical methods for assessment monitoring presented in §257.93(f) and (g). Statistical evaluation methodologies built into the CCR Rule, and numerous other federal rules, are key in determining whether or not individually measured data points represent a concentration increase over the baseline or a fixed standard (such as a GWPS in an assessment monitoring program).

For each detected Appendix IV constituent, the concentrations for each well were first compared directly to the GWPS, as shown on Table A1. Due to the significant operational changes that occurred within the ash management area and immediately adjacent to it during the CCR Rule baseline period, where groundwater flow rates and directions were changed drastically over relatively short periods of time, the data set used for statistical evaluation was limited to the six most recent events relative to the timeline of other factors that could be affecting observations of constituents in groundwater that are unrelated to releases from the ponds. Limiting the data set to the six most recent data points is appropriate for the BCC Ponds to allow for evaluation of groundwater quality that is representative of current conditions that excludes variability in the sample data set caused by the observed changes in site conditions that would not be indicative of a release from the BCC Ponds. Those observed changes are attributed to several possible reasons including cessation of hydraulic loading in the BCC Ponds in April 2016, changes in the analytical laboratory being used, and pumping from Veterans Memorial Pond (pumping influence observed from July 2017 through September 2017; construction completed in December 2017). These activities have the potential to influence the results of the statistical analysis by including data that may have different reporting limits or may have been biased low or high due to changing site conditions, introducing additional variability and uncertainty in the results that are unrelated to the natural groundwater data distribution. Use of the six most recent data points relative to the timeline of other site factors is adequate in providing the minimum density of data for the statistical analysis as recommended per the Unified Guidance; no fewer than four data points are used.

For the BCC-MW-15000-series monitoring wells, the confidence interval tests included data collected between July 2017 and September 2019. For the BCC-MW-17000-series wells, the confidence interval tests included data collected between February 2018 and September 2019 (six out of the seven data points accumulated since wells were installed in December 2017). Parameter-well combinations that included a direct exceedance of the GWPS during these timeframes were retained for further analysis. Arsenic in BCC-MW-15009, lithium in BCC-MW-15010, BCC-MW-17001, and BCC-MW-17002, molybdenum in BCC-MW-15014, and radium 226/228 in BCC-MW-15017 had individual results exceeding the GWPS.

Groundwater data were then evaluated utilizing Sanitas™ statistical software. Sanitas™ is a software tool that is commercially available for performing statistical evaluation consistent with procedures outlined in the Unified Guidance. Within the Sanitas™ statistical program, confidence limits were selected to perform the statistical comparison of compliance data to a fixed standard. Parametric and non-parametric confidence intervals were calculated, as appropriate, for each of the CCR Appendix IV

[DRAFT - ELECTRONIC REVIEW]

parameters using a per test[3] 99 percent confidence level, i.e., a significance level (α) of 0.01. The following narrative describes the methods employed, the results obtained and the Sanitas™ output files are included as an attachment.

The statistical data evaluation included the following steps:

- Review of data quality checklists for the data sets;
- Graphical representation of the monitoring data as time versus concentration by well-constituent pair;
- Outlier testing of individual data points that appear from the graphical representations as potential outliers;
- Evaluation of visual trends apparent in the graphical representations for statistical significance;
- Evaluation of percentage of non-detects for each well-constituent pair;
- Distribution of the data; and
- Calculation of the confidence intervals for each cumulative dataset.

The results of these evaluations are presented and discussed below.

Data from each round were evaluated for completeness, overall quality, and usability and were deemed appropriate for the purposes of the CCR assessment monitoring program. Initially, the recent baseline for the BCC-MW-15000-series monitoring wells (from July 2017 to September 2019) and for the BCC-MW-17000-series wells (February 2018 to September 2019) were observed visually for potential trends. No outliers were identified. Arsenic in BCC-MW-15009 exhibits a downward trend. The trend charts show that arsenic concentrations are generally decreasing with time, as evidenced by the negative Sen's Slope, and that the downward trend of arsenic at BCC-MW-15009 is statistically significant (Attachment 1). The decreases in arsenic concentrations are causing the confidence intervals to widen for BCC-MW-15009. Calculating a confidence interval around a trending data set incorporates not only variability present naturally in the underlying dataset, but also incorporates variability due to the trend itself. However, it is a decreasing trend for arsenic which suggests improvement in groundwater quality where the arsenic concentration has been below the GWPS for five consecutive monitoring events. In addition, assessment monitoring has already been triggered at the site by other constituents (i.e. lithium), and corrective measures are currently being assessed; therefore, no change in statistical methods were applied at this time but will be considered in the future based on additional data collected and status of corrective measures implementation.

The Sanitas™ software was then used to test compliance at the downgradient monitoring wells using the confidence interval method for the most recent five sampling events. The software outputs are included in Attachment 1 along with data reports showing the values used for the evaluation. The percentage of non-detect observations for well/constituent pairs with a direct GWPS exceedance are

[3] Confidence level is assessed for each individual comparison (i.e. per well and per constituent).

[DRAFT - ELECTRONIC REVIEW]

also included in Attachment 1. Non-detect data were handled in accordance with the Stats Plan for the purposes of calculating the confidence intervals. The tests were run with a per-test significance of α = 0.01. The Sanitas™ software generates an output that includes graphs of the parametric or non-parametric confidence intervals for each well along with notes on data transformations, as appropriate. The data sets with direct exceedances of the GWPS were found to be normally distributed. The confidence interval test compares the lower confidence limit to the GWPS.

The statistical evaluation of the Appendix IV parameters shows exceedances for lithium at BCC-MW-17001 and BCC-MW-17002. The lower confidence limits for the other Appendix IV constituents statistically evaluated at BCC-MW-15009, BCC-MW-15010, BCC-MW-15014, and BCC-MW-15017 were below their respective GWPSs. These results are consistent with the results of the initial assessment monitoring data statistical evaluation and Consumers Energy will continue to evaluate corrective measures per §257.96 and §257.97. Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Attachments

Table A1 Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to September 2019

Attachment 1 Sanitas™ Output Files

[DRAFT - ELECTRONIC REVIEW]

Table

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15009														
					Sample Date:	12/1/2015	2/17/2016	4/18/2016	7/12/2016	9/28/2016	2/14/2017	4/5/2017	7/11/2017	7/11/2017	9/13/2017	4/16/2018	6/13/2018	11/28/2018	4/9/2019	9/25/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient														
Appendix III														Field Dup						
Boron	ug/L	NC	NA	1,320	NA	2,380	2,520	2,170	2,070	2,190	2,110	2,190	2,210	1,690	2,120	–	1,670	1,690	1,600	1,500
Calcium	mg/L	NC	NA	259	NA	42.7	44.1	40.1	44.1	46.7	37.7	38.2	37.6	36.5	34.9	–	42.4	27.9	33	51
Chloride	mg/L	250*	NA	5,980	NA	24	24.0	27.1	26.9	24.3	22.8	24.9	26.3	26.3	26	–	95.7	51.1	32	41
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	63	39.3	49.5	55.2	49.1	31.6	39.8	43.0	47.2	41.7	–	< 2.0	19.2	49	30
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	240	230	220	220	230	200	190	216	246	188	–	456	454	300	290
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	10.6	10.8	10.3	10.0	10.0	10.2	10.1	9.6	--	10.2	9.8	9.8	9.8	9.4	8.7
Appendix IV																				
Antimony	ug/L	6	NA	1	6	1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	–
Arsenic	ug/L	10	NA	10	**10**	**45**	**31**	**24**	**24**	**20**	**14**	**13**	**12.0**	**10.8**	–	9.4	8.5	4.1	3.9	2.3
Barium	ug/L	2,000	NA	340	2,000	16	12	11	11	11	9	10	13.2	10.8	–	16.5	13.8	10.2	16	27
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	–
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	–	< 0.20	< 0.20	< 0.20	< 0.20	–
Chromium	ug/L	100	NA	3	100	< 1	< 1	1	2	< 1	< 1	< 1	< 1.0	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	–	< 15.0	< 15.0	< 6.0	< 6.0	–
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	–
Lithium	ug/L	NC	40	28	**40**	15.6	14.6	15	14	14	13	14	19	19	–	24	21	20	21	32
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	–	< 0.20	< 0.20	< 0.20	< 0.20	–
Molybdenum	ug/L	NC	100	9	**100**	57	60	50	49	49	40	38	43.7	41.8	–	16.0	11.6	5.2	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.166	< 0.157	< 0.209	< 0.158	< 0.269	< 0.159	< 0.347	< 0.756	< 0.887	–	< 0.934	< 0.580	< 0.567	< 0.153	0.370
Radium-228	pCi/L	NC	NA	NA	NA	< 0.451	< 0.475	< 0.467	< 0.461	< 0.628	0.678	< 0.502	< 1.96	< 2.96	–	< 0.957	< 3.27	< 0.903	< 0.583	< 0.551
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.451	< 0.475	< 0.467	< 0.461	< 0.628	0.747	< 0.502	< 2.72	< 3.85	–	< 1.89	< 3.85	< 1.47	< 0.583	0.807
Selenium	ug/L	50	NA	3	50	< 1	< 1	2	< 1	< 1	< 1	< 1	< 1.0	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	–	< 2.0	< 2.0	< 2.0	< 2.0	–

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15010														
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/13/2016	9/28/2016	2/14/2017	4/5/2017	7/11/2017	9/13/2017	9/13/2017	4/16/2018	6/14/2018	11/28/2018	4/9/2019	9/24/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient														
Appendix III															Field Dup					
Boron	ug/L	NC	NA	1,320	NA	1,970	1,510	1,340	1,270	1,570	1,440	1,760	1,340	1,770	1,770	–	2,100	1,850	1,700	1,100
Calcium	mg/L	NC	NA	259	NA	71.2	51.9	37.4	58.2	66.4	49.8	80.5	40.7	129	133	–	133	115	110	130
Chloride	mg/L	250*	NA	5,980	NA	23	22.5	21.5	22.7	25.1	22.3	24.2	25.5	24.5	24.4	–	29.3	39.6	22	42
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	120	52.6	31.0	50.7	69.7	24.2	53.5	24.8	143	143	–	73.7	48.3	49	2.9
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	410	270	220	260	320	250	360	288	570	618	–	636	590	490	450
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.7	7.8	7.8	7.8	8.0	8.0	7.8	7.8	7.8	--	7.8	7.4	7.5	7.6	7.4
Appendix IV																				
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	–
Arsenic	ug/L	10	NA	10	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	49	34	28	42	45	31	51	29.2	--	–	63.4	64.8	68.1	78	61
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	–	< 1.0	< 1.0	< 1.0	< 1.0	–
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	–	< 0.20	< 0.20	< 0.20	< 0.20	–
Chromium	ug/L	100	NA	3	100	< 1	< 1	2	< 1	< 1	1	< 1	< 1.0	--	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	–	< 15.0	< 15.0	< 6.0	< 6.0	–
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	–
Lithium	ug/L	NC	40	28	40	36.1	22.7	18	15	22	14	18	21	--	--	**46**	**54**	**51**	**41**	**43**
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	–	< 0.20	< 0.20	< 0.20	< 0.20	–
Molybdenum	ug/L	NC	100	9	100	33	29	27	15	20	9	7	16.2	--	–	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.302	< 0.217	< 0.244	< 0.145	< 0.297	< 0.179	< 0.216	< 0.642	--	–	< 0.869	0.661	< 0.820	< 0.185	< 0.140
Radium-228	pCi/L	NC	NA	NA	NA	0.849	< 0.502	< 0.447	0.420	0.728	< 0.363	< 0.380	< 0.956	--	–	< 0.877	< 0.978	< 0.805	< 0.516	< 0.578
Radium-226/228	pCi/L	5	NA	2.42	5	0.973	< 0.502	< 0.447	0.451	0.82	< 0.363	< 0.38	< 1.60	--	–	< 1.75	< 1.45	< 1.63	< 0.516	< 0.578
Selenium	ug/L	50	NA	3	50	< 1	< 1	1	1	< 1	< 1	< 1	< 1.0	--	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	–	< 2.0	< 2.0	< 2.0	< 2.0	–

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15011														
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/12/2016	9/28/2016	2/14/2017	4/5/2017	7/11/2017	9/13/2017	4/16/2018	6/13/2018	11/28/2018	4/10/2019	9/25/2019	9/25/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient														
Appendix III																				Field Dup
Boron	ug/L	NC	NA	1,320	NA	1,680	1,420	1,340	1,210	1,180	1,280	1,340	1,060	1,490	–	1,630	1,650	1,600	1,600	1,600
Calcium	mg/L	NC	NA	259	NA	53	47.6	36.9	47.3	48.0	47.9	52.0	42.2	23.9	–	22.6	29.5	41	63	63
Chloride	mg/L	250*	NA	5,980	NA	22	20.7	22.1	24.8	21.0	19.5	22.2	22.9	24.0	–	23.2	26.3	38	37	37
Fluoride	ug/L	4,000	NA	1,000	NA	1,200	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	50	30.8	35.8	43.8	38.5	37.2	42.8	29.1	6.4	–	12.3	21.9	38	97	99
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	270	230	210	240	230	230	240	224	140	–	244	182	260	380	400
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	8.7	8.5	8.2	8.5	8.7	9.2	9.0	8.2	8.5	9.1	8.5	8.9	8.8	8.4	–
Appendix IV																				
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	–	–
Arsenic	ug/L	10	NA	10	**10**	5	3	3	4	6	7	8	< 1.0	--	6.4	1.5	7.3	9.3	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	36	29	25	30	31	31	32	30.7	--	15.2	16.6	18.5	31	39	39
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	–	–
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	–	–
Chromium	ug/L	100	NA	3	100	1	< 1	2	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	–	–
Fluoride	ug/L	4,000	NA	1,000	4,000	1,200	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	–	–
Lithium	ug/L	NC	40	28	**40**	17.2	16	14	15	16	17	17	20	--	21	11	18	18	13	13
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	–	–
Molybdenum	ug/L	NC	100	9	**100**	20	29	35	26	27	25	22	21.4	--	8.9	5.8	13.9	15	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.199	< 0.141	< 0.319	< 0.166	< 0.284	< 0.160	< 0.296	< 1.12	--	< 0.742	0.350	< 0.771	0.226	0.272	< 0.192
Radium-228	pCi/L	NC	NA	NA	NA	0.956	< 0.447	< 0.435	< 0.402	< 0.496	< 0.394	< 0.599	< 0.954	--	< 0.872	< 0.923	< 0.747	< 0.532	0.454	< 0.519
Radium-226/228	pCi/L	5	NA	2.42	**5**	1.01	< 0.447	< 0.435	< 0.402	< 0.496	< 0.394	< 0.599	< 2.07	--	< 1.61	< 1.25	< 1.52	< 0.532	0.726	0.622
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	–	–

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15012														
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	9/13/2017	4/17/2018	6/13/2018	11/28/2018	4/10/2019	4/10/2019	9/25/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient														
Appendix III																			Field Dup	
Boron	ug/L	NC	NA	1,320	NA	961	1,390	1,830	1,450	1,470	1,380	1,500	1,340	1,140	–	1,450	1,280	1,300	1,300	1,300
Calcium	mg/L	NC	NA	259	NA	49.5	82.1	65.5	44.5	43.5	32.0	34.9	24.6	48.7	–	95.1	55.7	61	60	140
Chloride	mg/L	250*	NA	5,980	NA	20	20.4	23.7	23.0	22.6	19.7	22.7	24.1	23.3	–	22.7	21.5	20	20	22
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,200	1,100	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	69	111	106	65.6	50.9	55.7	57.2	21.8	59.6	–	355	137	190	180	540
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	300	370	340	250	210	190	200	168	318	--	902	302	380	380	850
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	8.0	8.1	8.1	8.9	9.2	8.6	8.5	9.9	11.4	9.7	10.2	9.8	9.4	--	10.1
Appendix IV																				
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	–
Arsenic	ug/L	10	NA	10	**10**	< 1	2	8	**12**	9	2	3	6.1	--	1.8	3.4	1.3	1.4	1.4	2.3
Barium	ug/L	2,000	NA	340	2,000	40	63	68	34	22	25	28	14.3	--	109	105	51.7	79	79	190
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	–
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	–
Chromium	ug/L	100	NA	3	100	< 1	< 1	1	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	–
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,200	1,100	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	–
Lithium	ug/L	NC	40	28	**40**	15.6	20.8	19	18	15	11	12	12	--	13	11	10	12	12	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	–
Molybdenum	ug/L	NC	100	9	**100**	29	9	35	37	44	35	27	94.5	--	50.8	71.3	28.3	26	26	75
Radium-226	pCi/L	NC	NA	NA	NA	< 0.164	< 0.243	< 0.256	< 0.216	< 0.335	< 0.153	< 0.243	0.436	--	< 0.693	< 0.526	0.700	< 0.142	0.219	0.241
Radium-228	pCi/L	NC	NA	NA	NA	< 0.471	< 0.634	0.827	< 0.539	< 0.548	< 0.416	< 0.554	< 2.08	--	< 0.733	< 0.789	< 0.992	< 0.485	< 0.481	< 0.551
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.471	< 0.634	0.919	< 0.539	< 0.548	< 0.416	< 0.554	< 2.28	--	< 1.43	< 1.32	1.27	< 0.485	0.514	0.776
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1.2	--	1.2	3.3	< 1.0	< 1.0	< 1.0	2.2
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	–

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15013															
					Sample Date:	12/1/2015	2/18/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	9/13/2017	4/17/2018	4/17/2018	6/13/2018	6/13/2018	11/29/2018	4/11/2019	9/25/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient															
Appendix III																Field Dup		Field Dup			
Boron	ug/L	NC	NA	1,320	NA	1,140	1,290	1,180	1,080	1,090	1,050	1,120	916	1,270	--	--	1,130	1,100	1,070	1,200	1,300
Calcium	mg/L	NC	NA	259	NA	65.2	58.3	47.5	48.4	59.7	52.5	50.9	43.9	34.4	--	--	47.3	48.9	50.8	50	45
Chloride	mg/L	250*	NA	5,980	NA	21	20.9	21.5	21.0	22.9	19.8	19.9	23.4	21.2	--	--	21.5	21.6	21.3	21	24
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	89	44.3	34.3	27.5	31.3	23.1	15.1	8.7	59.9	--	--	8.7	7.9	5.9	4.8	53
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	330	290	260	250	250	260	250	240	192	--	--	324	268	210	260	250
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.6	7.2	7.4	7.3	7.4	7.7	7.4	7.4	7.9	7.6	--	7.7	--	7.0	7.3	8.0
Appendix IV																					
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Arsenic	ug/L	10	NA	10	**10**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	71	58	49	47	51	52	48	41.9	--	43.3	44.7	43.9	41.1	39.5	45	31
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	--
Chromium	ug/L	100	NA	3	100	< 1	< 1	2	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	--
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Lithium	ug/L	NC	40	28	**40**	17.5	19.9	18	17	18	18	17	23	--	27	28	24	24	23	17	13
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	--
Molybdenum	ug/L	NC	100	9	**100**	17	20	21	12	11	10	9	7.7	--	< 5.0	< 5.0	< 5.0	< 5.0	5.0	5.7	9.9
Radium-226	pCi/L	NC	NA	NA	NA	0.272	< 0.299	0.173	< 0.181	< 0.215	< 0.230	< 0.215	0.731	--	< 0.505	< 0.506	< 0.546	< 0.585	< 0.696	< 0.232	< 0.201
Radium-228	pCi/L	NC	NA	NA	NA	0.914	< 0.527	0.727	0.483	< 0.598	< 0.481	< 0.516	< 0.940	--	< 0.633	< 0.780	< 0.754	< 0.903	< 0.728	< 0.450	< 0.482
Radium-226/228	pCi/L	5	NA	2.42	**5**	1.19	< 0.527	0.9	0.596	< 0.598	< 0.481	< 0.516	< 1.56	--	< 1.14	< 1.29	< 1.30	< 1.49	< 1.42	< 0.450	0.508
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	--

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15014														
					Sample Date:	12/1/2015	2/18/2016	4/18/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	9/13/2017	4/17/2018	6/13/2018	11/29/2018	4/11/2019	4/11/2019	9/25/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient														
Appendix III																			Field Dup	
Boron	ug/L	NC	NA	1,320	NA	2,560	2,230	1,840	1,630	1,690	1,530	1,560	1,300	1,410	–	1,370	1,400	1,500	1,600	1,400
Calcium	mg/L	NC	NA	259	NA	75.6	75.3	63.9	73.5	64.7	66.3	65.3	61.8	57.8	–	50.8	51.1	49	53	50
Chloride	mg/L	250*	NA	5,980	NA	21	21.9	21.9	22.0	22.7	18.6	22.1	22.4	22.5	–	21.3	20.5	20	22	23
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	43	34.7	31.4	35.6	23.7	27.8	23.9	24.9	19.2	--	2.4	12.4	12	14	25
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	350	310	270	290	250	280	270	292	282	--	338	224	260	290	250
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	11.5	11.6	11.2	11.0	11.1	11.5	11.3	11.5	12.0	11.6	11.4	11.5	11.3	--	11.3
Appendix IV																				
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1.7	--	1.1	< 1.0	< 1.0	< 1.0	< 1.0	–
Arsenic	ug/L	10	NA	10	**10**	**15**	**11**	**11**	8	9	7	7	8.4	--	6.2	5.5	4.0	3.8	4.0	2.6
Barium	ug/L	2,000	NA	340	2,000	329	376	257	508	357	571	546	732	--	779	607	604	620	630	560
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	–
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	–
Chromium	ug/L	100	NA	3	100	< 1	2	1	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	1.4	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	–
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	–
Lithium	ug/L	NC	40	28	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	19	--	27	16	21	12	11	23
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	–
Molybdenum	ug/L	NC	100	9	**100**	**119**	76	58	69	81	80	77	70.9	--	94.7	100	**106**	**120**	**110**	99
Radium-226	pCi/L	NC	NA	NA	NA	< 0.176	< 0.175	< 0.177	0.214	< 0.218	< 0.211	< 0.289	< 0.511	--	< 1.11	< 1.17	< 1.52	< 0.192	< 0.182	< 0.185
Radium-228	pCi/L	NC	NA	NA	NA	1.23	< 0.735	< 0.562	< 0.606	< 0.485	0.810	< 0.423	< 1.07	--	< 0.972	< 1.85	< 1.73	< 0.538	< 0.379	< 0.513
Radium-226/228	pCi/L	5	NA	2.42	5	1.31	< 0.735	< 0.562	< 0.606	< 0.485	0.883	< 0.423	< 1.58	--	< 2.08	< 3.02	< 3.25	< 0.538	< 0.379	< 0.513
Selenium	ug/L	50	NA	3	50	< 1	1	< 1	< 1	< 1	1	8	2.3	--	1.2	1.2	2.6	5.2	2.6	4.7
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	–

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15015															
					Sample Date:	12/1/2015	2/18/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	7/12/2017	9/13/2017	9/13/2017	4/17/2018	6/13/2018	11/29/2018	4/11/2019	9/26/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient															
Appendix III														Field Dup		Field Dup					
Boron	ug/L	NC	NA	1,320	NA	1,190	1,170	963	614	656	662	599	489	678	433	374	–	398	505	630	510
Calcium	mg/L	NC	NA	259	NA	32.8	33.0	30.6	36.2	40.1	38.4	37.6	29.4	32.3	36.9	38.8	–	45.0	50.8	68	46
Chloride	mg/L	250*	NA	5,980	NA	21	22.0	21.6	20.4	19.5	19.2	22.7	20.1	20.0	20.3	20.3	–	19.5	17.8	20	17
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	7.8	6.56	8.34	13.9	9.26	10.4	13.8	18.8	17.9	16.1	15.6	–	12.6	13.2	88	69
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	220	200	190	180	180	200	190	166	190	192	274	–	316	238	360	250
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.6	7.4	7.4	7.4	7.8	7.7	7.6	8.4	–	8.7	--	8.3	7.9	7.8	7.6	8.4
Appendix IV																					
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	–	< 1.0	< 1.0	< 1.0	< 1.0	–
Arsenic	ug/L	10	NA	10	**10**	2	2	2	6	5	5	6	6.4	7.6	--	–	4.7	5.5	4.3	4.3	5.7
Barium	ug/L	2,000	NA	340	2,000	23	22	21	25	28	30	28	30.1	33.6	--	–	39.9	37.9	41.0	63	44
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	–	< 1.0	< 1.0	< 1.0	< 1.0	–
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	–	< 0.20	< 0.20	< 0.20	< 0.20	–
Chromium	ug/L	100	NA	3	100	< 1	< 1	1	1	< 1	< 1	< 1	< 1.0	< 1.0	--	–	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	–	< 15.0	< 15.0	< 6.0	< 6.0	–
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	–	< 1.0	< 1.0	< 1.0	< 1.0	–
Lithium	ug/L	NC	40	28	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	12	11	--	–	16	13	14	11	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	–	< 0.20	< 0.20	< 0.20	< 0.20	–
Molybdenum	ug/L	NC	100	9	**100**	17	14	17	11	10	9	11	11.9	13.0	--	–	9.4	7.0	7.2	11	< 10
Radium-226	pCi/L	NC	NA	NA	NA	< 0.193	< 0.157	< 0.242	< 0.133	< 0.378	< 0.166	< 0.340	< 0.832	< 0.698	--	–	< 0.467	< 0.475	< 0.677	< 0.224	< 0.165
Radium-228	pCi/L	NC	NA	NA	NA	< 0.578	< 0.577	< 0.521	< 0.467	0.850	< 0.408	< 0.420	< 0.799	< 0.748	--	–	< 0.730	< 0.763	< 1.07	< 0.518	< 0.491
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.578	< 0.577	< 0.521	< 0.467	0.85	< 0.408	< 0.42	< 1.63	< 1.45	--	–	< 1.20	< 1.24	< 1.75	< 0.518	< 0.491
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1.0	< 1.0	--	–	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	--	< 2.0	< 2.0	< 2.0	< 2.0	–

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15016													
					Sample Date:	12/1/2015	2/18/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	9/13/2017	4/17/2018	6/12/2018	11/29/2018	4/11/2019	9/26/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient													
Appendix III																			
Boron	ug/L	NC	NA	1,320	NA	108	119	86	100	88	92	83	85.9	83	--	76.6	80.8	110	100
Calcium	mg/L	NC	NA	259	NA	172	184	164	172	181	176	172	170	182	--	168	169	170	160
Chloride	mg/L	250*	NA	5,980	NA	200	204	203	165	204	196	200	10.4	226	--	197	201	190	230
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 20
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	980	1,000	980	920	930	990	1,000	1,050	995	--	986	968	1,000	980
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	6.6	6.5	6.4	6.3	6.4	6.4	6.6	6.4	6.6	6.8	6.5	6.6	6.4	6.6
Appendix IV																			
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	--
Arsenic	ug/L	10	NA	10	**10**	2	2	3	3	2	2	2	1.5	--	1.5	1.3	1.3	1.6	1.4
Barium	ug/L	2,000	NA	340	2,000	656	647	614	619	621	666	613	596	--	649	652	548	700	630
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	--
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	--
Chromium	ug/L	100	NA	3	100	2	3	3	4	3	3	3	1.9	--	2.1	2.0	2.3	2.3	2.4
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	--
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	--
Lithium	ug/L	NC	40	28	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	--
Molybdenum	ug/L	NC	100	9	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.263	1.51	1.31	1.50	1.06	1.17	1.60	1.30	--	1.56	< 0.810	1.75	1.18	1.31
Radium-228	pCi/L	NC	NA	NA	NA	2.29	2.32	1.69	1.68	1.68	2.37	2.06	1.06	--	2.08	1.81	2.20	1.76	1.97
Radium-226/228	pCi/L	5	NA	2.42	**5**	2.29	3.83	3	3.18	2.74	3.54	3.66	2.36	--	3.64	2.50	3.95	2.94	3.27
Selenium	ug/L	50	NA	3	50	2	4	2	7	1	2	2	3.6	--	1.5	1.4	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	--

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15017														
					Sample Date:	12/1/2015	2/18/2016	4/18/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017	9/13/2017	4/17/2018	6/12/2018	6/12/2018	11/29/2018	4/11/2019	9/26/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient														
Appendix III																	Field Dup			
Boron	ug/L	NC	NA	1,320	NA	59	90	66	76	78	76	75	75	82.8	–	83.8	79.0	73.2	100	93
Calcium	mg/L	NC	NA	259	NA	225	247	220	232	252	232	232	203	245	–	243	232	242	220	220
Chloride	mg/L	250*	NA	5,980	NA	200	201	184	204	182	192	187	199	224	–	224	224	193	210	250
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 20
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	850	1,100	1,200	1,100	1,100	1,200	1,100	1,230	1,130	--	1,120	1,170	1,110	1,200	1,200
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	6.5	6.4	6.4	6.4	6.4	6.6	6.5	6.4	6.5	6.8	6.5	–	6.7	6.4	6.6
Appendix IV																				
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	–
Arsenic	ug/L	10	NA	10	**10**	**13**	7	5	**12**	**12**	5	4	3	--	2.3	2.1	2.1	1.8	1.9	1.8
Barium	ug/L	2,000	NA	340	2,000	1,030	981	924	985	955	968	876	772	--	955	936	953	824	960	900
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	–
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	–
Chromium	ug/L	100	NA	3	100	4	4	4	9	11	5	5	5.3	--	3.4	3.4	3.3	3.1	2.9	3.4
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	–
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	–
Lithium	ug/L	NC	40	28	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	–
Molybdenum	ug/L	NC	100	9	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	1.61	2.38	2.18	1.91	1.94	1.82	1.56	1.97	--	2.23	2.13	2.87	1.93	1.52	1.42
Radium-228	pCi/L	NC	NA	NA	NA	2.69	2.97	3.50	3.98	2.50	3.15	2.78	2.78	--	2.93	3.30	2.72	3.19	3.93	2.75
Radium-226/228	pCi/L	5	NA	2.42	**5**	4.3	**5.35**	**5.68**	**5.89**	4.44	4.97	4.34	4.75	--	**5.16**	**5.43**	**5.59**	**5.12**	**5.46**	4.16
Selenium	ug/L	50	NA	3	50	3	4	3	8	2	2	3	2.7	--	1.7	2.4	2.5	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	–

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15018																
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	9/29/2016	2/14/2017	4/5/2017	7/11/2017	7/11/2017	9/13/2017	9/13/2017	4/18/2018	4/18/2018	6/12/2018	11/29/2018	4/11/2019	9/26/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient																
Appendix III														Field Dup		Field Dup		Field Dup				
Boron	ug/L	NC	NA	1,320	NA	487	526	478	399	438	479	493	538	446	492	502	–	--	559	488	640	550
Calcium	mg/L	NC	NA	259	NA	88.6	100	87.9	86.8	98.5	100	92.1	84.8	81.1	90.7	89.1	–	--	87.6	101	96	94
Chloride	mg/L	250*	NA	5,980	NA	38.0	38.0	40.8	39.3	37.5	43.6	44.4	53.4	52.6	49.1	50.2	–	--	48.9	49.1	59	55
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	< 2.0	< 2.0	–	--	< 2.0	< 2.0	< 2.0	< 20
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	290	400	430	390	410	450	410	420	438	392	380	–	–	598	426	480	430
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.0	6.9	6.8	6.5	6.5	6.7	6.8	6.8	–	6.8	--	6.9	--	6.8	6.9	6.8	6.9
Appendix IV																						
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Arsenic	ug/L	10	NA	10	**10**	1	< 1	< 1	2	< 1	< 1	< 1	< 1.0	< 1.0	--	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	155	149	139	133	143	171	149	153	143	--	–	139	141	156	127	150	140
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	–	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	--
Chromium	ug/L	100	NA	3	100	< 1	1	1	1	1	< 1	1	< 1.0	< 1.0	--	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	–	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	--
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Lithium	ug/L	NC	40	28	**40**	21.4	23.1	24	12	14	21	21	26	26	--	–	29	27	26	22	24	20
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	–	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	--
Molybdenum	ug/L	NC	100	9	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	–	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	0.227	0.394	0.430	0.234	0.522	0.363	< 0.314	< 0.479	< 1.02	--	–	< 0.843	0.290	< 0.756	< 0.842	0.316	0.511
Radium-228	pCi/L	NC	NA	NA	NA	< 0.586	0.778	0.649	0.845	0.803	0.996	1.08	< 0.767	< 0.950	--	–	0.869	0.622	1.39	< 0.997	0.598	0.846
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.586	1.17	1.08	1.08	1.33	1.36	1.37	< 1.25	< 1.97	--	–	1.59	0.912	1.77	< 1.84	0.915	1.36
Selenium	ug/L	50	NA	3	50	< 1	< 1	1	4	< 1	< 1	< 1	< 1.0	1	--	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	–	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	--

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15019														
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/13/2016	9/30/2016	2/15/2017	4/5/2017	7/11/2017	9/13/2017	4/18/2018	6/12/2018	11/30/2018	4/12/2019	4/12/2019	9/26/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient														
Appendix III																			Field Dup	
Boron	ug/L	NC	NA	1,320	NA	1,530	1,590	1,440	1,320	1,260	1,370	1,410	1,430	1,010	–	1,170	1,540	1,600	1,500	1,000
Calcium	mg/L	NC	NA	259	NA	84.6	93.6	83.0	90.0	92.6	91.8	92.8	90.1	107	–	97.7	98.2	97	94	100
Chloride	mg/L	250*	NA	5,980	NA	34	32.4	33.7	37.7	35.6	34.5	33.6	52.5	73.9	–	67.7	42.6	39	39	68
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 20
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	340	390	440	410	370	410	420	470	618	--	524	556	430	440	530
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.0	6.8	6.9	6.7	6.4	6.8	6.9	6.8	6.7	7.0	6.7	6.9	6.7	--	6.9
Appendix IV																				
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	–
Arsenic	ug/L	10	NA	10	**10**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	91	94	88	88	96	93	90	109	--	161	187	114	110	120	150
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	–
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	–
Chromium	ug/L	100	NA	3	100	< 1	< 1	1	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	–
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	–
Lithium	ug/L	NC	40	28	**40**	23.7	27.9	26	24	22	23	22	27	--	25	23	26	22	22	20
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	–
Molybdenum	ug/L	NC	100	9	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	0.333	0.279	0.465	0.282	0.315	0.329	< 0.36	< 0.620	--	< 0.717	< 0.594	< 0.880	0.246	< 0.197	0.443
Radium-228	pCi/L	NC	NA	NA	NA	< 0.484	< 0.567	0.532	< 0.718	< 0.739	1.80	0.872	< 1.02	--	< 0.742	1.36	1.16	0.548	< 0.513	0.651
Radium-226/228	pCi/L	5	NA	2.42	**5**	0.674	0.798	0.997	0.969	< 0.739	2.13	0.974	< 1.64	--	< 1.46	1.75	< 1.77	0.794	0.669	1.09
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	2	< 1	< 1	< 1	1.2	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	–

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
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-- - not analyzed.
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RSL - Regional Screening Level from 83 FR 36435.
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GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15020															
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	9/30/2016	2/15/2017	4/5/2017	7/11/2017	9/13/2017	4/18/2018	6/12/2018	6/12/2018	11/30/2018	11/30/2018	4/12/2019	9/26/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient															
Appendix III																	Field Dup		Field Dup		
Boron	ug/L	NC	NA	1,320	NA	630	738	638	603	608	621	667	618	745	--	708	699	721	930	700	830
Calcium	mg/L	NC	NA	259	NA	61	67.6	59.1	60.7	66.5	67.0	66.6	68.1	107	--	96.3	91.6	81.5	81.7	76	110
Chloride	mg/L	250*	NA	5,980	NA	39	35.4	34.3	69.6	33.5	33.3	33.9	45.7	87.8	--	92.1	92.0	49.6	49.6	45	130
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	2.2	2.34	< 2	< 2	< 2	< 2	< 2	< 2.0	3	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	2.9
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	320	310	320	310	310	330	320	388	608	--	622	508	428	382	400	660
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.3	7.2	7.0	6.9	6.9	7.0	7.1	7.0	6.8	7.0	6.7	--	6.9	--	6.8	6.8
Appendix IV																					
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Arsenic	ug/L	10	NA	10	**10**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	48	52	51	47	54	53	52	60.4	--	148	197	196	119	115	120	330
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	--
Chromium	ug/L	100	NA	3	100	< 1	2	< 1	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.1
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	--
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Lithium	ug/L	NC	40	28	**40**	15.1	17.8	16	14	14	14	14	18	--	16	16	16	20	20	15	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	--
Molybdenum	ug/L	NC	100	9	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.269	< 0.240	< 0.341	< 0.190	< 0.276	< 0.294	< 0.290	< 0.761	--	0.744	< 0.899	< 0.774	1.14	< 1.06	0.226	0.672
Radium-228	pCi/L	NC	NA	NA	NA	< 0.467	0.731	0.474	< 0.598	0.682	< 0.591	0.543	< 0.627	--	0.813	1.75	1.47	0.925	1.30	< 0.558	1.26
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.467	0.847	0.73	< 0.598	0.724	< 0.591	0.652	< 1.39	--	1.56	2.64	2.00	2.07	1.79	< 0.558	1.94
Selenium	ug/L	50	NA	3	50	< 1	1	< 1	2	< 1	< 1	< 1	1.4	--	< 1.0	< 1.0	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	--

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15021														
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/13/2016	10/5/2016	2/15/2017	4/6/2017	7/12/2017	9/13/2017	4/18/2018	6/12/2018	11/30/2018	4/12/2019	9/26/2019	9/26/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient														
Appendix III																				Field Dup
Boron	ug/L	NC	NA	1,320	NA	362	489	400	425	491	465	519	519	602	–	809	798	940	930	960
Calcium	mg/L	NC	NA	259	NA	86.4	98.5	89.6	97.4	96.9	97.9	96.3	86.8	91.3	–	89.4	96.6	93	92	95
Chloride	mg/L	250*	NA	5,980	NA	88	82.7	87.2	98.3	98.9	94.6	93.9	97.0	108	–	112	120	110	110	110
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 20	< 20
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	610	540	570	590	620	570	560	548	490	--	576	534	590	570	570
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	6.8	6.8	6.8	6.7	6.8	6.9	6.9	6.8	6.8	7.1	6.8	6.7	6.7	6.9	–
Appendix IV																				
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	–	–
Arsenic	ug/L	10	NA	10	**10**	3	1	1	2	2	2	2	1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	274	244	236	233	252	240	228	211	--	236	238	224	250	240	230
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	–	–
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	–	–
Chromium	ug/L	100	NA	3	100	< 1	2	2	2	1	2	2	< 1.0	--	< 1.0	1.1	< 1.0	1.2	1.2	1.1
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	–	–
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	--	–
Lithium	ug/L	NC	40	28	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 8.0	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	–	–
Molybdenum	ug/L	NC	100	9	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	0.569	0.629	0.563	0.429	0.483	0.524	< 0.215	< 0.768	--	< 0.461	< 0.689	1.49	0.531	0.794	0.460
Radium-228	pCi/L	NC	NA	NA	NA	0.984	0.782	0.846	0.871	1.52	< 0.582	< 0.354	< 0.697	--	< 1.50	1.60	1.12	0.783	0.738	0.587
Radium-226/228	pCi/L	5	NA	2.42	**5**	1.55	1.41	1.41	1.3	2	0.966	< 0.354	< 1.47	--	< 1.96	1.97	2.61	1.31	1.53	1.05
Selenium	ug/L	50	NA	3	50	1	2	1	4	< 1	< 1	1	1.6	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	–	–

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15022													
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	10/5/2016	2/15/2017	4/6/2017	7/12/2017	9/13/2017	4/18/2018	6/11/2018	11/27/2018	4/12/2019	9/25/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient													
Appendix III																			
Boron	ug/L	NC	NA	1,320	NA	250	388	387	362	391	394	434	478	833	–	1,170	3,840	6,800	10,000
Calcium	mg/L	NC	NA	259	NA	46.7	46.4	47.8	43.0	43.7	54.1	49.3	51.8	35.2	–	38.2	265	310	300
Chloride	mg/L	250*	NA	5,980	NA	25	18.7	17.6	16.8	17.1	18.2	18.6	22.1	23.3	–	21.5	23.1	19	24
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	39	38.3	29.9	34.3	32.8	34.1	32.8	45.9	44.1	–	24.1	953	1,100	1,200
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	270	210	250	250	210	250	230	254	266	–	210	1,670	1,900	1,900
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	8.3	8.5	8.2	8.2	8.1	7.8	8.1	8.4	7.6	7.8	8.3	7.8	7.7	7.5
Appendix IV																			
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	1.9	< 1.0	< 1.0	< 1.0	--
Arsenic	ug/L	10	NA	10	**10**	6	7	8	8	6	4	4	5.8	--	< 1.0	1.1	< 1.0	1.4	4.0
Barium	ug/L	2,000	NA	340	2,000	139	119	155	116	119	137	129	138	--	102	104	242	190	130
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	–
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	–
Chromium	ug/L	100	NA	3	100	< 1	1	2	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	–
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	–
Lithium	ug/L	NC	40	28	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	13	11	25	23	22
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	–
Molybdenum	ug/L	NC	100	9	**100**	22	16	11	17	19	12	14	13.6	--	< 5.0	< 5.0	47.6	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	0.246	< 0.242	< 0.247	< 0.150	< 0.346	< 0.217	< 0.291	< 0.468	--	0.666	< 0.708	< 0.596	< 0.182	0.261
Radium-228	pCi/L	NC	NA	NA	NA	< 0.484	< 0.450	0.740	< 0.472	< 0.514	< 0.477	0.709	< 0.799	--	< 0.644	< 0.742	< 0.807	< 0.470	0.617
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.484	< 0.45	0.812	< 0.472	< 0.514	< 0.477	0.862	< 1.27	--	1.13	< 1.45	< 1.40	< 0.470	0.877
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	–

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15023													
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	10/5/2016	2/15/2017	4/5/2017	7/11/2017	9/13/2017	4/18/2018	6/11/2018	11/29/2018	4/12/2019	9/26/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient													
Appendix III																			
Boron	ug/L	NC	NA	1,320	NA	414	284	267	308	526	484	1,590	701	504	–	1,650	1,350	2,600	1,000
Calcium	mg/L	NC	NA	259	NA	59.7	59.4	53.3	54.1	64.0	59.9	74.5	50.8	60.9	–	98.9	116	120	100
Chloride	mg/L	250*	NA	5,980	NA	30	26.9	24.6	28.7	24.8	23.8	24.6	26.8	25.5	–	19.4	17.0	16	16
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	20	26.5	28.9	25.0	24.3	21.0	22.5	22.6	36.2	–	139	156	140	130
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	240	270	270	290	290	280	300	290	408	–	474	530	600	490
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.4	7.5	7.5	7.5	7.4	7.6	7.6	7.6	7.6	7.6	7.4	7.5	7.0	7.5
Appendix IV																			
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	--
Arsenic	ug/L	10	NA	10	**10**	2	2	1	3	2	2	< 1	1.9	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	340	2,000	57	48	43	40	47	42	46	38.0	--	97.1	87.8	90.4	100	92
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	–
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	–
Chromium	ug/L	100	NA	3	100	< 1	< 1	2	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	–
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	–
Lithium	ug/L	NC	40	28	**40**	12.1	10.6	< 10	< 10	< 10	< 10	11	< 10	--	19	18	20	31	13
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	–
Molybdenum	ug/L	NC	100	9	**100**	8	6	< 5	7	6	6	< 5	6.0	--	< 5.0	7.1	6.6	< 5.0	5.1
Radium-226	pCi/L	NC	NA	NA	NA	0.232	< 0.237	< 0.242	0.226	< 0.309	0.257	0.455	< 0.889	--	< 0.572	< 0.958	< 0.537	0.181	0.209
Radium-228	pCi/L	NC	NA	NA	NA	< 0.530	0.426	< 0.456	< 0.545	< 0.355	< 0.400	0.963	< 0.636	--	< 0.749	< 0.891	< 1.18	0.771	< 0.400
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 0.53	0.599	< 0.456	< 0.545	< 0.355	0.426	1.42	< 1.53	--	< 1.32	< 1.85	< 1.72	0.952	0.527
Selenium	ug/L	50	NA	3	50	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	–

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-17001								BCC-MW-17002						
					Sample Date:	12/7/2017	2/20/2018	6/15/2018	8/6/2018	11/29/2018	11/29/2018	4/11/2019	9/26/2019	12/7/2017	2/20/2018	6/15/2018	8/6/2018	11/29/2018	4/11/2019	9/26/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	Shallow 2017 Wells														
											Field Dup									
Appendix III																				
Boron	ug/L	NC	NA	1,320	NA	991	827	1,100	1,220	1,480	1,550	1,700	1,800	8,280	12,800	13,300	9,440	9,030	9,200	13,000
Calcium	mg/L	NC	NA	259	NA	118	118	124	117	135	134	130	120	178	201	224	194	197	220	200
Chloride	mg/L	250*	NA	5,980	NA	27.3	28.5	29.1	29.1	29.0	29.2	31	28	15.3	14.2	13.2	15.4	16.8	15	12
Fluoride	ug/L	4,000	NA	1,000	NA	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	< 1,000	< 1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	156	135	90.8	18.7	148	140	64	17	330	325	332	226	402	690	540
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	558	552	566	476	568	554	570	490	726	892	936	740	800	1,000	860
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.1	7.0	7.2	6.9	7.3	--	6.9	7.0	7.0	7.1	7.2	7.1	7.0	6.6	7.3
Appendix IV																				
Antimony	ug/L	6	NA	1	6	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	–	1.5	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	–
Arsenic	ug/L	10	NA	10	**10**	5.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**45.5**	2.0	2.6	3.8	2.0	1.6	1.8
Barium	ug/L	2,000	NA	340	2,000	85.6	71.3	65.8	73.8	74.4	70.6	82	81	148	76.7	62.8	57.6	97.7	130	75
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	–
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	–
Chromium	ug/L	100	NA	3	100	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	--	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	–
Fluoride	ug/L	4,000	NA	1,000	4,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	< 1,000	< 1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	–
Lithium	ug/L	NC	40	28	**40**	**55**	**73**	**65**	**62**	**64**	**63**	**43**	**60**	**75**	**160**	**150**	**130**	**120**	**100**	**140**
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	–	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	–
Molybdenum	ug/L	NC	100	9	**100**	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	30.1	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.509	< 0.890	< 0.766	< 0.616	< 0.942	< 0.754	0.314	0.260	< 1.03	< 1.07	< 0.757	0.306	< 0.968	0.233	0.501
Radium-228	pCi/L	NC	NA	NA	NA	< 0.830	< 0.901	< 0.947	< 0.822	0.989	1.20	< 0.413	0.821	< 0.996	< 3.77	< 2.35	1.25	2.01	< 0.598	< 0.527
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 1.34	< 1.79	< 1.71	< 1.44	< 1.69	< 1.45	0.721	1.08	< 2.03	< 4.84	< 3.11	1.56	2.29	0.688	0.702
Selenium	ug/L	50	NA	3	50	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	1.1	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	–

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-17003								BCC-MW-17004							
					Sample Date:	12/7/2017	2/20/2018	6/15/2018	8/7/2018	8/7/2018	11/29/2018	4/12/2019	9/26/2019	12/6/2017	2/20/2018	6/15/2018	8/7/2018	11/30/2018	4/12/2019	4/12/2019	9/26/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	Shallow 2017 Wells															
Appendix III										Field Dup										Field Dup	
Boron	ug/L	NC	NA	1,320	NA	413	394	369	383	377	410	380	350	367	429	525	425	601	440	450	570
Calcium	mg/L	NC	NA	259	NA	74.3	55.7	63.2	74.6	76.9	88.7	78	82	53.7	48.1	73.1	68.9	116	67	71	66
Chloride	mg/L	250*	NA	5,980	NA	18.3	21.5	22.7	21.9	21.8	19.1	17	23	21.3	21.3	21.4	21.2	18.7	19	20	16
Fluoride	ug/L	4,000	NA	1,000	NA	<1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	< 1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	48.4	< 2.0	< 2.0	17.7	25.9	49.6	12	37	< 2.0	< 2.0	8.3	< 2.0	166	7.8	7.5	3.1
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	324	330	412	326	324	362	360	380	228	238	410	320	500	330	340	300
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.0	7.2	7.4	7.3	--	7.3	7.1	7.5	7.2	7.3	7.4	7.3	7.3	7.5	–	7.6
Appendix IV																					
Antimony	ug/L	6	NA	1	6	1.1	< 1.0	< 1.0	< 2.0	< 2.0	< 1.0	< 1.0	–	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	–
Arsenic	ug/L	10	NA	10	**10**	**26**	< 1.0	< 1.0	1.0	1.1	< 1.0	3.8	9.4	2.5	1.8	1.1	< 1.0	2.1	1.7	1.7	< 1.0
Barium	ug/L	2,000	NA	340	2,000	128	78.1	66.5	77.9	83.3	92.7	83	93	145	116	175	148	252	150	150	140
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	–
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	–	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	–
Chromium	ug/L	100	NA	3	100	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	–	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	–
Fluoride	ug/L	4,000	NA	1,000	4,000	<1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	< 1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	–	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	–
Lithium	ug/L	NC	40	28	**40**	19	17	13	18	18	19	15	14	< 10	< 10	< 10	< 10	14	< 8.0	8.0	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	–	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	–
Molybdenum	ug/L	NC	100	9	**100**	48.8	6.3	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	9.9	5.9	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.889	< 0.755	< 0.594	< 0.687	0.353	< 0.685	0.205	0.347	< 0.945	< 0.723	< 0.441	< 0.519	< 0.766	0.182	< 0.203	0.271
Radium-228	pCi/L	NC	NA	NA	NA	< 0.663	< 0.707	< 0.828	0.932	< 0.871	< 0.695	< 0.483	< 0.521	< 0.804	< 0.719	< 0.810	1.03	< 0.790	0.539	< 0.623	< 0.546
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 1.55	< 1.46	< 1.42	< 1.49	< 1.03	< 1.38	0.539	0.676	< 1.75	< 1.44	< 1.25	< 1.46	< 1.56	0.721	0.638	< 0.546
Selenium	ug/L	50	NA	3	50	< 1.0	2.2	< 1.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	–	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	–

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to September 2019
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-17005											BCC-MW-17006						
					Sample Date:	12/6/2017	12/6/2017	2/20/2018	2/20/2018	6/15/2018	6/15/2018	8/7/2018	11/30/2018	4/12/2019	9/26/2019	9/26/2019	12/6/2017	2/20/2018	6/15/2018	8/7/2018	11/30/2018	4/12/2019	9/26/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	Shallow 2017 Wells																	
Appendix III							Field Dup		Field Dup		Field Dup					Field Dup							
Boron	ug/L	NC	NA	1,320	NA	191	208	238	228	377	353	342	350	400	490	520	569	594	653	765	630	650	600
Calcium	mg/L	NC	NA	259	NA	51.9	54.0	54.2	53.1	71.2	71.1	68.1	68.1	69	120	120	106	95.0	97.5	90.4	99.8	150	130
Chloride	mg/L	250*	NA	5,980	NA	19.4	19.4	21.6	21.3	20.5	20.5	19.6	18.5	15	17	17	19.0	20.3	20.9	21.5	20.4	19	18
Fluoride	ug/L	4,000	NA	1,000	NA	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	< 1,000	< 1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	200	NA	11.5	11.00	< 2.0	< 2.0	9.6	9.0	4.3	42.1	120	65	64	129	93.1	69.8	46.2	102	290	220
Total Dissolved Solids	mg/L	500*	NA	5,170	NA	262	220	310	266	358	416	318	318	380	550	520	474	472	478	438	432	800	680
pH, Field	SU	6.5 - 8.5*	NA	6.6 - 8.3	NA	7.3	--	7.3	--	7.4	--	7.3	7.6	7.5	7.3	--	7.7	7.3	7.5	7.5	7.7	7.5	7.8
Appendix IV																							
Antimony	ug/L	6	NA	1	6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	--
Arsenic	ug/L	10	NA	10	10	2.9	2.8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	4.9	2.4	4.6	< 1.0	6.6	5.9	4.3
Barium	ug/L	2,000	NA	340	2,000	168	167	123	128	161	149	179	131	84	340	350	83.3	79.0	70.3	73	68.6	120	98
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	--
Chromium	ug/L	100	NA	3	100	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.1	3.8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.2
Cobalt	ug/L	NC	6	15	15	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	--	--	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	--
Fluoride	ug/L	4,000	NA	1,000	4,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	< 1,000	< 1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	2	15	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Lithium	ug/L	NC	40	28	**40**	10	12	11	11	< 10	< 10	13	11	< 8.0	14	14	38	37	31	36	32	35	28
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	--
Molybdenum	ug/L	NC	100	9	**100**	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.863	1.56	< 0.804	0.910	< 0.692	< 0.610	0.440	< 0.592	0.270	0.497	0.481	< 0.930	< 0.766	< 0.862	< 0.582	1.13	< 0.225	0.497
Radium-228	pCi/L	NC	NA	NA	NA	< 0.722	< 0.649	< 0.904	< 0.945	< 0.796	< 0.853	< 0.741	< 0.656	< 0.479	< 0.564	0.596	< 0.833	< 0.716	< 0.888	< 0.757	1.06	< 0.556	< 0.437
Radium-226/228	pCi/L	5	NA	2.42	**5**	< 1.59	< 1.61	< 1.71	< 1.80	< 1.49	< 1.46	< 1.15	< 1.25	0.700	0.739	1.08	< 1.76	< 1.48	< 1.75	< 1.34	2.19	< 0.556	0.819
Selenium	ug/L	50	NA	3	50	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	--	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	--

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Technical Memorandum

Sanitas™ Output Files

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[DRAFT - ELECTRONIC REVIEW]

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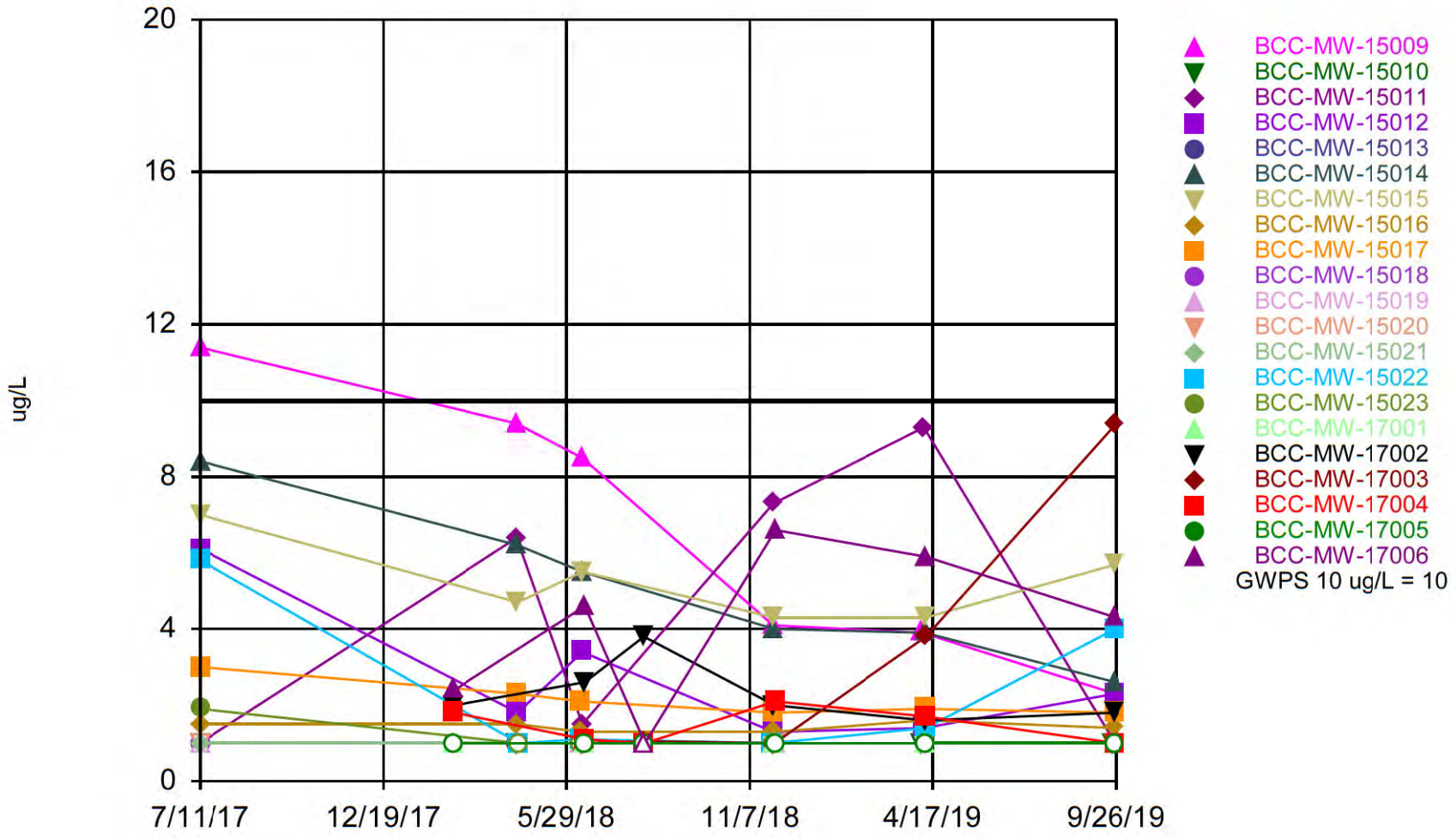
Hollow symbols indicate censored values.

Time Series

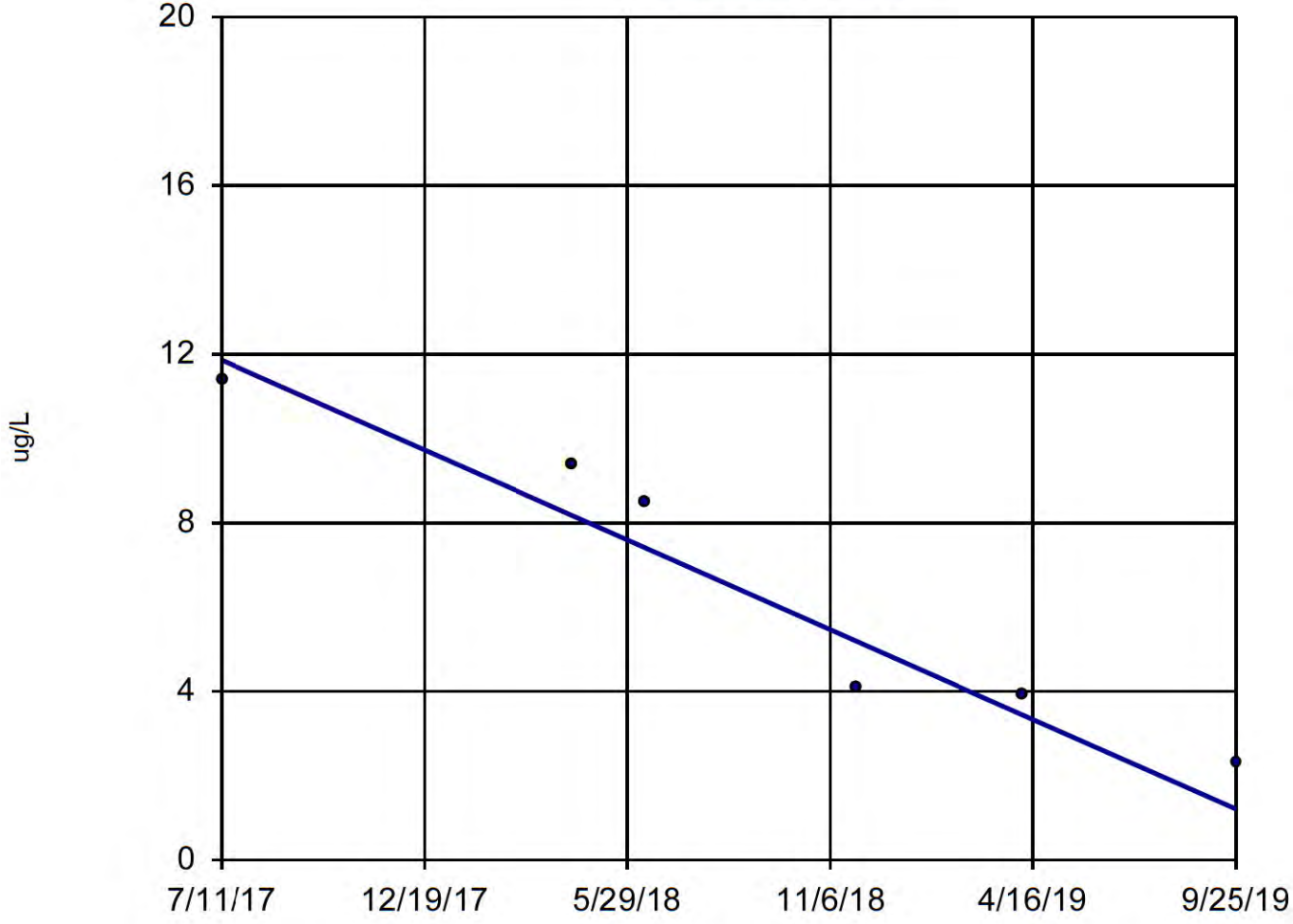


Constituent: Arsenic, Total Analysis Run 12/9/2019 8:05 AM

Client: Consumers Energy Data: BCC_Sanitas_19.11.06

Sen's Slope Estimator

BCC-MW-15009



n = 6

Slope = -4.825 units per year.

Mann-Kendall statistic = -15
critical = -13

Decreasing trend significant at 98% confidence level (α = 0.01 per tail).

Constituent: Arsenic, Total Analysis Run 11/7/2019 10:22 AM

Client: Consumers Energy Data: BCC_Sanitas_19.11.06

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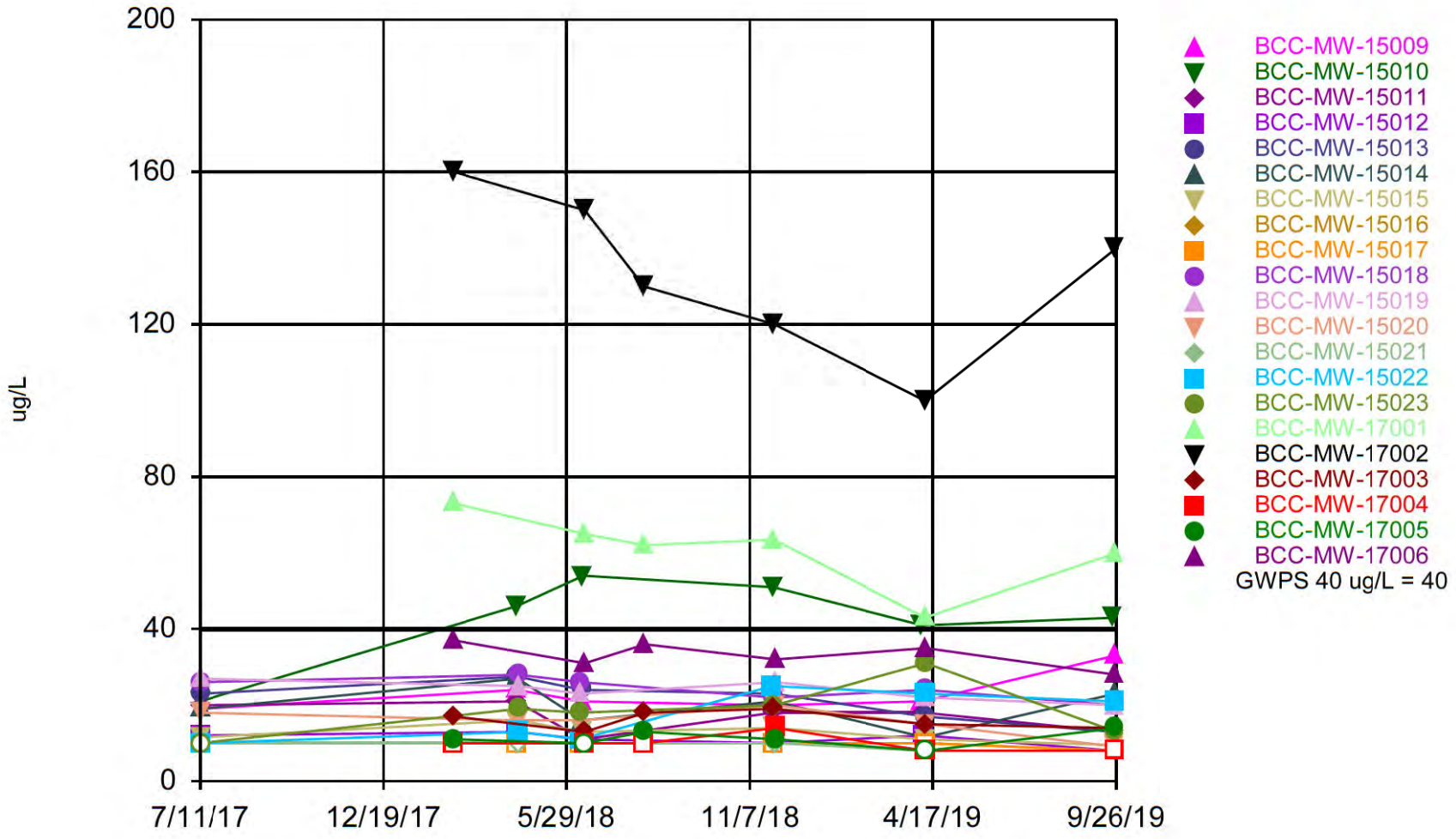
Time Series

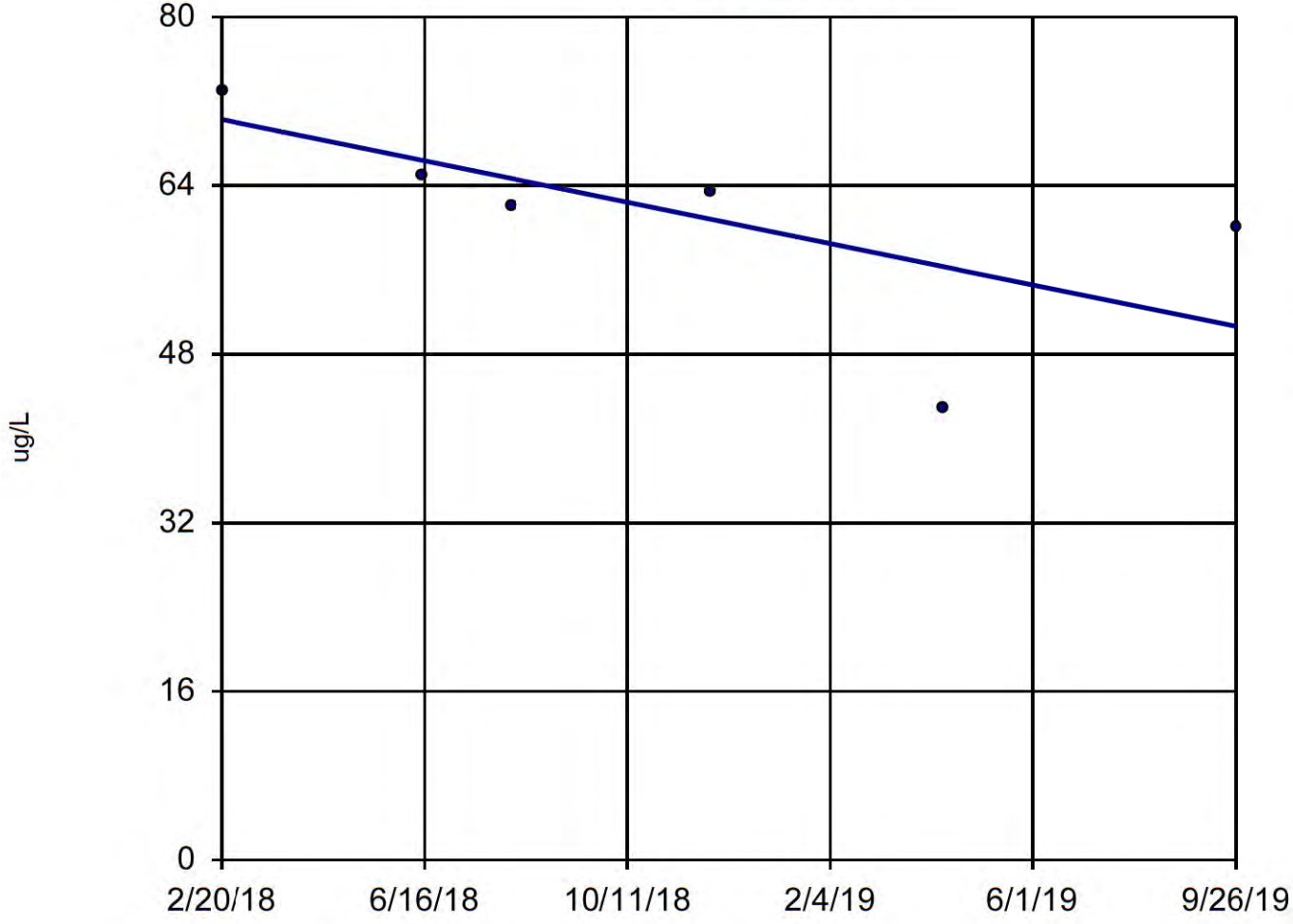


Constituent: Lithium, Total Analysis Run 12/9/2019 8:06 AM

Client: Consumers Energy Data: BCC_Sanitas_19.11.06

Sen's Slope Estimator

BCC-MW-17001



n = 6

Slope = -12.3 units per year.

Mann-Kendall statistic = -11
critical = -13

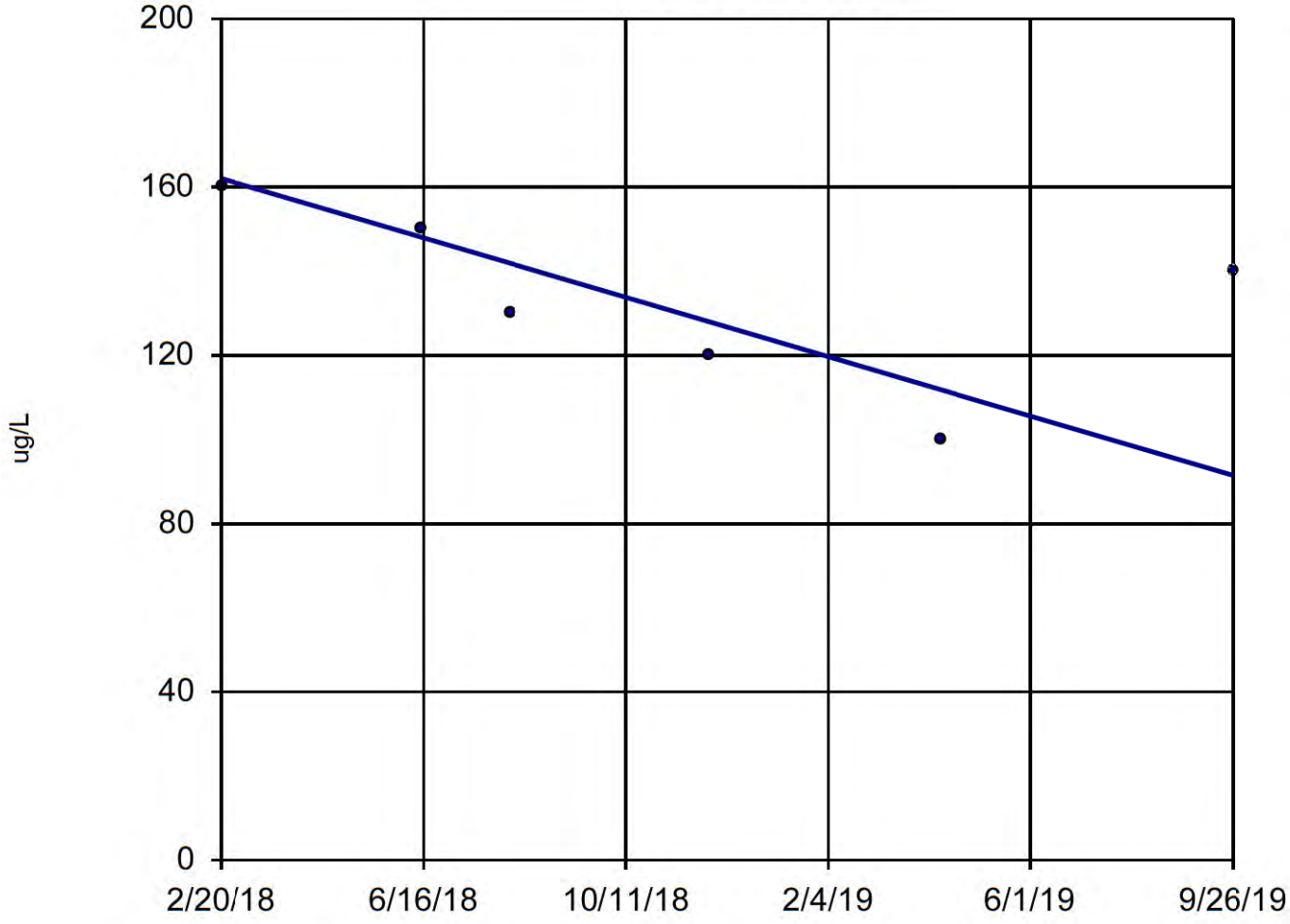
Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: Lithium, Total Analysis Run 11/7/2019 10:25 AM

Client: Consumers Energy Data: BCC_Sanitas_19.11.06

Sen's Slope Estimator

BCC-MW-17002



n = 6

Slope = -44.15 units per year.

Mann-Kendall statistic = -9
critical = -13

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

Constituent: Lithium, Total Analysis Run 11/7/2019 10:24 AM

Client: Consumers Energy Data: BCC_Sanitas_19.11.06

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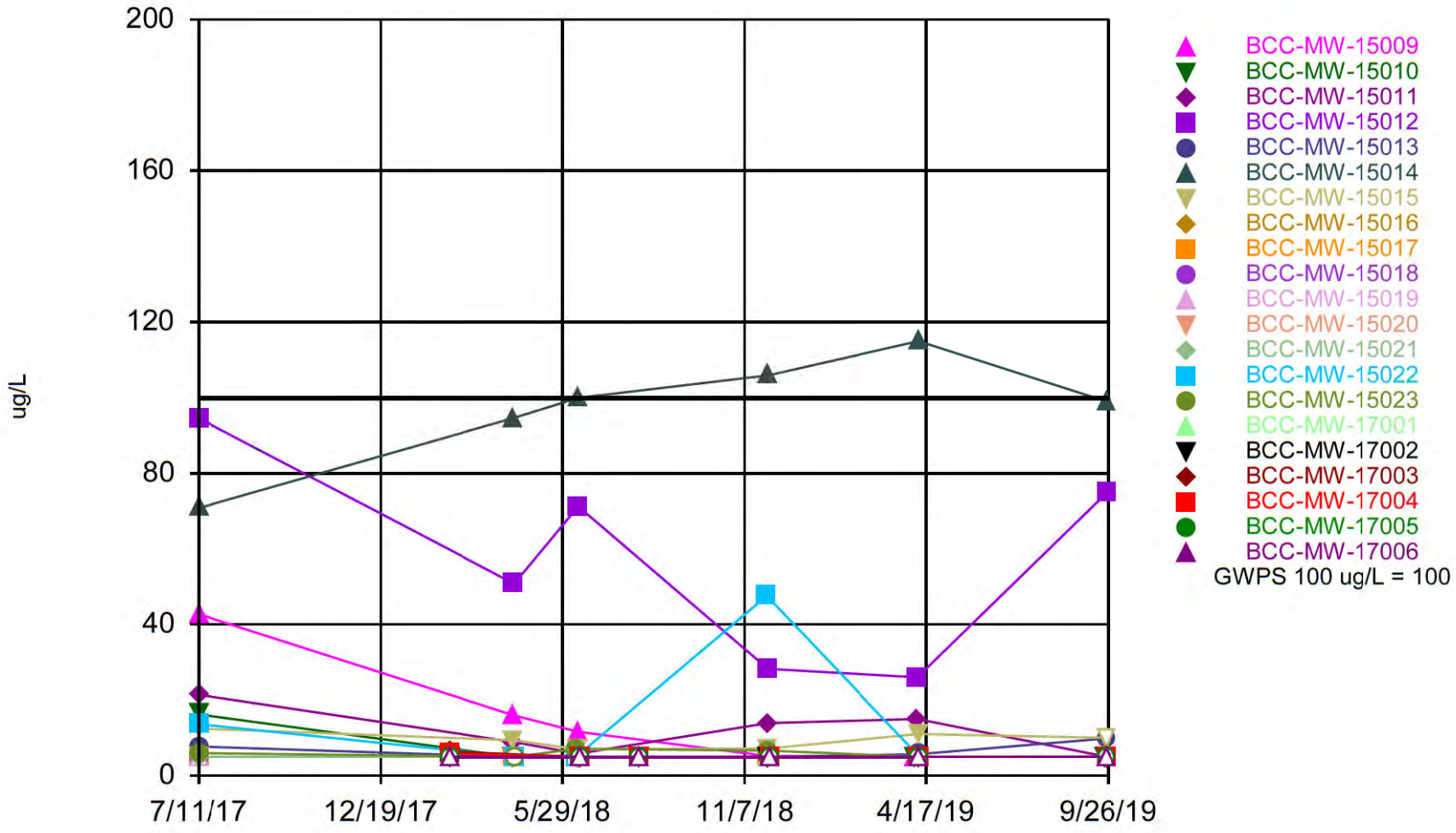
Time Series

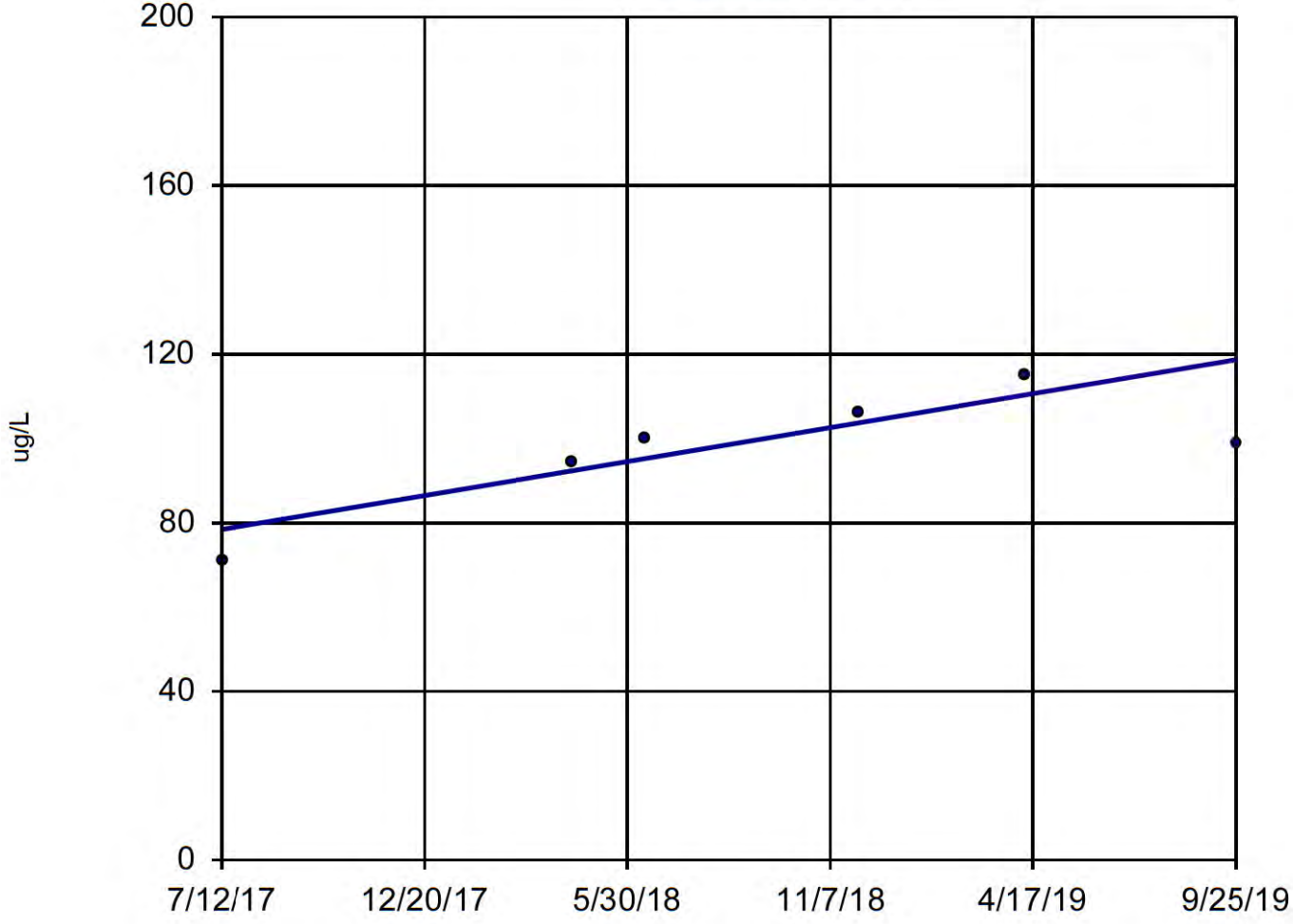


Constituent: Molybdenum, Total Analysis Run 12/9/2019 8:07 AM

Client: Consumers Energy Data: BCC_Sanitas_19.11.06

Sen's Slope Estimator

BCC-MW-15014



n = 6

Slope = 18.25 units per year.

Mann-Kendall statistic = 9
critical = 13

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

Constituent: Molybdenum, Total Analysis Run 11/7/2019 10:25 AM

Client: Consumers Energy Data: BCC_Sanitas_19.11.06

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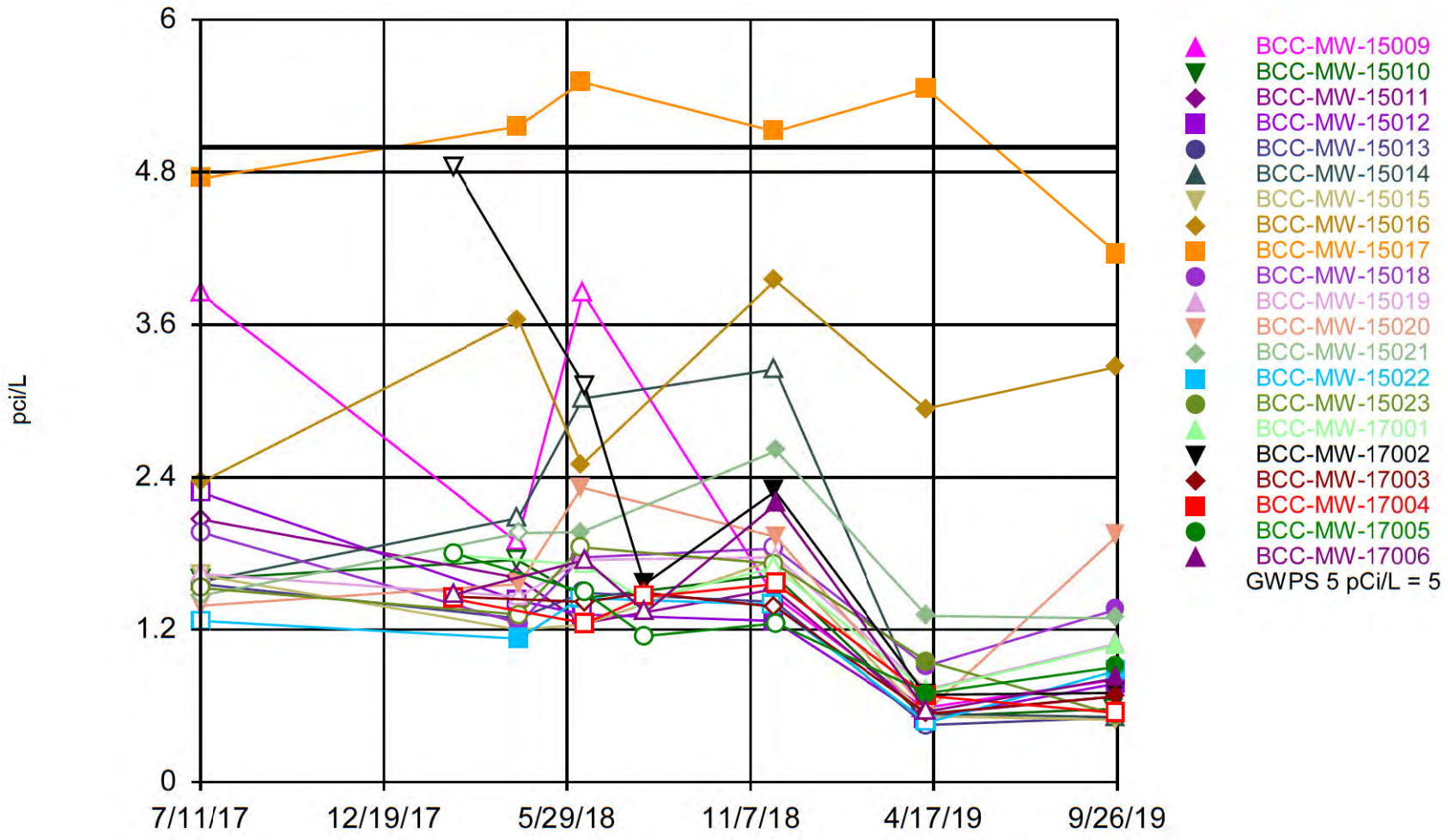
Hollow symbols indicate censored values.

Time Series



Constituent: Radium-226/228 Analysis Run 12/9/2019 8:07 AM

Client: Consumers Energy Data: BCC_Sanitas_19.11.06

Summary Report

Constituent: Arsenic, Total Analysis Run 12/9/2019 8:08 AM
Client: Consumers Energy Data: BCC_Sanitas_19.11.06

For observations made between 7/11/2017 and 9/26/2019, a summary of the selected data set:

Observations = 126
ND/Trace = 62
Wells = 21
Minimum Value = 1
Maximum Value = 11.4
Mean Value = 2.379
Median Value = 1.025
Standard Deviation = 2.266
Coefficient of Variation = 0.9525
Skewness = 1.893

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	6	0	2.3	11.4	6.6	6.3	3.647	0.5526	0.111
BCC-MW-15010	6	6	1	1	1	1	0	0	NaN
BCC-MW-15011	6	2	1	9.3	4.417	3.95	3.686	0.8347	0.1909
BCC-MW-15012	6	0	1.3	6.1	2.717	2.05	1.826	0.6721	1.191
BCC-MW-15013	6	6	1	1	1	1	0	0	NaN
BCC-MW-15014	6	0	2.6	8.4	5.1	4.75	2.057	0.4034	0.4693
BCC-MW-15015	6	0	4.3	7	5.25	5.1	1.043	0.1986	0.6931
BCC-MW-15016	6	0	1.3	1.6	1.433	1.45	0.1211	0.08449	0.05482
BCC-MW-15017	6	0	1.8	3	2.15	2	0.4593	0.2136	1.166
BCC-MW-15018	6	6	1	1	1	1	0	0	NaN
BCC-MW-15019	6	6	1	1	1	1	0	0	NaN
BCC-MW-15020	6	6	1	1	1	1	0	0	NaN
BCC-MW-15021	6	5	1	1	1	1	0	0	NaN
BCC-MW-15022	6	2	1	5.8	2.383	1.25	2.036	0.8543	0.9279
BCC-MW-15023	6	5	1	1.9	1.15	1	0.3674	0.3195	1.789
BCC-MW-17001	6	6	1	1	1	1	0	0	NaN
BCC-MW-17002	6	0	1.6	3.8	2.3	2	0.8075	0.3511	1.199
BCC-MW-17003	6	3	1	9.4	2.875	1.025	3.386	1.178	1.427
BCC-MW-17004	6	2	1	2.1	1.45	1.4	0.4764	0.3286	0.2188
BCC-MW-17005	6	6	1	1	1	1	0	0	NaN
BCC-MW-17006	6	1	1	6.6	4.133	4.45	2.111	0.5106	-0.3575

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Lithium, Total Analysis Run 12/9/2019 8:08 AM
Client: Consumers Energy Data: BCC_Sanitas_19.11.06

For observations made between 7/11/2017 and 9/26/2019, a summary of the selected data set:

Observations = 126
ND/Trace = 27
Wells = 21
Minimum Value = 8
Maximum Value = 160
Mean Value = 25.7
Median Value = 18
Standard Deviation = 27.78
Coefficient of Variation = 1.081
Skewness = 3.143

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	6	0	19	33	23	21	5.177	0.2251	1.412
BCC-MW-15010	6	0	21	54	42.67	44.5	11.67	0.2736	-1.116
BCC-MW-15011	6	0	11	21	16.83	18	3.971	0.2359	-0.5164
BCC-MW-15012	6	1	8	13	11	11.5	1.789	0.1626	-0.6889
BCC-MW-15013	6	0	13	27.5	21.25	23	5.27	0.248	-0.5427
BCC-MW-15014	6	0	11.5	27	19.58	20	5.426	0.2771	-0.1696
BCC-MW-15015	6	0	9.5	16	12.5	12.25	2.324	0.1859	0.2619
BCC-MW-15016	6	6	8	10	9.667	10	0.8165	0.08447	-1.789
BCC-MW-15017	6	6	8	10	9.667	10	0.8165	0.08447	-1.789
BCC-MW-15018	6	0	20	28	24.33	25	2.944	0.121	-0.3053
BCC-MW-15019	6	0	20	27	23.83	24	2.639	0.1107	-0.233
BCC-MW-15020	6	0	9.1	20	15.68	16	3.688	0.2352	-0.8417
BCC-MW-15021	6	6	8	10	9.333	10	1.033	0.1107	-0.7071
BCC-MW-15022	6	1	10	25	17.17	17	6.585	0.3836	0.04646
BCC-MW-15023	6	1	10	31	18.5	18.5	7.232	0.3909	0.6812
BCC-MW-17001	6	0	43	73	61.08	62.75	9.922	0.1624	-0.9303
BCC-MW-17002	6	0	100	160	133.3	135	21.6	0.162	-0.3381
BCC-MW-17003	6	0	13	19	16	16	2.366	0.1479	0
BCC-MW-17004	6	4	8	14	10	10	2.191	0.2191	1
BCC-MW-17005	6	2	8	14	11.17	11	2.137	0.1914	-0.09978
BCC-MW-17006	6	0	28	37	33.17	33.5	3.43	0.1034	-0.3498

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Molybdenum, Total Analysis Run 12/9/2019 8:08 AM
Client: Consumers Energy Data: BCC_Sanitas_19.11.06

For observations made between 7/11/2017 and 9/26/2019, a summary of the selected data set:

Observations = 126
ND/Trace = 87
Wells = 21
Minimum Value = 5
Maximum Value = 115
Mean Value = 13.51
Median Value = 5
Standard Deviation = 23.34
Coefficient of Variation = 1.728
Skewness = 3.067

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	6	2	5	42.75	14.26	8.4	14.67	1.029	1.444
BCC-MW-15010	6	5	5	16.2	6.867	5	4.572	0.6659	1.789
BCC-MW-15011	6	1	5	21.4	11.67	11.4	6.283	0.5385	0.3984
BCC-MW-15012	6	0	26	94.5	57.65	61.05	27.41	0.4754	0.005288
BCC-MW-15013	6	2	5	9.9	6.383	5.35	2.015	0.3157	1.004
BCC-MW-15014	6	0	70.9	115	97.6	99.5	14.85	0.1521	-0.8822
BCC-MW-15015	6	1	7	12.45	9.508	9.7	2.133	0.2243	0.0183
BCC-MW-15016	6	6	5	5	5	5	0	0	NaN
BCC-MW-15017	6	6	5	5	5	5	0	0	NaN
BCC-MW-15018	6	6	5	5	5	5	0	0	NaN
BCC-MW-15019	6	6	5	5	5	5	0	0	NaN
BCC-MW-15020	6	6	5	5	5	5	0	0	NaN
BCC-MW-15021	6	6	5	5	5	5	0	0	NaN
BCC-MW-15022	6	4	5	47.6	13.53	5	17.04	1.259	1.641
BCC-MW-15023	6	2	5	7.1	5.8	5.55	0.9099	0.1569	0.3926
BCC-MW-17001	6	6	5	5	5	5	0	0	NaN
BCC-MW-17002	6	6	5	5	5	5	0	0	NaN
BCC-MW-17003	6	5	5	6.3	5.217	5	0.5307	0.1017	1.789
BCC-MW-17004	6	5	5	5.9	5.15	5	0.3674	0.07134	1.789
BCC-MW-17005	6	6	5	5	5	5	0	0	NaN
BCC-MW-17006	6	6	5	5	5	5	0	0	NaN

[DRAFT - ELECTRONIC REVIEW]

Summary Report

Constituent: Radium-226/228 Analysis Run 12/9/2019 8:08 AM
Client: Consumers Energy Data: BCC_Sanitas_19.11.06

For observations made between 7/11/2017 and 9/26/2019, a summary of the selected data set:

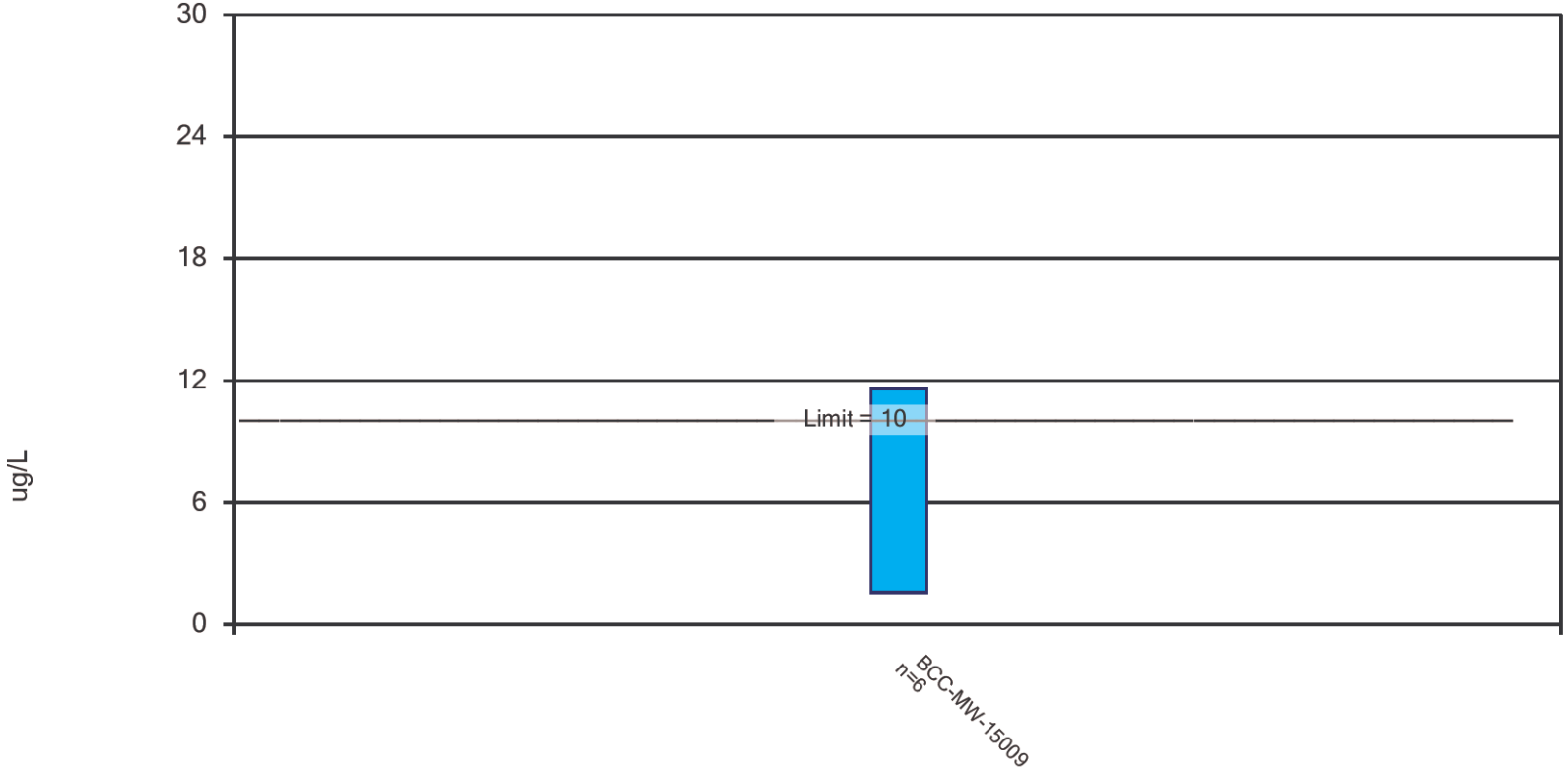
Observations = 126
ND/Trace = 76
Wells = 21
Minimum Value = 0.45
Maximum Value = 5.51
Mean Value = 1.681
Median Value = 1.46
Standard Deviation = 1.101
Coefficient of Variation = 0.6549
Skewness = 1.721

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
BCC-MW-15009	6	5	0.583	3.85	2.075	1.68	1.452	0.6996	0.4009
BCC-MW-15010	6	6	0.516	1.75	1.254	1.525	0.5563	0.4436	-0.6195
BCC-MW-15011	6	5	0.532	2.07	1.276	1.385	0.5862	0.4594	-0.08447
BCC-MW-15012	6	3	0.4995	2.28	1.263	1.295	0.6141	0.4864	0.4716
BCC-MW-15013	6	5	0.45	1.56	1.12	1.355	0.5045	0.4506	-0.6157
BCC-MW-15014	6	6	0.513	3.25	1.83	1.83	1.18	0.6447	0.01386
BCC-MW-15015	6	6	0.491	1.75	1.138	1.22	0.5355	0.4705	-0.2286
BCC-MW-15016	6	0	2.36	3.95	3.11	3.105	0.6286	0.2021	0.08107
BCC-MW-15017	6	0	4.16	5.51	5.027	5.14	0.5051	0.1005	-0.8071
BCC-MW-15018	6	2	0.915	1.97	1.518	1.565	0.4078	0.2687	-0.3221
BCC-MW-15019	6	3	0.7315	1.77	1.407	1.55	0.4155	0.2953	-0.7295
BCC-MW-15020	6	2	0.558	2.32	1.616	1.745	0.612	0.3786	-0.7493
BCC-MW-15021	6	2	1.29	2.61	1.768	1.715	0.5126	0.2899	0.6169
BCC-MW-15022	6	4	0.47	1.45	1.1	1.2	0.3712	0.3376	-0.7937
BCC-MW-15023	6	4	0.527	1.85	1.317	1.425	0.4998	0.3797	-0.5496
BCC-MW-17001	6	4	0.721	1.79	1.405	1.565	0.4236	0.3015	-0.7095
BCC-MW-17002	6	2	0.688	4.84	2.198	1.925	1.597	0.7263	0.6534
BCC-MW-17003	6	4	0.539	1.49	1.161	1.4	0.4324	0.3725	-0.7156
BCC-MW-17004	6	5	0.546	1.56	1.156	1.345	0.4346	0.376	-0.5797
BCC-MW-17005	6	4	0.7	1.8	1.217	1.2	0.3954	0.325	0.1841
BCC-MW-17006	6	4	0.556	2.19	1.356	1.41	0.5991	0.4419	-0.02322

[DRAFT - ELECTRONIC REVIEW]

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Arsenic, Total Analysis Run 12/11/2019 3:01 PM

Client: Consumers Energy Data: BCC_Sanitas_19.11.06

Confidence Interval

Constituent: Arsenic, Total (ug/L) Analysis Run 12/11/2019 3:02 PM

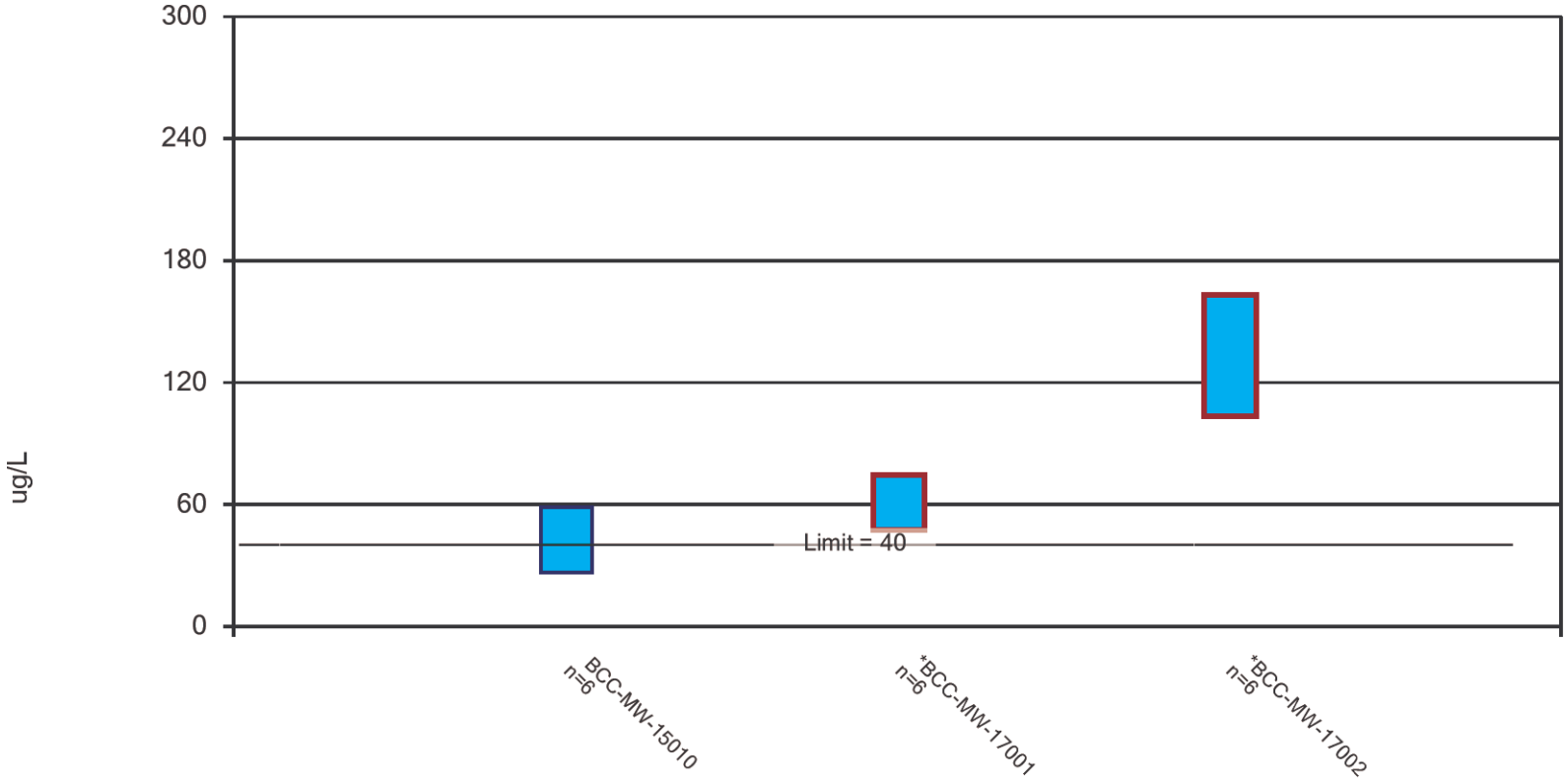
Client: Consumers Energy Data: BCC_Sanitas_19.11.06

	BCC-MW-15009
7/11/2017	11.4 (D)
4/16/2018	9.4
6/13/2018	8.5
11/28/2018	4.1
4/9/2019	3.9
9/25/2019	2.3
Mean	6.6
Std. Dev.	3.647
Upper Lim.	11.61
Lower Lim.	1.589

[DRAFT - ELECTRONIC REVIEW]

Parametric Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Lithium, Total Analysis Run 11/7/2019 12:48 PM

Client: Consumers Energy Data: BCC_Sanitas_19.11.06

Confidence Interval

Constituent: Lithium, Total (ug/L) Analysis Run 11/7/2019 12:48 PM

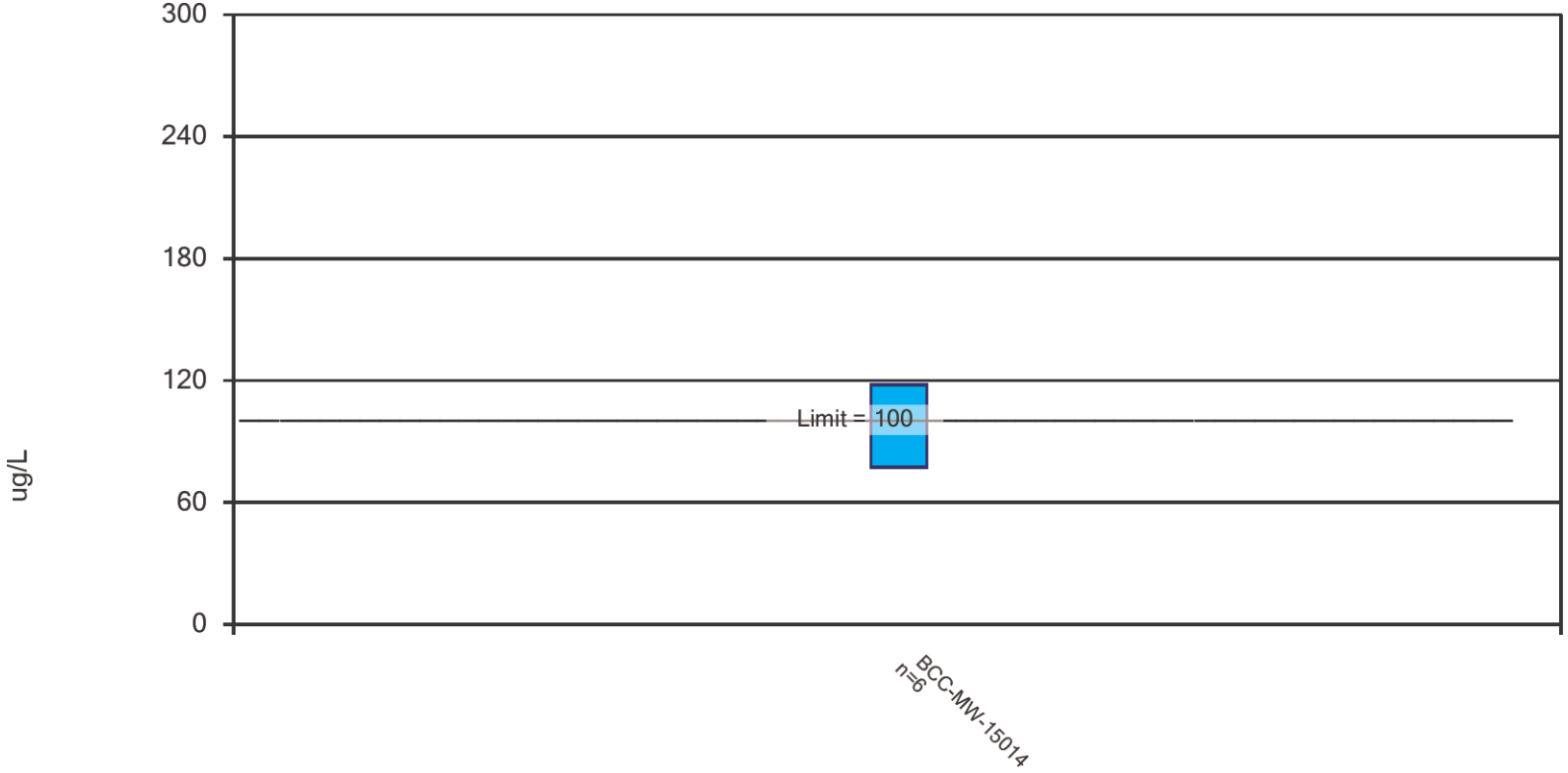
Client: Consumers Energy Data: BCC_Sanitas_19.11.06

	BCC-MW-15010	BCC-MW-17001	BCC-MW-17002
7/11/2017	21		
2/20/2018		73	160
4/16/2018	46		
6/14/2018	54		
6/15/2018		65	150
8/6/2018		62	130
11/28/2018	51		
11/29/2018		63.5 (D)	120
4/9/2019	41		
4/11/2019		43	100
9/24/2019	43		
9/26/2019		60	140
Mean	42.67	61.08	133.3
Std. Dev.	11.67	9.922	21.6
Upper Lim.	58.7	74.71	163
Lower Lim.	26.63	47.45	103.7

[DRAFT - ELECTRONIC REVIEW]

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Molybdenum, Total Analysis Run 11/7/2019 12:50 PM

Client: Consumers Energy Data: BCC_Sanitas_19.11.06

Confidence Interval

Constituent: Molybdenum, Total (ug/L) Analysis Run 11/7/2019 12:50 PM

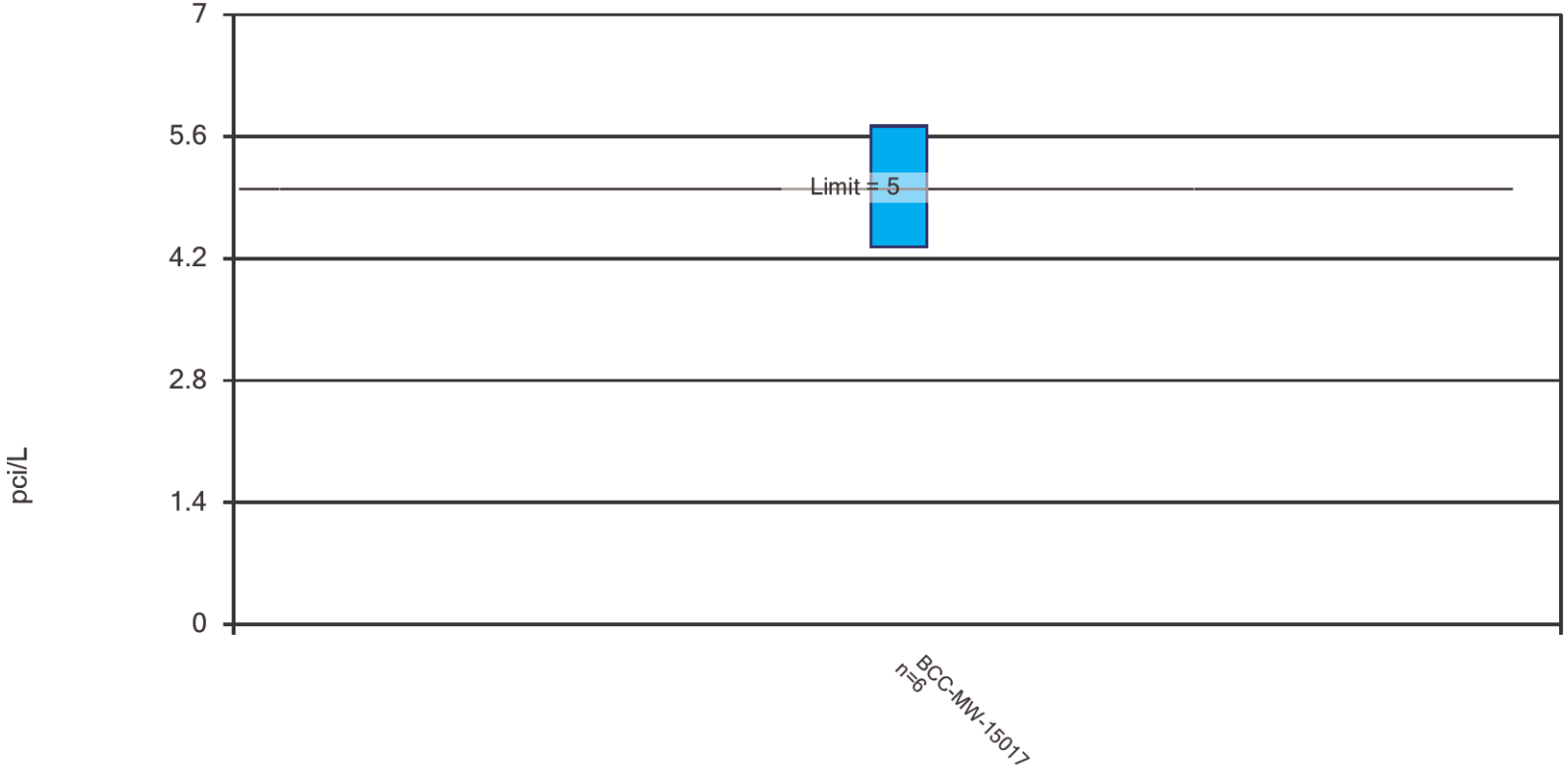
Client: Consumers Energy Data: BCC_Sanitas_19.11.06

	BCC-MW-15014
7/12/2017	70.9
4/17/2018	94.7
6/13/2018	100
11/29/2018	106
4/11/2019	115 (D)
9/25/2019	99
Mean	97.6
Std. Dev.	14.85
Upper Lim.	118
Lower Lim.	77.2

[DRAFT - ELECTRONIC REVIEW]

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Radium-226/228 Analysis Run 11/7/2019 12:49 PM

Client: Consumers Energy Data: BCC_Sanitas_19.11.06

Confidence Interval

Constituent: Radium-226/228 (pci/L) Analysis Run 11/7/2019 12:49 PM

Client: Consumers Energy Data: BCC_Sanitas_19.11.06

	BCC-MW-15017
7/12/2017	4.75
4/17/2018	5.16
6/12/2018	5.51 (D)
11/29/2018	5.12
4/11/2019	5.46
9/26/2019	4.16
Mean	5.027
Std. Dev.	0.5051
Upper Lim.	5.721
Lower Lim.	4.333

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Appendix F
ACM Extension Certification

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Consumers Energy
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A CMS Energy Company

Date: July 12, 2019

To: Operating Record

From: Harold D. Register, Jr., P.E.

RE: Demonstration for 60-Day Extension for Assessment of Corrective Measures
Professional Engineer Certification
BC Cobb Bottom Ash Pond and BC Cobb Ponds 0-8

Professional Engineer Certification Statement [§257.96(a)]

Consumers Energy has determined that the analysis of the effectiveness of potential corrective measures in meeting all of the requirements and objectives of a selected remedy described in §257.97 cannot be achieved within the 90-day timeline to complete the Assessment of Corrective Measures for BC Cobb Bottom Ash Pond and BC Cobb Ponds 0-8 due to site-specific conditions that are changing based on initiating closure activities. Notification was made on March 30, 2018 that closure activities had been initiated. Groundwater monitoring data collected to date indicates changing conditions that can influence factors that must be considered in the assessment, including source evaluation, plume delineation, groundwater assessment, and source control. The final published rule allows for a single 60 day extension based on site-specific conditions or circumstances.

I hereby attest that, having reviewed the detection and assessment monitoring documentation and being familiar with the provisions of Title 40 of the Code of Federal Regulations §257.96, that the demonstration justifying a 60-day time extension to the 90-day completion period of the Assessment of Corrective Measures is accurate for BC Cobb Bottom Ash Pond and BC Cobb Ponds 0-8 in accordance with the requirements of §257.96(a). This will now set the deadline for completing the Assessment of Corrective Measures for September 11, 2019.

Harold D. Register Jr.

Signature

STATE OF MICHIGAN
HAROLD D. REGISTER, JR.
ENGINEER
No. 6201056266
LICENSED PROFESSIONAL ENGINEER

July 12, 2019

Date of Certification

Harold D. Register, Jr., P.E.

Name

07/12/2019

6201056266

Professional Engineer Certification Number

[DRAFT - ELECTRONIC REVIEW]

Appendix G
Semiannual Progress Report

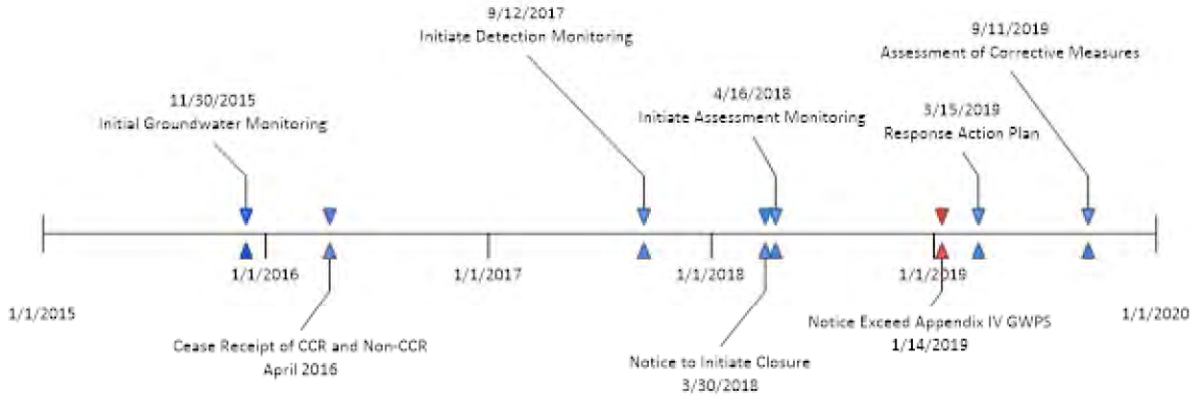
[DRAFT - ELECTRONIC REVIEW]

Initial Semiannual Progress Report - Selection of Final Remedy

BC Cobb Bottom Ash Pond and Ponds 0-8 CCR Units
Michelle Marion, Consumers Energy
January 30, 2020

This Semi-annual Progress Report, prepared as a requirement of §257.97(a) of the federal Coal Combustion Residual (CCR Rule), describes progress toward selecting and designing the final remedy for CCR units that triggered Assessment of Corrective Measures (ACM) under the CCR Rule: the BC Cobb Bottom Ash Pond and Ponds 0-8 (BCC Ponds). A progress report is required to be prepared semiannually upon completion of the Assessment of Corrective Measures Report until the final remedy is selected.

As presented in the key milestones timeline below, a groundwater monitoring system was installed for the BCC Ponds and background monitoring commenced in December 2015. Consumers Energy Company (CEC) first reported the potential for statistically significant increases (SSIs) for Appendix IV constituents in the *"Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g)"* (CEC, January 2019). Subsequently, the Assessment of Corrective Measures Report (TRC, September 2019) was completed on September 11, 2019.



[DRAFT - ELECTRONIC REVIEW]

Source Control Measures Undertaken

In 2018, CEC placed the February 2018 Closure Plan, prepared and certified by Golder Associates, Inc. in the Operating record and provided formal Notification of Intent to Initiate Closure on March 30, 2018 confirming that CEC plans to close the BCC Ponds under the CCR Rule's closure by removal provision in §257.102(c). Consumers Energy also submitted a closure work plan to the Michigan Department of Environmental Quality, now the Department of Environment, Great Lakes, and Energy, who approved it on October 16, 2018 and clarified the workplan on August 13, 2018 and September 20, 2019. Excavation of CCR removal is planned to commence in 2020; with elements of construction such as design, permitting, and procurement having already commenced. Removal activities are planned to be completed and documented in an excavation completion report by 2023.

Results of 2019 Semi-Annual Sampling Events

The statistical assessments from both 2019 semiannual groundwater monitoring events have confirmed that lithium is the only Appendix IV constituent present at statistically significant levels above the Groundwater Protection Standard (GWPS). Although lithium concentrations exceed the site-specific GWPS in on-site groundwater, the property containing the site is owned and operated by Consumers Energy and on-site groundwater is not used for drinking water. Additionally, concentrations of lithium are below applicable State of Michigan unrestricted cleanup criteria. The nearest off-site drinking water well is more than 2,000 feet away on the other side of the North Branch of the Muskegon River. Groundwater chemistry already appears to be improving as a result of discontinuing the hydraulic loading to BCC Ponds and is expected to further improve following the completed source removal of CCR.

Progress Towards Remedy Selection

Consumers Energy first provided the Michigan Department of Environment, Great Lakes, and Energy (EGLE) a Response Action Plan prepared in accordance with Part 115 on March 15, 2019 after calculating a potential SSI for lithium at BCC Ponds. This report documents identified potential sources of contamination, interim response activities taken to control possible sources of contamination, and a schedule for terminating receipt of waste and initiating closure of the BCC Ponds. This report was approved by EGLE on May 14, 2019. CEC also committed to initiate an Assessment of Corrective Measures (ACM) which was submitted to EGLE on September 11, 2019. This ACM stated that Consumers Energy plans to use an adaptive management strategy that includes measures to remove source material, reduce infiltration, and/or minimize the potential future migration.

Source removal is schedule to begin in 2020 and will consist of dewatering to allow for excavation of the vertical and lateral extent of waste CCR. The reduction of hydraulic loading and recharge of the aquifer are expected to have changed groundwater redox conditions (e.g. from aerobic to anaerobic) and the physical removal of CCR is expected to further improve groundwater quality. It is anticipated that the remedy selection process for addressing affected groundwater will proceed following the implementation of the CCR source material

[DRAFT - ELECTRONIC REVIEW]

management strategies. Additionally, CEC will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98, which includes semiannual assessment monitoring in accordance with §257.95 to monitor groundwater conditions and inform the remedy selection. The final remedy will be formally selected per §257.97 once the selected option is reviewed and commented on by EGLE and a public meeting is conducted at least 30-days prior to the final selection as required under §257.96(e).

References

Consumer Energy Company. March 30, 2018. Notification of Intent to Close Two CCR Units. B.C. Cobb Generating Facility Bottom Ash Pond and Ponds 0-8 Closure Plan, Muskegon, Michigan. Prepared for Consumers Energy Company.

Consumer Energy Company. January 15, 2019. Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g). B.C. Cobb Generating Facility Bottom Ash Pond and Ponds 0-8, Muskegon, Michigan. Prepared for Consumers Energy Company.

Golder Associates Inc. February 2018. BC Cobb Generating Facility Bottom Ash Pond and Ponds 0-8 Closure Plan, Muskegon, Michigan. Prepared for Consumers Energy Company.

Golder Associates Inc. 2018, May 30, 2018 clarified October 16, 2018 and September 20, 2019. BC Cobb Ponds 0-8 and Bottom Ash Closure Work Plan, Muskegon, Michigan. Prepared for Consumers Energy Company.

TRC Environmental Corporation. September 11, 2019. Assessment of Corrective Measures, Consumers Energy, Former BC Cobb Power Plant, Bottom Ash Pond & Ponds 0-8, Muskegon, Michigan. Prepared for Consumers Energy Company.

[DRAFT - ELECTRONIC REVIEW]

Annual Groundwater Monitoring Report

Former BC Cobb Power Plant
Bottom Ash Pond & Ponds 0-8 CCR Unit
Muskegon, Michigan

January 2018

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Annual Groundwater Monitoring Report

Former BC Cobb Power Plant
Bottom Ash Pond & Ponds 0-8 CCR Unit

Muskegon, Michigan

January 2018

Prepared For
Consumers Energy Company

Sarah B. Holmstrom, P.G.
Project Hydrogeologist

Vincent E. Buening, C.P.G.
Sr. Project Manager

TRC | Consumers Energy Company
Final
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[DRAFT - ELECTRONIC REVIEW]

Table of Contents

Executive Summary iii

1. Introduction 1
   - 1.1 Program Summary 1
   - 1.2 Site Overview 1
   - 1.3 Geology/Hydrogeology 2

2. Groundwater Monitoring 4
   - 2.1 Monitoring Well Network 4
   - 2.2 Background Sampling 4
   - 2.3 Semiannual Groundwater Monitoring 5
     - 2.3.1 Data Summary 5
     - 2.3.2 Data Quality Review 5
     - 2.3.3 Groundwater Flow Rate and Direction 5

3. Statistical Evaluation 7
   - 3.1 Establishing Background Limits 7
   - 3.2 Data Comparison to Background Limits 7

4. Conclusions and Recommendations 8

5. References 9

List of Tables

Table 1 Summary of Groundwater Elevation Data – September 2017
Table 2 Summary of Groundwater Sampling Results (Analytical) – September 2017
Table 3 Summary of Field Parameter Results – September 2017
Table 4 Comparison of Appendix III Parameter Results to Background Limits – September 2017

List of Figures

Figure 1 Site Location Map
Figure 2 Site Plan With CCR Monitoring Well Locations
Figure 3 Groundwater Contour Map – September 13, 2017

[DRAFT - ELECTRONIC REVIEW]

List of Appendices

Appendix A	Background Data
Appendix B	Data Quality Review
Appendix C	Statistical Background Limits

[DRAFT - ELECTRONIC REVIEW]

Executive Summary

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule). The CCR Rule, which became effective on October 19, 2015, applies to the Consumers Energy Company (CEC) Bottom Ash Pond and Ponds 0-8 (BCC Ponds) at the former BC Cobb Power Plant Site (the Site). The BCC Ponds are monitored using a multiunit groundwater monitoring system (in accordance with 40 CFR §257.91). Pursuant to the CCR Rule, no later than January 31, 2018, and annually thereafter, the owner or operator of a CCR unit must prepare an annual groundwater monitoring and corrective action report for the CCR unit documenting the status of groundwater monitoring and corrective action for the preceding year in accordance with §257.90(e).

TRC Environmental Corporation (TRC) prepared this Annual Groundwater Monitoring Report for the BCC Ponds CCR unit on behalf of CEC. This Annual Report was prepared in accordance with the requirements of §257.90(e) and presents the monitoring results and the statistical evaluation of the detection monitoring parameters (Appendix III to Part 257 of the CCR Rule) for the September 2017 semiannual groundwater monitoring event for the BCC Ponds CCR unit. This event is the initial detection monitoring event performed to comply with §257.94. As part of the statistical evaluation, the data collected during detection monitoring events are evaluated to identify statistically significant increases (SSIs) in detection monitoring parameters to determine if concentrations in detection monitoring well samples exceed background levels.

Potential SSIs over background limits were noted for boron, fluoride and pH in one or more downgradient wells for the September 2017 monitoring event. This is the initial detection monitoring event; therefore, it is the initial identification of a SSI over background levels. According to §257.94(e), if the facility determines, pursuant to §257.93(h), that there is a SSI over background levels for one or more of the Appendix III constituents, the facility will, within 90 days of detecting a SSI, establish an assessment monitoring program **<or>** demonstrate that:

- A source other than the CCR unit caused the SSI, or
- The SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

In response to the potential SSIs over background limits noted during September 2017, CEC plans to prepare an Alternative Source Demonstration (ASD) to evaluate whether a source other than the CCR unit caused the SSIs prior to initiating assessment monitoring.

[DRAFT - ELECTRONIC REVIEW]

Section 1
Introduction

1.1 Program Summary

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule). The CCR Rule, which became effective on October 19, 2015, applies to the Consumers Energy Company (CEC) Bottom Ash Pond and Ponds 0-8 (BCC Ponds) at the former BC Cobb Power Plant Site (the Site). The BCC Ponds are monitored using a multiunit groundwater monitoring system (in accordance with 40 CFR §257.91). Pursuant to the CCR Rule, no later than January 31, 2018, and annually thereafter, the owner or operator of a CCR unit must prepare an annual groundwater monitoring and corrective action report for the CCR unit documenting the status of groundwater monitoring and corrective action for the preceding year in accordance with §257.90(e).

TRC Environmental Corporation (TRC) prepared this Annual Groundwater Monitoring Report (Annual Report) for the BCC Ponds CCR unit on behalf of CEC. This Annual Report was prepared in accordance with the requirements of §257.90(e) and presents the monitoring results and the statistical evaluation of the detection monitoring parameters (Appendix III to Part 257 of the CCR Rule) for the September 2017 semiannual groundwater monitoring event for the BCC Ponds CCR unit. This event is the initial detection monitoring event performed to comply with §257.94. The monitoring was performed in accordance with the *BC Cobb Monitoring Program Sample Analysis Plan* (SAP) (ARCADIS, 2016) and statistically evaluated per the *Groundwater Statistical Evaluation Plan* (Stats Plan) (TRC, October 2017). As part of the statistical evaluation, the data collected during detection monitoring events are evaluated to identify statistically significant increases (SSIs) of detection monitoring parameters compared to background levels.

1.2 Site Overview

The former BC Cobb coal-fired power generation facility is located east of Muskegon Lake, south of Cedar Creek, northwest of the CSX rail line, and west of the Muskegon River marsh in Muskegon, Michigan (Figure 1). The plant began generating electricity in 1948, and plant operations ceased in April 2016. There are two RCRA CCR units associated with the plant—the Bottom Ash Pond and Ponds 0-8, both of which are wet ash dewatering areas. From 1984 through plant closure in 2016, CCR have been deposited in the ash ponds by utilizing sluicing methods. Some of the CCR was periodically removed from the ponds and transported by truck to the JH Campbell Type III landfill (West Olive, Michigan) for disposal or were commercially marketed for beneficial reuse to the extent possible. Site features are shown on Figure 2.

[DRAFT - ELECTRONIC REVIEW]

1.3 Geology/Hydrogeology

The majority of the BCC Ponds CCR unit is comprised of surficial CCR and sand fill. USGS topographic maps and aerial photographs dating back to 1929, in addition to field descriptions of subsurface soil at the site, indicate that the area currently occupied by the ash ponds was originally marsh land. The subsurface materials encountered in the pond area generally consist of CCR ranging from 3 to 28 feet below ground surface (ft bgs) overlying 10 to 20 feet of poorly graded, fine-grained sand. Discontinuous layers of organic materials (i.e., humus) and peat (on the order of 0.5 to 1.0 feet thick), and organic-rich zones or sand and silt are present within the fine-grained sand. Organic-rich silt was also encountered at 20 to 30 ft bgs, beneath the fine-grained sand, ranging in thickness from approximately 1 to 13 feet. Silty clay and/or poorly graded, fine- to medium-grained sand is generally observed within 30 to 40 ft bgs, beneath the organic-rich silt. An underlying gray clay was encountered throughout the pond area at approximately 40 ft bgs, beneath the fine to medium-grained sand.

Bedrock and quaternary geologic maps of Michigan and local water well records indicate that 120 to 190 feet of glacio-lacustrine sand, gravel, moraine and lacustrine clay deposits are present throughout Muskegon County. These lacustrine deposits are situated on top of the sandstone bedrock that is part of the Marshall Formation, typically encountered at approximately 200 to 250 ft bgs throughout Muskegon County. Glacial moraine deposits are more prevalent in the northern and eastern portions of the County, while glacio-lacustrine sands dominate in the western and southern areas surrounding Muskegon Lake, and the area approaching Lake Michigan. The site is located in the central area of the County.

The BCC Ponds CCR unit is bound by several surface water features (Figure 2): the North Channel Muskegon River and former plant-associated discharge channel adjoin the northwestern and southernmost boundaries of the pond area, and Veterans Memorial Pond (at the time of the September 2017 monitoring event, Veteran Memorial Pond was separated from the River by a weir, drained, and undergoing construction, but as of the report completion date, is no longer drained and construction appears to be mostly complete) is located northeast of the pond area, approximately 100 feet northeast of Michigan Highway 120.

Groundwater flow within the uppermost aquifer varies between early CCR monitoring at the Site before plant operations ceased in April 2016 and the post-shutdown period when sluicing operations had ended. In general, groundwater is typically encountered at a similar or slightly higher elevation relative to the surrounding surface water features, flowing outward toward the bounding surface water features. While the ponds were actively receiving CCR and non-CCR wastewater, groundwater in the pond area was several feet higher than surrounding surface water and upgradient groundwater, creating a mound in the BCC Ponds CCR unit.

[DRAFT - ELECTRONIC REVIEW]

Based on the hydrogeology at the Site, particularly the conductive properties of the sandy aquifer, the proximity of the BCC Ponds CCR unit to the surrounding surface water bodies, and consistent groundwater flow direction toward the adjacent surface water bodies, an inter-well statistical approach is recommended for detection monitoring as outlined in the Stats Plan.

[DRAFT - ELECTRONIC REVIEW]

Section 2
Groundwater Monitoring

2.1 Monitoring Well Network

A groundwater monitoring system has been established for the BCC Ponds CCR unit, which established the monitoring well locations for detection monitoring. The detection monitoring well network for the BCC Ponds CCR unit currently consists of 22 monitoring wells that are screened in the uppermost aquifer. The monitoring well locations are shown on Figure 2. Monitoring wells BCC-MW-15002 through BCC-MW-15008 are located southwest of the BCC Ponds and provide data on background groundwater quality that has not been affected by the CCR unit (total of 7 background wells). Monitoring wells BCC-MW-15009 through BCC-MW-15023 are located downgradient of the BCC Ponds CCR unit (total of 15 downgradient wells). As shown on Figure 2, monitoring well BCC-MW-15001 is used for water level measurements only. Monitoring well BCC-MW-15001 was excluded from the background data set due to the presence of significant amounts of surficial CCR recorded in the boring log at that location.

2.2 Background Sampling

Background groundwater monitoring was conducted at the BCC Ponds CCR unit from November 2015 through July 2017 in accordance with the SAP. Data collection included eight rounds (Rounds 1 through 8) of static water elevation measurements, analysis for parameters required in the CCR Rule's Appendix III and Appendix IV to Part 257, and field parameters (dissolved oxygen, oxidation reduction potential, pH, specific conductivity, temperature, and turbidity) from all 23 monitoring wells installed at the site. The Rounds 1 through 7 groundwater samples were collected and analyzed by CEC's Laboratory Services, Jackson, Michigan. Round 8 groundwater sampling was conducted by TRC the week of July 11, 2017, and analyzed by Pace Analytical Services, LLC (Pace). Background data are included in Appendix A Tables 1 through 3, where: Table 1 is a summary of static water elevation data; Table 2 is a summary of groundwater analytical data compared to potentially relevant criteria; and Table 3 is a summary of field data.

In addition to the data tables, groundwater contour maps were developed for each of the background events to evaluate groundwater flow directions. The contour maps for each background monitoring event are also included in Appendix A as Figures 1 through 8.

[DRAFT - ELECTRONIC REVIEW]

2.3 Semiannual Groundwater Monitoring

The semiannual monitoring parameters for the detection groundwater monitoring program were selected per the CCR Rule's Appendix III to Part 257 – Constituents for Detection Monitoring. The Appendix III indicator parameters consist of boron, calcium, chloride, fluoride, pH (field reading), sulfate, and total dissolved solids (TDS) and were analyzed in accordance with the SAP. In addition to pH, the collected field parameters included dissolved oxygen, oxidation reduction potential, specific conductivity, temperature, and turbidity.

2.3.1 Data Summary

The initial semiannual groundwater detection monitoring event for 2017 was performed during September 12 through 14, 2017, by TRC personnel and samples were analyzed by Pace in accordance with the SAP. Static water elevation data were collected at all monitoring well locations. Groundwater samples were collected from the seven background monitoring wells and 15 downgradient monitoring wells for the Appendix III indicator parameters and field parameters. A summary of the groundwater data collected during the September 2017 event is provided on Table 1 (static groundwater elevation data), Table 2 (analytical results), and Table 3 (field data).

2.3.2 Data Quality Review

Data from each round were evaluated for completeness, overall quality and usability, method-specified sample holding times, precision and accuracy, and potential sample contamination. The data were found to be complete and usable for the purposes of the CCR monitoring program. Particular data non-conformances are summarized in Appendix B.

2.3.3 Groundwater Flow Rate and Direction

Groundwater elevation data collected during the most recent background sampling events (post-April 2016) showed that groundwater is typically encountered at a similar or slightly higher elevation relative to the surrounding surface water features, flowing outward toward the bounding surface water features. Groundwater elevations measured during the September 2017 sampling event are provided on Table 1 and were used to construct a groundwater contour map (Figure 3).

The map indicates that current groundwater flow continues to radiate outward non-uniformly toward the surface water. The direction of the highest gradient (towards the northeast) appears to be influenced by dewatering activities that were taking place at the Veteran's Pond relative to previous monitoring events. The average hydraulic gradient throughout the BCC Ponds CCR unit area during this event is estimated at 0.004 ft/ft. The

[DRAFT - ELECTRONIC REVIEW]

gradient was calculated using the following well pairs: BCC-MW-15007/BCC-MW-15001 and BCC-MW-15012/BCC-MW-15022 (Figure 3). Using the mean hydraulic conductivity of 58 ft/day (ARCADIS, 2016) and an assumed effective porosity of 0.3, the estimated average seepage velocity is approximately 0.78 ft/day or 280 ft/year for this event.

Although the gradient toward the northeast has increased since the background sampling events commenced in November 2015, the general flow direction is similar to that identified in previous monitoring rounds and continues to demonstrate that the downgradient wells are appropriately positioned to detect the presence of Appendix III parameters that could potentially migrate from the BCC Ponds CCR unit.

[DRAFT - ELECTRONIC REVIEW]

Section 3
Statistical Evaluation

3.1 Establishing Background Limits

Per the Stats Plan, background limits were established for the Appendix III indicator parameters following the eighth round of background monitoring using data collected from the seven established background monitoring wells (BCC-MW-15002 through BCC-MW-15008). The statistical evaluation of the background data is presented in detail in Appendix C. The Appendix III background limits will be used throughout the detection monitoring period to determine whether groundwater has been impacted from the BCC Ponds CCR unit by comparing concentrations in the downgradient wells to the background limits for each Appendix III indicator parameter.

3.2 Data Comparison to Background Limits

The concentrations of the indicator parameters in the downgradient wells were compared to the statistical background limits calculated from the background data collected from MW-15002 through MW-15008. The comparisons are presented on Table 4.

The statistical evaluation of the September 2017 Appendix III indicator parameters shows potential SSIs over background for:

- Boron at BCC-MW-15009, BCC-MW-15010, BCC-MW-15011, and BCC-MW-15014;
- Fluoride at BCC-MW-15012; and
- pH at BCC-MW-15009, BCC-MW-15011, BCC-MW-15012, BCC-MW-15014, BCC-MW-15015, and BCC-MW-15017.

The initial observation of an indicator parameter concentration above the established background limits does not necessarily constitute a SSI. Per the Stats Plan, if there is an exceedance of a prediction limit for one or more of the parameters, the well(s) of concern can be resampled within 30 days of the completion of the initial statistical analysis for verification purposes. There were no SSIs compared to background for calcium, chloride, sulfate or TDS at any of the downgradient wells.

[DRAFT - ELECTRONIC REVIEW]

Section 4
Conclusions and Recommendations

Potential SSIs over background limits were noted for boron, fluoride and pH in one or more downgradient wells during September 2017. This is the initial detection monitoring event; therefore, it is the initial identification of a SSI over background levels. According to §257.94(e), if the facility determines, pursuant to §257.93(h), that there is a SSI over background levels for one or more of the Appendix III constituents, the facility will, within 90 days of detecting a SSI, establish an assessment monitoring program **<or>** demonstrate that:

- A source other than the CCR unit caused the SSI, or
- The SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

The owner or operator must complete a written demonstration (i.e., Alternative Source Demonstration, ASD), of the above within 90 days of confirming the SSI. Based on the outcome of the ASD the following steps will be taken:

- If a successful ASD is completed, a certification from a qualified professional engineer is required, and the CCR unit may continue with detection monitoring.
- If a successful ASD is not completed within the 90-day period, the owner or operator of the CCR unit must initiate an assessment monitoring program as required under §257.95. The facility must also include the ASD in the annual groundwater monitoring and corrective action report required by §257.90(e), in addition to the certification by a qualified professional engineer.

During the 90-day period after triggering assessment monitoring, the groundwater monitoring system wells will have groundwater samples collected and analyzed for Appendix IV constituents pursuant to §257.95(b). Within 90 days of obtaining the results from the first assessment monitoring event, the groundwater monitoring system wells will have groundwater samples collected and analyzed for Appendix III parameters and the detected Appendix IV parameters in the initial assessment monitoring event.

In response to the potential SSIs over background limits noted during September 2017, CEC plans to prepare an ASD to evaluate whether a source other than the BCC Ponds CCR unit caused the SSIs prior to initiating assessment monitoring. Based on the results from the ASD, CEC will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

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Section 5
References

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Tables

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Table 1
Summary of Groundwater Elevation Data – September 2017
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Well Location	Ground Surface Elevation (ft)	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Depth (ft BGS)			Screen Interval Elevation (ft)			Borehole Terminus Depth (ft BGS)	Borehole Terminus Elevation (ft)	September 13, 2017	
												Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Background													
BCC-MW-15001	583.6	586.52	Sand w/ organic seam at 18.8 ft bgs	10.0	to	20.0	573.6	to	563.6	20.0	563.6	7.42	579.10
BCC-MW-15002	583.8	586.87	Sand	15.0	to	20.0	568.8	to	563.8	20.0	563.8	7.32	579.55
BCC-MW-15003	584.1	587.12	Sand	13.0	to	18.0	571.1	to	566.1	20.0	564.1	6.96	580.16
BCC-MW-15004	587.7	590.57	Sand	5.0	to	15.0	582.7	to	572.7	20.0	567.7	10.11	580.46
BCC-MW-15005	584.8	587.77	Sand	5.0	to	15.0	579.8	to	569.8	20.0	564.8	6.90	580.87
BCC-MW-15006	584.9	587.81	Sand	5.0	to	15.0	579.9	to	569.9	20.0	564.9	7.10	580.71
BCC-MW-15007	584.5	587.43	Sand	4.0	to	10.0	580.5	to	574.5	20.0	564.5	7.05	580.38
BCC-MW-15008	584.8	587.76	Sand	4.0	to	9.0	580.8	to	575.8	20.0	564.8	6.80	580.96
Downgradient													
BCC-MW-15009	586.3	589.27	Sand (14 - 17.2 ft bgs) and Clay/silt (17.2 - 24 ft bgs)	14.0	to	24.0	572.3	to	562.3	24.0	562.3	8.85	580.42
BCC-MW-15010	585.2	588.11	Sand w/ little silt and organic matter	12.0	to	22.0	573.2	to	563.2	24.0	561.2	8.44	579.67
BCC-MW-15011	592.3	595.22	Sand w/ some silt	21.0	to	31.0	571.3	to	561.3	32.0	560.3	15.44	579.78
BCC-MW-15012	594.5	597.39	Sand	21.0	to	31.0	573.5	to	563.5	35.0	559.5	17.54	579.85
BCC-MW-15013	595.9	598.50	Sand with clay/silt and organic material from 36.5 - 37.5 ft bgs	30.0	to	40.0	565.9	to	555.9	40.0	555.9	17.77	580.73
BCC-MW-15014	596.2	599.04	Sand/silty sand	23.0	to	31.0	573.2	to	565.2	40.0	556.2	18.64	580.40
BCC-MW-15015	593.9	596.75	Sand with clay/silt and organic material from 29 - 29.5 ft bgs	20.0	to	30.0	573.9	to	563.9	30.0	563.9	15.80	580.95
BCC-MW-15016	586.2	589.05	Sand	35.0	to	40.0	551.2	to	546.2	45.0	541.2	8.16	580.89
BCC-MW-15017	585.7	588.61	Sand	35.0	to	40.0	550.7	to	545.7	40.0	545.7	7.68	580.93
BCC-MW-15018	589.4	592.43	Sand	37.5	to	42.5	551.9	to	546.9	45.0	544.4	11.48	580.95
BCC-MW-15019	589.4	592.42	Sand	37.0	to	42.0	552.4	to	547.4	45.0	544.4	11.70	580.72
BCC-MW-15020	589.5	592.23	Sand	35.0	to	40.0	554.5	to	549.5	45.0	544.5	12.00	580.23
BCC-MW-15021	590.7	593.73	Sand	39.5	to	42.5	551.2	to	548.2	50.0	540.7	13.71	580.02
BCC-MW-15022	592.6	595.82	Sand	24.0	to	30.0	568.6	to	562.6	45.0	547.6	17.60	578.22
BCC-MW-15023	585.4	588.08	Sand/silty sand	12.0	to	19.5	573.4	to	565.9	20.0	565.4	11.85	576.23

Notes:
Survey conducted by Williams & Works, November 2015.
Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).
TOC: Top of well casing.
ft BTOC: Feet below top of well casing.
ft BGS: Feet below ground surface.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Groundwater Sampling Results (Analytical) – September 2017
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15002	BCC-MW-15003	BCC-MW-15004	BCC-MW-15005	BCC-MW-15006	BCC-MW-15007	BCC-MW-15008	BCC-MW-15009	BCC-MW-15010	BCC-MW-15011	BCC-MW-15012
					Sample Date:	9/14/2017	9/14/2017	9/14/2017	9/14/2017	9/14/2017	9/14/2017	9/14/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							downgradient			
Appendix III																
Boron	ug/L	NC	**500**	**500**	7,200	**1,130**	361	325	36.8	45.1	141	401	**2,120**	**1,770**	**1,490**	**1,140**
Calcium	mg/L	NC	NC	NC	500	132	145	115	64.2	79.6	133	51.8	34.9	129	23.9	48.7
Chloride	mg/L	**250****	**250**	**250**	**500**	152	**493**	**382**	7.0	16.1	**1,940**	68.9	26.0	24.5	24.0	23.3
Fluoride	ug/L	4,000	NC	NC	NC	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	1,000	1,100
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.2	7.1	6.8	7.3	7.2	6.7	7.7	**10.2**	7.8	8.5	**11.4**
Sulfate	mg/L	250**	250	250	500	13.8	<2.0	5.8	2.9	11.6	8.3	3.0	41.7	143	6.4	59.6
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**772**	**1,370**	**934**	240	322	**2,690**	448	188	**570**	140	318

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Groundwater Sampling Results (Analytical) – September 2017
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15013	BCC-MW-15014	BCC-MW-15015	BCC-MW-15016	BCC-MW-15017	BCC-MW-15018	BCC-MW-15019	BCC-MW-15020	BCC-MW-15021	BCC-MW-15022	BCC-MW-15023
					Sample Date:	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient										
Appendix III																
Boron	ug/L	NC	**500**	**500**	7,200	**1,270**	**1,410**	433	83.0	82.8	492	**1,010**	**745**	**602**	**833**	**504**
Calcium	mg/L	NC	NC	NC	500	34.4	57.8	36.9	182	245	90.7	107	107	91.3	35.2	60.9
Chloride	mg/L	**250****	**250**	**250**	**500**	21.2	22.5	20.3	226	224	49.1	73.9	87.8	108	23.3	25.5
Fluoride	ug/L	4,000	NC	NC	NC	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.9	**12.0**	**8.7**	6.6	6.5	6.8	6.7	6.8	6.8	7.6	7.6
Sulfate	mg/L	250**	250	250	500	59.9	19.2	16.1	<2.0	<2.0	<2.0	<2.0	3.0	<2.0	44.1	36.2
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	192	282	192	**995**	**1,130**	392	**618**	**608**	490	266	408

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 3
Summary of Field Parameter Results – September 2017
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Background							
BCC-MW-15002	9/14/2017	0.21	56.4	7.2	1,338	14.73	2.33
BCC-MW-15003	9/14/2017	0.21	69.1	7.1	2,151	14.13	<1
BCC-MW-15004	9/14/2017	0.25	77.4	6.8	1,740	15.57	1.76
BCC-MW-15005	9/14/2017	0.19	-117.9	7.3	424	17.26	4.20
BCC-MW-15006	9/14/2017	0.39	-25.0	7.2	545	20.60	2.28
BCC-MW-15007	9/14/2017	0.13	-67.7	6.7	4,965	19.70	2.19
BCC-MW-15008	9/14/2017	0.13	-108.0	7.7	743	19.03	1.49
Downgradient							
BCC-MW-15009	9/13/2017	0.03	-363.9	10.2	307	16.14	2.88
BCC-MW-15010	9/13/2017	0.11	-126.9	7.8	875	14.98	1.43
BCC-MW-15011	9/13/2017	0.11	-127.8	8.5	247	15.07	<1
BCC-MW-15012	9/13/2017	0.12	-172.3	11.4	441	15.91	<1
BCC-MW-15013	9/13/2017	0.12	-122.3	7.9	320	15.46	<1
BCC-MW-15014	9/13/2017	0.09	-185.6	12.0	679	15.11	1.65
BCC-MW-15015	9/13/2017	0.07	-183.4	8.7	340	15.06	<1
BCC-MW-15016	9/13/2017	0.11	-87.9	6.6	2,018	15.55	3.11
BCC-MW-15017	9/13/2017	0.17	-71.2	6.5	2,420	14.49	2.68
BCC-MW-15018	9/13/2017	0.19	-55.3	6.8	839	14.52	4.65
BCC-MW-15019	9/13/2017	0.16	-70.2	6.7	1,058	13.81	2.94
BCC-MW-15020	9/13/2017	0.22	-59.7	6.8	985	14.40	4.62
BCC-MW-15021	9/13/2017	0.24	-81.7	6.8	1,123	13.87	2.32
BCC-MW-15022	9/13/2017	0.30	-71.3	7.6	376	15.43	2.84
BCC-MW-15023	9/13/2017	0.22	-33.4	7.6	519	14.16	1.28

Notes:
mg/L - Milligrams per Liter.
mV - Millivolts.
SU - Standard units
umhos/cm - Micromhos per centimeter.
NTU - Nephelometric Turbidity Unit.

Table 4

Comparison of Appendix III Parameter Results to Background Limits – September 2017

BC Cobb – RCRA CCR Monitoring Program

Muskegon, Michigan

		Sample Location:	BCC-MW-15009	BCC-MW-15010	BCC-MW-15011	BCC-MW-15012	BCC-MW-15013	BCC-MW-15014	BCC-MW-15015	BCC-MW-15016
		Sample Date:	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017
Constituent	Unit	UTL	downgradient							
Appendix III										
Boron	ug/L	**1,320**	**2,120**	**1,770**	**1,490**	1,140	1,270	**1,410**	433	83.0
Calcium	mg/L	259	34.9	129	23.9	48.7	34.4	57.8	36.9	182
Chloride	mg/L	5,980	26.0	24.5	24.0	23.3	21.2	22.5	20.3	226
Fluoride	ug/L	**1,000**	<1,000	<1,000	1,000	**1,100**	<1,000	<1,000	<1,000	<1,000
pH, Field	SU	**6.6 - 8.3**	**10.2**	7.8	**8.5**	**11.4**	7.9	**12.0**	**8.7**	6.6
Sulfate	mg/L	200	41.7	143	6.4	59.6	59.9	19.2	16.1	<2.0
Total Dissolved Solids	mg/L	5,170	188	570	140	318	192	282	192	995

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

All metals were analyzed as total unless otherwise specified.

RESULT Shading and bold font indicates an exceedance of the Upper Tolerance Limit (UTL) using the number of significant figures in the UTL.

Table 4

Comparison of Appendix III Parameter Results to Background Limits – September 2017

BC Cobb – RCRA CCR Monitoring Program

Muskegon, Michigan

		Sample Location:	BCC-MW-15017	BCC-MW-15018	BCC-MW-15019	BCC-MW-15020	BCC-MW-15021	BCC-MW-15022	BCC-MW-15023
		Sample Date:	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017
Constituent	Unit	UTL	downgradient						
Appendix III									
Boron	ug/L	**1,320**	82.8	492	1,010	745	602	833	504
Calcium	mg/L	259	245	90.7	107	107	91.3	35.2	60.9
Chloride	mg/L	5,980	224	49.1	73.9	87.8	108	23.3	25.5
Fluoride	ug/L	**1,000**	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000
pH, Field	SU	**6.6 - 8.3**	**6.5**	6.8	6.7	6.8	6.8	7.6	7.6
Sulfate	mg/L	200	<2.0	<2.0	<2.0	3.0	<2.0	44.1	36.2
Total Dissolved Solids	mg/L	5,170	1,130	392	618	608	490	266	408

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

All metals were analyzed as total unless otherwise specified.

RESULT Shading and bold font indicates an exceedance of the Upper Tolerance Limit (UTL) using the number of significant figures in the UTL.

Figures

[DRAFT - ELECTRONIC REVIEW]

BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

1" = 3,000'
1:36,000

0 3,000 6,000 FEET

TRC

1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080

TRC - GIS

PROJECT:

CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:

SITE LOCATION MAP

DRAWN BY:	J. PAPEZ
CHECKED BY:	S. HOLMSTROM
APPROVED BY:	G. CROCKFORD
DATE:	OCTOBER 2017
PROJ. NO.:	269767-001
FILE:	269767-001-010slm.mxd

FIGURE 1

E:\ConsumersEnergy\CCR_GW\2017_269767\269767-001-010slm.mxd -- Saved By: SMAJOR on 10/11/2017, 10:19:47 AM

[DRAFT - ELECTRONIC REVIEW]

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- APPROXIMATE POND BOUNDARY

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.

N

0 300 600 Feet

1" = 300'
1:3,600

PROJECT:
CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:
SITE PLAN
WITH CCR MONITORING WELL LOCATIONS

DRAWN BY:	J. PAPEZ	PROJ NO.:	269767-001
CHECKED BY:	S HOLMSTROM		
APPROVED BY:	G. CROCKFORD		**FIGURE 2**
DATE:	JANUARY 2018		

TRC

1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 269767-001-002X.mxd

Plot Date: 1/12/2018, 16:44:48 PM by SMAJOR – LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\269767-001-002X.mxd

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

TRC - GIS

[DRAFT - ELECTRONIC REVIEW]

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- APPROXIMATE POND BOUNDARY
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)
- GROUNDWATER ELEVATION CONTOUR (1' INTERVAL, DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.
3. NU= NOT USED. WELL SCREENED AT DEEPER INTERVAL RELATIVE TO ADJACENT WELLS, NOT USED TO CONSTRUCT CONTOUR MAP.

N

0 300 600 Feet

1" = 300'

1:3,600

PROJECT:

CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:

GROUNDWATER CONTOUR MAP
SEPTEMBER 13, 2017

DRAWN BY:	S. MAJOR	PROJ NO.:	269767-001
CHECKED BY:	S. HOLMSTROM		
APPROVED BY:	G. CROCKFORD		**FIGURE 3**
DATE:	JANUARY 2018		

TRC

1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 269767-001-016A.mxd

Plot Date: 1/15/2018, 14:42:57 PM by SMAJOR – LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\269767-001-016A.mxd

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

TRC - GIS

[DRAFT - ELECTRONIC REVIEW]

Appendix A
Background Data

[DRAFT - ELECTRONIC REVIEW]

Table 1
Summary of Groundwater Elevation Data
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Well Location	Ground Surface Elevation (ft)	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Depth (ft BGS)			Screen Interval Elevation (ft)			Borehole Terminus Depth (ft BGS)	Borehole Terminus Elevation (ft)	Round 1 November 30, 2015		Round 2 February 16, 2016		Round 3 April 12, 2016		Round 4 July 11, 2016	
												Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Background																			
BCC-MW-15001	583.6	586.52	Sand w/ organic seam at 18.8 ft bgs	10.0	to	20.0	573.6	to	563.6	20.0	563.6	5.68	580.84	5.89	580.63	5.34	581.18	5.76	580.76
BCC-MW-15002	583.8	586.87	Sand	15.0	to	20.0	568.8	to	563.8	20.0	563.8	6.01	580.86	6.23	580.64	5.66	581.21	6.13	580.74
BCC-MW-15003	584.1	587.12	Sand	13.0	to	18.0	571.1	to	566.1	20.0	564.1	6.28	580.84	6.48	580.64	5.89	581.23	6.39	580.73
BCC-MW-15004	587.7	590.57	Sand	5.0	to	15.0	582.7	to	572.7	20.0	567.7	9.75	580.82	9.90	580.67	9.29	581.28	9.84	580.73
BCC-MW-15005	584.8	587.77	Sand	5.0	to	15.0	579.8	to	569.8	20.0	564.8	7.23	580.54	7.37	580.40	6.77	581.00	6.94	580.83
BCC-MW-15006	584.9	587.81	Sand	5.0	to	15.0	579.9	to	569.9	20.0	564.9	6.67	581.14	6.90	580.91	6.23	581.58	6.89	580.92
BCC-MW-15007	584.5	587.43	Sand	4.0	to	10.0	580.5	to	574.5	20.0	564.5	6.30	581.13	6.58	580.85	5.88	581.55	6.61	580.82
BCC-MW-15008	584.8	587.76	Sand	4.0	to	9.0	580.8	to	575.8	20.0	564.8	6.77	580.99	7.17	580.59	5.79	581.97	6.99	580.77
Downgradient																			
BCC-MW-15009	586.3	589.27	Sand (14 - 17.2 ft bgs) and Clay/silt (17.2 - 24 ft bgs)	14.0	to	24.0	572.3	to	562.3	24.0	562.3	7.39	581.88	7.64	581.63	6.99	582.28	8.40	580.87
BCC-MW-15010	585.2	588.11	Sand w/ little silt and organic matter	12.0	to	22.0	573.2	to	563.2	24.0	561.2	6.69	581.42	6.96	581.15	6.38	581.73	7.31	580.80
BCC-MW-15011	592.3	595.22	Sand w/ some silt	21.0	to	31.0	571.3	to	561.3	32.0	560.3	13.09	582.13	13.30	581.92	12.76	582.46	14.37	580.85
BCC-MW-15012	594.5	597.39	Sand	21.0	to	31.0	573.5	to	563.5	35.0	559.5	13.93	583.46	14.11	583.28	13.60	583.79	16.48	580.91
BCC-MW-15013	595.9	598.50	Sand with clay/silt and organic material from 36.5 - 37.5 ft bgs	30.0	to	40.0	565.9	to	555.9	40.0	555.9	16.71	581.79	16.81	581.69	16.22	582.28	17.65	580.85
BCC-MW-15014	596.2	599.04	Sand/silty sand	23.0	to	31.0	573.2	to	565.2	40.0	556.2	15.85	583.19	16.02	583.02	15.53	583.51	18.18	580.86
BCC-MW-15015	593.9	596.75	Sand with clay/silt and organic material from 29 - 29.5 ft bgs	20.0	to	30.0	573.9	to	563.9	30.0	563.9	15.94	580.81	15.95	580.80	15.50	581.25	15.97	580.78
BCC-MW-15016	586.2	589.05	Sand	35.0	to	40.0	551.2	to	546.2	45.0	541.2	8.97	580.08	8.77	580.28	8.65	580.40	8.40	580.65
BCC-MW-15017	585.7	588.61	Sand	35.0	to	40.0	550.7	to	545.7	40.0	545.7	8.62	579.99	8.47	580.14	8.26	580.35	7.94	580.67
BCC-MW-15018	589.4	592.43	Sand	37.5	to	42.5	551.9	to	546.9	45.0	544.4	12.35	580.08	12.26	580.17	11.90	580.53	11.70	580.73
BCC-MW-15019	589.4	592.42	Sand	37.0	to	42.0	552.4	to	547.4	45.0	544.4	12.31	580.11	12.25	580.17	12.88	579.54	11.71	580.71
BCC-MW-15020	589.5	592.23	Sand	35.0	to	40.0	554.5	to	549.5	45.0	544.5	12.09	580.14	12.06	580.17	11.66	580.57	11.50	580.73
BCC-MW-15021	590.7	593.73	Sand	39.5	to	42.5	551.2	to	548.2	50.0	540.7	13.63	580.10	13.45	580.28	13.38	580.35	13.12	580.61
BCC-MW-15022	592.6	595.82	Sand	24.0	to	30.0	568.6	to	562.6	45.0	547.6	12.40	583.42	12.31	583.51	12.14	583.68	15.00	580.82
BCC-MW-15023	585.4	588.08	Sand/silty sand	12.0	to	19.5	573.4	to	565.9	20.0	565.4	4.02	584.06	4.20	583.88	3.80	584.28	7.41	580.67

Notes:
Survey conducted by Williams & Works, November 2015.
Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).
TOC: Top of well casing.
ft BTOC: Feet below top of well casing.
ft BGS: Feet below ground surface.

[DRAFT - ELECTRONIC REVIEW]

Table 1
Summary of Groundwater Elevation Data
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Well Location	Ground Surface Elevation (ft)	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Depth (ft BGS)			Screen Interval Elevation (ft)			Round 5 September 27, 2016		Round 6 February 13, 2017		Round 7 April 4, 2017		Round 8 July 11, 2017	
										Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Background																	
BCC-MW-15001	583.6	586.52	Sand w/ organic seam at 18.8 ft bgs	10.0	to	20.0	573.6	to	563.6	5.63	580.89	6.52	580.00	5.75	580.77	6.10	580.42
BCC-MW-15002	583.8	586.87	Sand	15.0	to	20.0	568.8	to	563.8	5.77	581.10	6.75	580.12	5.91	580.96	6.18	580.69
BCC-MW-15003	584.1	587.12	Sand	13.0	to	18.0	571.1	to	566.1	6.02	581.10	6.96	580.16	6.34	580.78	6.09	581.03
BCC-MW-15004	587.7	590.57	Sand	5.0	to	15.0	582.7	to	572.7	9.47	581.10	10.35	580.22	9.75	580.82	9.39	581.18
BCC-MW-15005	584.8	587.77	Sand	5.0	to	15.0	579.8	to	569.8	6.86	580.91	7.83	579.94	7.11	580.66	6.46	581.31
BCC-MW-15006	584.9	587.81	Sand	5.0	to	15.0	579.9	to	569.9	6.31	581.50	7.46	580.35	6.63	581.18	6.36	581.45
BCC-MW-15007	584.5	587.43	Sand	4.0	to	10.0	580.5	to	574.5	6.24	581.19	7.32	580.11	6.45	580.98	6.22	581.21
BCC-MW-15008	584.8	587.76	Sand	4.0	to	9.0	580.8	to	575.8	6.91	580.85	8.02	579.74	7.08	580.68	6.50	581.26
Downgradient																	
BCC-MW-15009	586.3	589.27	Sand (14 - 17.2 ft bgs) and Clay/silt (17.2 - 24 ft bgs)	14.0	to	24.0	572.3	to	562.3	8.48	580.79	9.49	579.78	8.66	580.61	8.15	581.12
BCC-MW-15010	585.2	588.11	Sand w/ little silt and organic matter	12.0	to	22.0	573.2	to	563.2	7.17	580.94	8.14	579.97	7.35	580.76	7.34	580.77
BCC-MW-15011	592.3	595.22	Sand w/ some silt	21.0	to	31.0	571.3	to	561.3	14.35	580.87	15.29	579.93	14.53	580.69	14.38	580.84
BCC-MW-15012	594.5	597.39	Sand	21.0	to	31.0	573.5	to	563.5	16.56	580.83	17.43	579.96	16.70	580.69	16.50	580.89
BCC-MW-15013	595.9	598.50	Sand with clay/silt and organic material from 36.5 - 37.5 ft bgs	30.0	to	40.0	565.9	to	555.9	18.00	580.50	18.95	579.55	18.04	580.46	17.40	581.10
BCC-MW-15014	596.2	599.04	Sand/silty sand	23.0	to	31.0	573.2	to	565.2	18.46	580.58	19.29	579.75	18.51	580.53	18.03	581.01
BCC-MW-15015	593.9	596.75	Sand with clay/silt and organic material from 29 - 29.5 ft bgs	20.0	to	30.0	573.9	to	563.9	16.45	580.30	17.36	579.39	16.42	580.33	15.64	581.11
BCC-MW-15016	586.2	589.05	Sand	35.0	to	40.0	551.2	to	546.2	8.61	580.44	9.61	579.44	8.75	580.30	8.03	581.02
BCC-MW-15017	585.7	588.61	Sand	35.0	to	40.0	550.7	to	545.7	8.20	580.41	9.28	579.33	8.53	580.08	7.55	581.06
BCC-MW-15018	589.4	592.43	Sand	37.5	to	42.5	551.9	to	546.9	12.14	580.29	13.13	579.30	12.18	580.25	11.33	581.10
BCC-MW-15019	589.4	592.42	Sand	37.0	to	42.0	552.4	to	547.4	12.12	580.30	13.11	579.31	12.16	580.26	11.41	581.01
BCC-MW-15020	589.5	592.23	Sand	35.0	to	40.0	554.5	to	549.5	11.92	580.31	12.87	579.36	11.91	580.32	11.33	580.90
BCC-MW-15021	590.7	593.73	Sand	39.5	to	42.5	551.2	to	548.2	13.05	580.68	14.13	579.60	13.33	580.40	13.06	580.67
BCC-MW-15022	592.6	595.82	Sand	24.0	to	30.0	568.6	to	562.6	14.94	580.88	15.66	580.16	15.08	580.74	15.65	580.17
BCC-MW-15023	585.4	588.08	Sand/silty sand	12.0	to	19.5	573.4	to	565.9	7.35	580.73	8.00	580.08	7.13	580.95	8.44	579.64

Notes:
Survey conducted by Williams & Works, November 2015.
Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).
TOC: Top of well casing.
ft BTOC: Feet below top of well casing.
ft BGS: Feet below ground surface.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15001							
					Sample Date:	11/30/2015	2/17/2016	4/12/2016	7/12/2016	9/27/2016	2/13/2017	4/4/2017	7/11/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**1,120**	**1,290**	**1,310**	**1,290**	**1,010**	**1,060**	**1,080**	**1,100**
Calcium	mg/L	NC	NC	NC	500	118	129	105	113	130	105	107	91.1
Chloride	mg/L	**250****	**250**	**250**	**500**	35.0	22.4	21.3	19.7	19.9	23.2	22.3	27.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	6.96	7.0	7.1	7.1	6.7	6.9	7.0	6.92
Sulfate	mg/L	**250****	**250**	**250**	500	67.0	46.2	33.8	33.5	35.6	41.9	37.0	44.8
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**580**	**520**	460	470	**520**	470	470	**526**
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	<1	<1	<1	<1	<1	<1	<1	<1.0
Barium	ug/L	2,000	2,000	2,000	**670**	127	118	114	98	116	102	105	109
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	1	3	2	<1	1	1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	32.2	32.2	31	30	30	28	27	32
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.366	0.387	0.312	0.255	0.311	0.297	<0.276	<0.948
Radium-226/228	pCi/L	**5**	NC	NC	NC	1.54	0.963	1.23	1.39	<1.11	1.55	0.885	<1.80
Radium-228	pCi/L	5	NC	NC	NC	1.17	<0.812	0.921	1.13	<1.11	1.25	0.610	<0.855
Selenium	ug/L	50	50	50	**5**	<1	<1	<1	1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15002							
					Sample Date:	11/30/2015	2/17/2016	4/12/2016	7/12/2016	9/27/2016	2/13/2017	4/4/2017	7/11/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**1,320**	**1,200**	**1,050**	**834**	**979**	**1,110**	**1,170**	**988**
Calcium	mg/L	NC	NC	NC	500	214	259	197	169	165	184	167	185
Chloride	mg/L	**250****	**250**	**250**	**500**	**720**	**519**	**681**	**577**	**328**	226	**354**	**472**
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	6.74	7.1	7.0	7.0	7.0	7.2	7.2	7.11
Sulfate	mg/L	**250****	**250**	**250**	500	250	**327**	**300**	202	127	116	85.6	113
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**1,900**	**1,900**	**1,900**	**1,800**	**1,100**	**1,100**	**1,200**	**1,500**
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	10	4	2	2	1	1	<1	<1.0
Barium	ug/L	2,000	2,000	2,000	**670**	274	257	252	232	148	134	146	186
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	1	2	3	2	<1	2	2	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	11
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.816	0.600	0.893	0.641	<0.254	0.419	0.387	<0.912
Radium-226/228	pCi/L	**5**	NC	NC	NC	3.03	2.03	2.32	1.88	<0.927	1.41	1.79	2.20
Radium-228	pCi/L	5	NC	NC	NC	2.21	1.43	1.43	1.24	<0.927	0.995	1.40	1.49
Selenium	ug/L	50	50	50	**5**	1	<1	<1	1	<1	<1	1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

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Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15003							
					Sample Date:	11/30/2015	2/17/2016	4/12/2016	7/12/2016	9/27/2016	2/13/2017	4/4/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**542**	**574**	**2,370**	**528**	494	608	**679**	**695**
Calcium	mg/L	NC	NC	NC	500	216	233	180	177	179	163	167	154
Chloride	mg/L	**250****	**250**	**250**	**500**	**700**	**682**	**640**	**581**	**512**	**456**	**363**	**293**
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.24	7.1	7.2	7.1	7.1	7.4	7.3	7.07
Sulfate	mg/L	**250****	**250**	**250**	500	46.0	48.7	41.2	28.3	27.2	20.1	16.7	6.8
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**1,900**	**1,900**	**1,700**	**1,600**	**1,500**	**1,400**	**1,200**	**1,110**
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	2	<1	<1	1	<1	<1	<1	<1.0
Barium	ug/L	2,000	2,000	2,000	**670**	236	219	189	170	159	137	138	112
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	2	2	2	1	1	1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	11
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.667	0.633	0.522	0.387	0.284	0.350	0.442	0.442
Radium-226/228	pCi/L	**5**	NC	NC	NC	2.40	1.30	1.39	1.66	1.53	1.58	1.25	<1.03
Radium-228	pCi/L	5	NC	NC	NC	1.73	0.664	0.870	1.27	1.25	1.23	0.807	<0.858
Selenium	ug/L	50	50	50	**5**	2	<1	<1	1	<1	<1	1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15004							
					Sample Date:	11/30/2015	2/17/2016	4/12/2016	7/12/2016	9/27/2016	2/13/2017	4/4/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	198	124	166	338	279	193	376	302
Calcium	mg/L	NC	NC	NC	500	94.6	80.9	70.7	87.0	81.9	75.1	73.4	67.2
Chloride	mg/L	**250****	**250**	**250**	**500**	27.0	18.1	22.0	30.9	22.1	28.2	35.2	45.7
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.28	7.2	6.9	6.7	6.9	7.1	7.1	6.95
Sulfate	mg/L	**250****	**250**	**250**	500	33.0	17.8	13.6	<2	8.06	7.20	<2	2.9
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	440	340	350	420	380	340	380	450
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	2	1	1	2	7	2	2	3.2
Barium	ug/L	2,000	2,000	2,000	**670**	33	18	29	43	42	29	33	38.4
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	1	2	2	1	1	3	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	<10
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	7	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	<0.203	<0.216	<0.370	<0.157	<0.292	<0.181	<0.308	<0.654
Radium-226/228	pCi/L	**5**	NC	NC	NC	1.02	<0.565	0.518	0.808	1.08	1.18	1.02	<1.45
Radium-228	pCi/L	5	NC	NC	NC	0.879	<0.565	0.518	0.768	0.986	1.10	1.02	<0.796
Selenium	ug/L	50	50	50	**5**	<1	2	2	<1	<1	<1	1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15005							
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/12/2016	9/27/2016	2/13/2017	4/4/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	<20	51	35	46	43	39	25	31.3
Calcium	mg/L	NC	NC	NC	500	57.2	93.3	60.6	75.4	67.3	99.2	43.9	60.2
Chloride	mg/L	**250****	**250**	**250**	**500**	9.50	137	66.6	13.1	1.23	181	20.1	3.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.18	7.2	7.3	7.2	7.1	7.3	7.6	7.33
Sulfate	mg/L	**250****	**250**	**250**	500	10.0	5.27	4.69	5.39	<2	5.57	7.88	4.4
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	230	480	340	**590**	230	**570**	200	204
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	1	1	<1	2	2	<1	<1	1.1
Barium	ug/L	2,000	2,000	2,000	**670**	83	125	97	151	147	173	82	116
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	<1	2	1	<1	<1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	<10
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.180	<0.336	<0.244	0.221	<0.332	<0.192	<0.279	<0.675
Radium-226/228	pCi/L	**5**	NC	NC	NC	0.882	<0.494	<0.378	0.662	0.545	1.02	0.447	<1.41
Radium-228	pCi/L	5	NC	NC	NC	0.702	<0.494	<0.378	0.441	0.471	1.02	0.447	<0.739
Selenium	ug/L	50	50	50	**5**	<1	<1	<1	<1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15006							
					Sample Date:	11/30/2015	2/17/2016	4/13/2016	7/12/2016	9/28/2016	2/13/2017	4/4/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	48	39	33	43	55	32	35	42.3
Calcium	mg/L	NC	NC	NC	500	84.5	73.9	60.0	60.6	86.2	70.5	67.9	68.8
Chloride	mg/L	**250****	**250**	**250**	**500**	50.0	12.8	32.5	63.1	19.6	48.0	23.5	69.8
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.03	7.3	7.2	6.9	6.9	7.3	7.4	7.15
Sulfate	mg/L	**250****	**250**	**250**	500	17.0	17.1	12.7	8.54	12.2	7.34	6.88	9.4
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	380	290	300	380	320	330	260	346
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	1	<1	<1	1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	1	1	<1	2	3	3	2	4.3
Barium	ug/L	2,000	2,000	2,000	**670**	26	16	17	20	26	17	17	27.8
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	1	2	1	<1	1	1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	<10
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	5	6	7	7	7	8	8	8.5
Radium-226	pCi/L	5	NC	NC	NC	<0.301	<0.268	<0.205	<0.225	<0.416	<0.240	<0.198	<0.701
Radium-226/228	pCi/L	**5**	NC	NC	NC	0.629	<0.623	<0.479	<0.522	<0.571	<0.483	0.652	<1.41
Radium-228	pCi/L	5	NC	NC	NC	0.584	<0.623	<0.479	<0.522	<0.571	<0.483	0.459	<0.708
Selenium	ug/L	50	50	50	**5**	3	3	2	1	1	<1	1	1.2
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15007							
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/12/2016	9/28/2016	2/14/2017	4/4/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	79	74	65	89	135	76	83	130
Calcium	mg/L	NC	NC	NC	500	165	222	226	234	250	181	169	170
Chloride	mg/L	**250****	**250**	**250**	**500**	**1,900**	**2,300**	**2,480**	**2,280**	**2,390**	**1,850**	**1,670**	**1,900**
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	6.74	6.6	6.6	6.6	6.6	6.7	6.7	6.74
Sulfate	mg/L	**250****	**250**	**250**	500	21.0	15.7	11.0	9.87	9.38	3.19	4.25	9.1
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**3,700**	**2,000**	**3,900**	**4,500**	**4,800**	**3,700**	**3,100**	**3,700**
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	5	1	1	5	3	1	2	5.8
Barium	ug/L	2,000	2,000	2,000	**670**	285	267	236	294	377	227	167	229
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	2	2	2	1	2	2	1.1
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	<10
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	8	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.686	0.659	0.289	0.554	1.15	0.629	0.492	<0.711
Radium-226/228	pCi/L	**5**	NC	NC	NC	2.19	1.69	1.56	1.65	2.75	2.02	1.29	<1.45
Radium-228	pCi/L	5	NC	NC	NC	1.50	1.03	1.27	1.10	1.60	1.39	0.796	0.850
Selenium	ug/L	50	50	50	**5**	1	<1	<1	<1	<1	<1	2	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15008							
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/12/2016	9/28/2016	2/14/2017	4/4/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**1,060**	**897**	**794**	**866**	**1,160**	489	416	396
Calcium	mg/L	NC	NC	NC	500	39.6	39.5	48.4	77.2	109	63.4	63.0	54.4
Chloride	mg/L	**250****	**250**	**250**	**500**	160	157	193	**546**	**423**	129	95.9	70.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	8.15	8.3	8.1	8.1	7.8	7.8	7.6	7.62
Sulfate	mg/L	**250****	**250**	**250**	500	45.0	3.05	5.13	22.3	12.0	8.70	4.60	3.9
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**540**	**530**	**590**	**1,300**	**1,100**	**650**	**510**	414
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	1	<1	<1	4	<1	<1	<1	2.3
Barium	ug/L	2,000	2,000	2,000	**670**	39	42	49	61	100	63	59	54.6
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	<1	1	2	<1	<1	1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	12.9	13.5	16	19	28	17	18	23
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	<0.188	<0.215	<0.199	0.174	<0.217	<0.173	<0.284	<0.592
Radium-226/228	pCi/L	**5**	NC	NC	NC	0.620	<0.457	0.646	<0.405	1.03	0.843	<0.346	1.66
Radium-228	pCi/L	5	NC	NC	NC	0.521	<0.457	0.516	<0.405	0.893	0.672	<0.346	1.47
Selenium	ug/L	50	50	50	**5**	<1	<1	<1	1	<1	<1	1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15009							
					Sample Date:	12/1/2015	2/17/2016	4/18/2016	7/12/2016	9/28/2016	2/14/2017	4/5/2017	7/11/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**2,380**	**2,520**	**2,170**	**2,070**	**2,190**	**2,110**	**2,190**	**2,210**
Calcium	mg/L	NC	NC	NC	500	42.7	44.1	40.1	44.1	46.7	37.7	38.2	37.6
Chloride	mg/L	**250****	**250**	**250**	**500**	24.0	24.0	27.1	26.9	24.3	22.8	24.9	26.3
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	**10.62**	**10.8**	**10.3**	**10**	**10**	**10.2**	**10.1**	**9.6**
Sulfate	mg/L	**250****	**250**	**250**	500	63.0	39.3	49.5	55.2	49.1	31.6	39.8	43.0
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	240	230	220	220	230	200	190	216
Appendix IV													
Antimony	ug/L	6	6	6	130	1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	**45**	**31**	**24**	**24**	**20**	**14**	**13**	**12.0**
Barium	ug/L	2,000	2,000	2,000	**670**	16	12	11	11	11	9	10	13.2
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	<1	1	2	<1	<1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	15.6	14.6	15	14	14	13	14	19
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	57	60	50	49	49	40	38	43.7
Radium-226	pCi/L	5	NC	NC	NC	<0.166	<0.157	<0.209	<0.158	<0.269	<0.159	<0.347	<0.756
Radium-226/228	pCi/L	**5**	NC	NC	NC	<0.451	<0.475	<0.467	<0.461	<0.628	0.747	<0.502	<2.72
Radium-228	pCi/L	5	NC	NC	NC	<0.451	<0.475	<0.467	<0.461	<0.628	0.678	<0.502	<1.96
Selenium	ug/L	50	50	50	**5**	<1	<1	2	<1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15010							
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/12/2016	9/28/2016	2/14/2017	4/5/2017	7/11/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**1,970**	**1,510**	**1,340**	**1,270**	**1,570**	**1,440**	**1,760**	**1,340**
Calcium	mg/L	NC	NC	NC	500	71.2	51.9	37.4	58.2	66.4	49.8	80.5	40.7
Chloride	mg/L	**250****	**250**	**250**	**500**	23.0	22.5	21.5	22.7	25.1	22.3	24.2	25.5
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.74	7.8	7.8	7.8	8.0	8.0	7.8	7.8
Sulfate	mg/L	**250****	**250**	**250**	500	120	52.6	31.0	50.7	69.7	24.2	53.5	24.8
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	410	270	220	260	320	250	360	288
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	<1	<1	<1	<1	<1	<1	<1	<1.0
Barium	ug/L	2,000	2,000	2,000	**670**	49	34	28	42	45	31	51	29.2
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	<1	2	<1	<1	1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	36.1	22.7	18	15	22	14	18	21
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	33	29	27	15	20	9	7	16.2
Radium-226	pCi/L	5	NC	NC	NC	<0.302	<0.217	<0.244	<0.145	<0.297	<0.179	<0.216	<0.642
Radium-226/228	pCi/L	**5**	NC	NC	NC	0.973	<0.502	<0.447	0.451	0.820	<0.363	<0.380	<1.60
Radium-228	pCi/L	5	NC	NC	NC	0.849	<0.502	<0.447	0.420	0.728	<0.363	<0.380	<0.956
Selenium	ug/L	50	50	50	**5**	<1	<1	1	1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15011							
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/12/2016	9/28/2016	2/14/2017	4/5/2017	7/11/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**1,680**	**1,420**	**1,340**	**1,210**	**1,180**	**1,280**	**1,340**	**1,060**
Calcium	mg/L	NC	NC	NC	500	53.0	47.6	36.9	47.3	48.0	47.9	52.0	42.2
Chloride	mg/L	**250****	**250**	**250**	**500**	22.0	20.7	22.1	24.8	21.0	19.5	22.2	22.9
Fluoride	ug/L	4,000	NC	NC	NC	1,200	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	**8.68**	8.5	8.2	8.5	**8.7**	**9.2**	**9.0**	8.2
Sulfate	mg/L	**250****	**250**	**250**	500	50.0	30.8	35.8	43.8	38.5	37.2	42.8	29.1
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	270	230	210	240	230	230	240	224
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	5	3	3	4	6	7	8	<1.0
Barium	ug/L	2,000	2,000	2,000	**670**	36	29	25	30	31	31	32	30.7
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	1	<1	2	1	<1	<1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	1,200	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	17.2	16	14	15	16	17	17	20
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	20	29	35	26	27	25	22	21.4
Radium-226	pCi/L	5	NC	NC	NC	<0.199	<0.141	<0.319	<0.166	<0.284	<0.160	<0.296	<1.12
Radium-226/228	pCi/L	**5**	NC	NC	NC	1.01	<0.447	<0.435	<0.402	<0.496	<0.394	<0.599	<2.07
Radium-228	pCi/L	5	NC	NC	NC	0.956	<0.447	<0.435	<0.402	<0.496	<0.394	<0.599	<0.954
Selenium	ug/L	50	50	50	**5**	<1	<1	<1	1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15012							
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**961**	**1,390**	**1,830**	**1,450**	**1,470**	**1,380**	**1,500**	**1,340**
Calcium	mg/L	NC	NC	NC	500	49.5	82.1	65.5	44.5	43.5	32.0	34.9	24.6
Chloride	mg/L	**250****	**250**	**250**	**500**	20.0	20.4	23.7	23.0	22.6	19.7	22.7	24.1
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	1,200
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.98	8.1	8.1	**8.9**	**9.2**	**8.6**	8.5	**9.89**
Sulfate	mg/L	**250****	**250**	**250**	500	69.0	111	106	65.6	50.9	55.7	57.2	21.8
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	300	370	340	250	210	190	200	168
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	<1	2	8	**12**	9	2	3	6.1
Barium	ug/L	2,000	2,000	2,000	**670**	40	63	68	34	22	25	28	14.3
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	<1	1	1	<1	<1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	1,200
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	15.6	20.8	19	18	15	11	12	12
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	29	9	35	37	44	35	27	**94.5**
Radium-226	pCi/L	5	NC	NC	NC	<0.164	<0.243	<0.256	<0.216	<0.335	<0.153	<0.243	0.436
Radium-226/228	pCi/L	**5**	NC	NC	NC	<0.471	<0.634	0.919	<0.539	<0.548	<0.416	<0.554	<2.28
Radium-228	pCi/L	5	NC	NC	NC	<0.471	<0.634	0.827	<0.539	<0.548	<0.416	<0.554	<2.08
Selenium	ug/L	50	50	50	**5**	<1	<1	<1	<1	<1	<1	<1	1.2
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15013							
					Sample Date:	12/1/2015	2/18/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**1,140**	**1,290**	**1,180**	**1,080**	**1,090**	**1,050**	**1,120**	**916**
Calcium	mg/L	NC	NC	NC	500	65.2	58.3	47.5	48.4	59.7	52.5	50.9	43.9
Chloride	mg/L	**250****	**250**	**250**	**500**	21.0	20.9	21.5	21.0	22.9	19.8	19.9	23.4
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.61	7.2	7.4	7.3	7.4	7.7	7.4	7.36
Sulfate	mg/L	**250****	**250**	**250**	500	89.0	44.3	34.3	27.5	31.3	23.1	15.1	8.7
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	330	290	260	250	250	260	250	240
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	<1	<1	<1	<1	<1	<1	<1	<1.0
Barium	ug/L	2,000	2,000	2,000	**670**	71	58	49	47	51	52	48	41.9
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	<1	2	1	<1	<1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	17.5	19.9	18	17	18	18	17	23
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	17	20	21	12	11	10	9	7.7
Radium-226	pCi/L	5	NC	NC	NC	0.272	<0.299	0.173	<0.181	<0.215	<0.230	<0.215	0.731
Radium-226/228	pCi/L	**5**	NC	NC	NC	1.19	<0.527	0.900	0.596	<0.598	<0.481	<0.516	<1.56
Radium-228	pCi/L	5	NC	NC	NC	0.914	<0.527	0.727	0.483	<0.598	<0.481	<0.516	<0.940
Selenium	ug/L	50	50	50	**5**	<1	<1	<1	1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
\# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15014							
					Sample Date:	12/1/2015	2/18/2016	4/18/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**2,560**	**2,230**	**1,840**	**1,630**	**1,690**	**1,530**	**1,560**	**1,300**
Calcium	mg/L	NC	NC	NC	500	75.6	75.3	63.9	73.5	64.7	66.3	65.3	61.8
Chloride	mg/L	**250****	**250**	**250**	**500**	21.0	21.9	21.9	22.0	22.7	18.6	22.1	22.4
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	**11.53**	**11.6**	**11.2**	**11**	**11.1**	**11.5**	**11.3**	**11.5**
Sulfate	mg/L	**250****	**250**	**250**	500	43.0	34.7	31.4	35.6	23.7	27.8	23.9	24.9
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	350	310	270	290	250	280	270	292
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	1.7
Arsenic	ug/L	**10**	**10**	**10**	**10**	**15**	**11**	**11**	8	9	7	7	8.4
Barium	ug/L	2,000	2,000	2,000	**670**	329	376	257	508	357	571	546	**732**
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	2	1	1	<1	<1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	19
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	**119**	**76**	58	69	**81**	**80**	**77**	70.9
Radium-226	pCi/L	5	NC	NC	NC	<0.176	<0.175	<0.177	0.214	<0.218	<0.211	<0.289	<0.511
Radium-226/228	pCi/L	**5**	NC	NC	NC	1.31	<0.735	<0.562	<0.606	<0.485	0.883	<0.423	<1.58
Radium-228	pCi/L	5	NC	NC	NC	1.23	<0.735	<0.562	<0.606	<0.485	0.810	<0.423	<1.07
Selenium	ug/L	50	50	50	**5**	<1	1	<1	<1	<1	1	**8**	2.3
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg $CaCO_3$/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15015							
					Sample Date:	12/1/2015	2/18/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**1,190**	**1,170**	**963**	**614**	**656**	**662**	**599**	489
Calcium	mg/L	NC	NC	NC	500	32.8	33.0	30.6	36.2	40.1	38.4	37.6	29.4
Chloride	mg/L	**250****	**250**	**250**	**500**	21.0	22.0	21.6	20.4	19.5	19.2	22.7	20.1
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.56	7.4	7.4	7.4	7.8	7.7	7.6	8.35
Sulfate	mg/L	**250****	**250**	**250**	500	7.80	6.56	8.34	13.9	9.26	10.4	13.8	18.8
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	220	200	190	180	180	200	190	166
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	2	2	2	6	5	5	6	6.4
Barium	ug/L	2,000	2,000	2,000	**670**	23	22	21	25	28	30	28	30.1
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	<1	1	1	<1	<1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	12
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	17	14	17	11	10	9	11	11.9
Radium-226	pCi/L	5	NC	NC	NC	<0.193	<0.157	<0.242	<0.133	<0.378	<0.166	<0.340	<0.832
Radium-226/228	pCi/L	**5**	NC	NC	NC	<0.578	<0.577	<0.521	<0.467	0.850	<0.408	<0.420	<1.63
Radium-228	pCi/L	5	NC	NC	NC	<0.578	<0.577	<0.521	<0.467	0.850	<0.408	<0.420	<0.799
Selenium	ug/L	50	50	50	**5**	<1	<1	<1	1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg $CaCO_3$/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15016							
					Sample Date:	12/1/2015	2/18/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	108	119	86	100	88	92	83	85.9
Calcium	mg/L	NC	NC	NC	500	172	184	164	172	181	176	172	170
Chloride	mg/L	**250****	**250**	**250**	**500**	200	204	203	165	204	196	200	10.4
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	6.55	6.5	**6.4**	**6.3**	**6.4**	**6.4**	6.6	**6.44**
Sulfate	mg/L	**250****	**250**	**250**	500	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**980**	**1,000**	**980**	**920**	**930**	**990**	**1,000**	**1,050**
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	2	2	3	3	2	2	2	1.5
Barium	ug/L	2,000	2,000	2,000	**670**	656	647	614	619	621	666	613	596
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	2	3	3	4	3	3	3	1.9
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	<10
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	<0.263	1.51	1.31	1.50	1.06	1.17	1.60	1.30
Radium-226/228	pCi/L	**5**	NC	NC	NC	2.29	3.83	3.00	3.18	2.74	3.54	3.66	2.36
Radium-228	pCi/L	5	NC	NC	NC	2.29	2.32	1.69	1.68	1.68	2.37	2.06	1.06
Selenium	ug/L	50	50	50	**5**	2	4	2	**7**	1	2	2	3.6
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15017							
					Sample Date:	12/1/2015	2/18/2016	4/18/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	59	90	66	76	78	76	75	75.0
Calcium	mg/L	NC	NC	NC	500	225	247	220	232	252	232	232	203
Chloride	mg/L	**250****	**250**	**250**	**500**	200	201	184	204	182	192	187	199
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	**6.46**	**6.4**	**6.4**	**6.4**	**6.4**	6.6	6.5	**6.41**
Sulfate	mg/L	**250****	**250**	**250**	500	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**850**	**1,100**	**1,200**	**1,100**	**1,100**	**1,200**	**1,100**	**1,230**
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	**13**	7	5	**12**	**12**	5	4	3.0
Barium	ug/L	2,000	2,000	2,000	**670**	**1,030**	**981**	**924**	**985**	**955**	**968**	**876**	**772**
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	4	4	4	9	11	5	5	5.3
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	<10
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	1.61	2.38	2.18	1.91	1.94	1.82	1.56	1.97
Radium-226/228	pCi/L	**5**	NC	NC	NC	4.30	**5.35**	**5.68**	**5.89**	4.44	4.97	4.34	4.75
Radium-228	pCi/L	5	NC	NC	NC	2.69	2.97	3.50	3.98	2.50	3.15	2.78	2.78
Selenium	ug/L	50	50	50	**5**	3	4	3	**8**	2	2	3	2.7
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15018							
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	9/29/2016	2/14/2017	4/5/2017	7/11/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	487	**526**	478	399	438	479	493	**538**
Calcium	mg/L	NC	NC	NC	500	88.6	100	87.9	86.8	98.5	100	92.1	84.8
Chloride	mg/L	**250****	**250**	**250**	**500**	38.0	38.0	40.8	39.3	37.5	43.6	44.4	53.4
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.0	6.9	6.8	6.5	6.5	6.7	6.8	6.78
Sulfate	mg/L	**250****	**250**	**250**	500	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	290	400	430	390	410	450	410	420
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	1	<1	<1	2	<1	<1	<1	<1.0
Barium	ug/L	2,000	2,000	2,000	**670**	155	149	139	133	143	171	149	153
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	1	1	1	1	<1	1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	21.4	23.1	24	12	14	21	21	26
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.227	0.394	0.430	0.234	0.522	0.363	<0.314	<0.479
Radium-226/228	pCi/L	**5**	NC	NC	NC	<0.586	1.17	1.08	1.08	1.33	1.36	1.37	<1.25
Radium-228	pCi/L	5	NC	NC	NC	<0.586	0.778	0.649	0.845	0.803	0.996	1.08	<0.767
Selenium	ug/L	50	50	50	**5**	<1	<1	1	4	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15019							
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/13/2016	9/30/2016	2/15/2017	4/5/2017	7/11/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**1,530**	**1,590**	**1,440**	**1,320**	**1,260**	**1,370**	**1,410**	**1,430**
Calcium	mg/L	NC	NC	NC	500	84.6	93.6	83.0	90.0	92.6	91.8	92.8	90.1
Chloride	mg/L	**250****	**250**	**250**	**500**	34.0	32.4	33.7	37.7	35.6	34.5	33.6	52.5
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.0	6.8	6.9	6.7	**6.4**	6.8	6.9	6.79
Sulfate	mg/L	**250****	**250**	**250**	500	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	340	390	440	410	370	410	420	470
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	<1	<1	<1	<1	<1	<1	<1	<1.0
Barium	ug/L	2,000	2,000	2,000	**670**	91	94	88	88	96	93	90	109
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	<1	1	1	<1	<1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	23.7	27.9	26	24	22	23	22	27
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.333	0.279	0.465	0.282	0.315	0.329	<0.360	<0.620
Radium-226/228	pCi/L	**5**	NC	NC	NC	0.674	0.798	0.997	0.969	<0.739	2.13	0.974	<1.64
Radium-228	pCi/L	5	NC	NC	NC	<0.484	<0.567	0.532	<0.718	<0.739	1.80	0.872	<1.02
Selenium	ug/L	50	50	50	**5**	<1	<1	<1	2	<1	<1	<1	1.2
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15020							
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	9/30/2016	2/15/2017	4/5/2017	7/11/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**630**	**738**	**638**	**603**	**608**	**621**	**667**	**618**
Calcium	mg/L	NC	NC	NC	500	61.0	67.6	59.1	60.7	66.5	67.0	66.6	68.1
Chloride	mg/L	**250****	**250**	**250**	**500**	39.0	35.4	34.3	69.6	33.5	33.3	33.9	45.7
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.27	7.2	7.0	6.9	6.9	7.0	7.1	7.01
Sulfate	mg/L	**250****	**250**	**250**	500	2.20	2.34	<2	<2	<2	<2	<2	<2.0
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	320	310	320	310	310	330	320	388
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	<1	<1	<1	<1	<1	<1	<1	<1.0
Barium	ug/L	2,000	2,000	2,000	**670**	48	52	51	47	54	53	52	60.4
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	2	<1	1	<1	<1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	15.1	17.8	16	14	14	14	14	18
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	<0.269	<0.240	<0.341	<0.190	<0.276	<0.294	<0.290	<0.761
Radium-226/228	pCi/L	**5**	NC	NC	NC	<0.467	0.847	0.730	<0.598	0.724	<0.591	0.652	<1.39
Radium-228	pCi/L	5	NC	NC	NC	<0.467	0.731	0.474	<0.598	0.682	<0.591	0.543	<0.627
Selenium	ug/L	50	50	50	**5**	<1	1	<1	2	<1	<1	<1	1.4
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15021							
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/13/2016	10/5/2016	2/15/2017	4/5/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	362	489	400	425	491	465	**519**	**519**
Calcium	mg/L	NC	NC	NC	500	86.4	98.5	89.6	97.4	96.9	97.9	96.3	86.8
Chloride	mg/L	**250****	**250**	**250**	**500**	88.0	82.7	87.2	98.3	98.9	94.6	93.9	97.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	6.83	6.8	6.8	6.7	6.8	6.9	6.9	6.81
Sulfate	mg/L	**250****	**250**	**250**	500	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**610**	**540**	**570**	**590**	**620**	**570**	**560**	**548**
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	3	1	1	2	2	2	2	1.0
Barium	ug/L	2,000	2,000	2,000	**670**	274	244	236	233	252	240	228	211
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	2	2	2	1	2	2	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	<10
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.569	0.629	0.563	0.429	0.483	0.524	<0.215	<0.768
Radium-226/228	pCi/L	**5**	NC	NC	NC	1.55	1.41	1.41	1.30	2.00	0.966	<0.354	<1.47
Radium-228	pCi/L	5	NC	NC	NC	0.984	0.782	0.846	0.871	1.52	<0.582	<0.354	<0.697
Selenium	ug/L	50	50	50	**5**	1	2	1	4	<1	<1	1	1.6
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15022							
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	10/5/2016	2/15/2017	4/6/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	250	388	387	362	391	394	434	478
Calcium	mg/L	NC	NC	NC	500	46.7	46.4	47.8	43.0	43.7	54.1	49.3	51.8
Chloride	mg/L	**250****	**250**	**250**	**500**	25.0	18.7	17.6	16.8	17.1	18.2	18.6	22.1
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	8.29	8.5	8.2	8.2	8.1	7.8	8.1	8.36
Sulfate	mg/L	**250****	**250**	**250**	500	39.0	38.3	29.9	34.3	32.8	34.1	32.8	45.9
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	270	210	250	250	210	250	230	254
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	6	7	8	8	6	4	4	5.8
Barium	ug/L	2,000	2,000	2,000	**670**	139	119	155	116	119	137	129	138
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	1	2	1	<1	<1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	<10
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	22	16	11	17	19	12	14	13.6
Radium-226	pCi/L	5	NC	NC	NC	0.246	<0.242	<0.247	<0.150	<0.346	<0.217	<0.291	<0.468
Radium-226/228	pCi/L	**5**	NC	NC	NC	<0.484	<0.450	0.812	<0.472	<0.514	<0.477	0.862	<1.27
Radium-228	pCi/L	5	NC	NC	NC	<0.484	<0.450	0.740	<0.472	<0.514	<0.477	0.709	<0.799
Selenium	ug/L	50	50	50	**5**	<1	<1	<1	<1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

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Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15023							
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	10/5/2016	2/15/2017	4/6/2017	7/11/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	414	284	267	308	**526**	484	**1,590**	**701**
Calcium	mg/L	NC	NC	NC	500	59.7	59.4	53.3	54.1	64.0	59.9	74.5	50.8
Chloride	mg/L	**250****	**250**	**250**	**500**	30.0	26.9	24.6	28.7	24.8	23.8	24.6	26.8
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.43	7.5	7.5	7.5	7.4	7.6	7.6	7.63
Sulfate	mg/L	**250****	**250**	**250**	500	20.0	26.5	28.9	25.0	24.3	21.0	22.5	22.6
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	240	270	270	290	290	280	300	290
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	2	2	1	3	2	2	<1	1.9
Barium	ug/L	2,000	2,000	2,000	**670**	57	48	43	40	47	42	46	38.0
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	<1	2	1	<1	<1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	12.1	10.6	<10	<10	<10	<10	11	<10
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	8	6	<5	7	6	6	<5	6.0
Radium-226	pCi/L	5	NC	NC	NC	0.232	<0.237	<0.242	0.226	<0.309	0.257	0.455	<0.889
Radium-226/228	pCi/L	**5**	NC	NC	NC	<0.530	0.599	<0.456	<0.545	<0.355	0.426	1.42	<1.53
Radium-228	pCi/L	5	NC	NC	NC	<0.530	0.426	<0.456	<0.545	<0.355	<0.400	0.963	<0.636
Selenium	ug/L	50	50	50	**5**	<1	<1	<1	1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

[DRAFT - ELECTRONIC REVIEW]

Table 3
Summary of Field Parameters
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen	Oxidation Reduction Potential	Specific Conductivity	Temperature	Turbidity
		mg/L	mV	umhos/cm	°C	NTU
BCC-MW-15001	11/30/15	0.09	-139.3	884	13.12	0.94
	02/17/16	0.8	-92.3	859	8.4	2.4
	04/12/16	0.5	-66.1	802	9.3	5.6
	07/12/16	0.4	-162.2	766	15.4	4.5
	09/27/16	0.4	-83.1	880	12.7	<1
	02/13/17	0.5	-93.6	780	11.2	5.5
	04/04/17	0.1	-94.8	848	10.7	<1
	07/11/17	0.11	-110.8	721.0	14.60	3.94
BCC-MW-15002	11/30/15	0.14	-129.4	3,401	12.52	1.72
	02/17/16	0.2	-82.0	3,114	9.6	<1
	04/12/16	0.3	-82.9	3,693	10.5	<1
	07/12/16	0.4	-43.4	3,087	17.0	<1
	09/27/16	0.4	-50.5	2,003	14.1	<1
	02/13/17	0.5	-77.4	1,784	11.4	<1
	04/04/17	0.6	-59.8	2,072	10.2	<1
	07/11/17	0.10	-11.0	2,479.2	14.21	<1
BCC-MW-15003	11/30/15	2.32	34.1	2,957	11.24	5.1
	02/17/16	0.3	-76.2	3,291	7.5	<1
	04/12/16	0.3	-51.2	2,991	9.8	<1
	07/12/16	0.3	-119.9	2,796	15.5	<1
	09/27/16	0.4	-67.8	2,749	14.3	<1
	02/13/17	0.4	-82.6	2,438	9.9	2.1
	04/04/17	0.0	-107.0	2,349	9.2	1.6
	07/12/17	0.15	-87.2	1,803.0	14.60	5.79
BCC-MW-15004	11/30/15	1.64	-7.3	655	11.07	3.09
	02/17/16	1.0	41.1	556	7.0	2.3
	04/12/16	0.5	-14.0	616	7.6	<1
	07/12/16	0.3	-120.7	741	15.9	<1
	09/27/16	0.4	-69.5	688	16.9	<1
	02/13/17	0.6	-11.2	570	9.0	<1
	04/04/17	0.6	-67.3	615	8.7	<1
	07/12/17	0.14	-39.2	647.9	15.02	3.08
BCC-MW-15005	12/01/15	0.67	-100.7	345	9.19	1.23
	02/17/16	0.3	-65.7	731	5.4	<1
	04/13/16	0.7	-37.1	573	6.7	1.1
	07/12/16	0.3	-141.1	482	17.3	2.3
	09/27/16	0.5	-79.1	387	19.0	2.3
	02/13/17	0.9	-35.7	921	7.1	4.5
	04/04/17	3.2	-66.6	424	7.4	8.0
	07/12/17	0.20	-90.8	374.9	18.31	2.68

Notes:
mg/L - Milligrams per Liter.
mV - Millivolts.
umhos/cm - Micromhos per centimeter.
NTU - Nephelometric Turbidity Unit.

[DRAFT - ELECTRONIC REVIEW]

Table 3
Summary of Field Parameters
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen	Oxidation Reduction Potential	Specific Conductivity	Temperature	Turbidity
		mg/L	mV	umhos/cm	°C	NTU
BCC-MW-15006	11/30/15	2.71	-55.1	683	9.71	2.81
	02/17/16	2.7	73.4	471	4.6	8.7
	04/13/16	2.6	60.5	518	6.8	<1
	07/12/16	1.4	-18.5	678	23.9	<1
	09/28/16	1.2	-5.5	557	19.4	<1
	02/13/17	2.0	-49.7	503	5.5	<1
	04/04/17	3.5	-10.0	414	8.0	<1
	07/12/17	1.49	33.2	598.8	21.51	<1
BCC-MW-15007	12/01/15	0.23	-134.8	6,286	10.56	2.03
	02/17/16	1.4	-72.5	7,506	5.3	1
	04/13/16	0.3	-48.7	7,861	7.1	<1
	07/12/16	0.3	-109.9	7,314	19.1	<1
	09/28/16	0.4	-94.8	8,664	20.3	<1
	02/14/17	0.5	-90.8	6,474	6.1	1.3
	04/04/17	0.1	-72.9	6,047	7.6	<1
	07/12/17	0.13	-118.7	4,980.0	19.60	2.12
BCC-MW-15008	12/01/15	0.00	-308.4	938	12.78	1.18
	02/17/16	0.1	-219.5	956	6.2	<1
	04/13/16	0.2	-230.2	1,133	6.7	<1
	07/12/16	0.2	-239.0	2,443	21.8	<1
	09/28/16	0.4	-250.7	2,149	19.9	<1
	02/14/17	0.6	-117.9	1,078	6.5	<1
	04/04/17	0.5	-88.3	864	7.8	<1
	07/12/17	0.11	-114.3	710.6	18.29	3.79
BCC-MW-15009	12/01/15	0.41	-236.7	335	13.50	1.93
	02/17/16	0.2	-280.2	352	12.7	<1
	04/18/16	0.4	-195.5	346	17.7	<1
	07/12/16	0.2	-367.1	356	19.7	<1
	09/28/16	0.4	-365.3	358	16.8	<1
	02/14/17	0.4	-361.2	329	13.6	1.2
	04/05/17	0.0	-292.0	338	13.5	2.5
	07/11/17	0.05	-319.6	295.7	17.00	6.99
BCC-MW-15010	12/01/15	0.01	-246.0	587	12.97	2.51
	02/17/16	0.1	-197.3	402	11.4	2.8
	04/13/16	0.2	-182.6	344	10.9	<1
	07/13/16	0.3	-174.7	449	16.0	3.1
	09/28/16	0.4	-104.8	547	18.5	<1
	02/14/17	0.5	-192.3	390	12.0	<1
	04/05/17	0.5	-52.9	556	11.3	<1
	07/11/17	0.08	-193.4	345.0	15.50	4.71

Notes:
mg/L - Milligrams per Liter.
mV - Millivolts.
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[DRAFT - ELECTRONIC REVIEW]

Table 3
Summary of Field Parameters
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen	Oxidation Reduction Potential	Specific Conductivity	Temperature	Turbidity
		mg/L	mV	umhos/cm	°C	NTU
BCC-MW-15011	12/01/15	0.00	-322.4	391	13.76	3.54
	02/17/16	0.2	-180.3	346	10.4	<1
	04/13/16	0.3	-145.7	323	14.1	<1
	07/12/16	0.2	-208.0	371	19.2	<1
	09/28/16	0.4	-100.0	390	15.2	<1
	02/14/17	0.5	-221.3	389	12.2	<1
	04/05/17	0.1	-198.5	427	13.0	<1
	07/11/17	0.10	-198.1	345.5	16.00	2.65
BCC-MW-15012	12/01/15	0.49	0.8	374	14.33	2.25
	02/17/16	0.2	-201.2	569	12.6	<1
	04/13/16	0.2	-217.3	570	14.2	1.8
	07/13/16	0.4	-179.0	406	19.9	<1
	09/29/16	0.5	-174.9	354	14.7	<1
	02/14/17	0.6	-186.8	318	12.2	<1
	04/05/17	0.4	-208.8	340	12.6	<1
	07/12/17	0.12	-297.0	264.7	15.20	4.41
BCC-MW-15013	12/01/15	0.07	-262.9	528	14.25	1.59
	02/18/16	0.4	-119.7	436	8.7	<1
	04/13/16	0.3	-130.3	400	13.5	<1
	07/13/16	0.4	-117.9	392	15.8	<1
	09/29/16	0.5	-118.8	449	14.4	<1
	02/14/17	0.4	-161.6	444	12.4	1.2
	04/05/17	0.1	-137.0	435	13.0	<1
	07/12/17	0.13	-169.9	416.8	14.80	3.97
BCC-MW-15014	12/01/15	0.17	-308.7	605	15.87	3.47
	02/18/16	0.1	-215.0	642	10.8	<1
	04/18/16	0.2	-221.3	654	13.6	1
	07/13/16	0.3	-205.9	676	14.8	1.6
	09/29/16	0.4	-242.5	590	12.4	<1
	02/14/17	0.4	-226.2	576	10.9	<1
	04/05/17	0.3	-237.2	568	10.5	<1
	07/12/17	0.14	-315.6	761.0	14.00	4.76
BCC-MW-15015	12/01/15	0.02	-299.8	313	14.51	1.84
	02/18/16	0.2	-230.1	298	9.4	<1
	04/13/16	0.2	-222.5	296	12.5	<1
	07/13/16	0.3	-140.4	318	15.8	<1
	09/29/16	0.4	-152.8	349	13.6	<1
	02/14/17	0.4	-201.7	354	10.8	<1
	04/05/17	0.1	-170.2	369	11.1	1.2
	07/12/17	0.14	-222.6	328.7	14.10	1.77

Notes:
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[DRAFT - ELECTRONIC REVIEW]

Table 3
Summary of Field Parameters
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen	Oxidation Reduction Potential	Specific Conductivity	Temperature	Turbidity
		mg/L	mV	umhos/cm	°C	NTU
BCC-MW-15016	12/01/15	0.84	-109.7	1,902	10.85	2.92
	02/18/16	0.1	-61.8	2,061	11.0	2.8
	04/13/16	0.1	-92.2	2,170	12.1	<1
	07/13/16	0.3	-126.3	2,171	16.7	5
	09/29/16	0.3	-90.1	2,161	15.0	<1
	02/14/17	0.5	-97.3	2,061	11.4	1.3
	04/05/17	0.4	-96.3	1,929	10.6	<1
	07/12/17	0.09	-63.7	2,005.4	14.21	3.58
BCC-MW-15017	12/01/15	0.04	-204.9	1,963	11.22	1.39
	02/18/16	0.2	-132.6	2,237	10.1	<1
	04/18/16	0.3	-95.2	2,159	14.8	<1
	07/13/16	0.2	-101.2	2,211	16.1	<1
	09/29/16	0.5	-83.1	2,242	13.9	3.2
	02/14/17	0.5	-86.8	1,988	11.1	5.4
	04/05/17	0.0	-99.8	2,410	10.0	3.5
	07/12/17	0.07	-79.5	2,182.4	13.75	3.52
BCC-MW-15018	12/02/15	0.20	-138.5	710	12.77	5.46
	02/18/16	0.2	-76.6	753	9.8	<1
	04/14/16	0.3	-80.8	772	10.1	<1
	07/14/16	0.4	-83.7	819	14.9	<1
	09/29/16	0.5	-53.5	824	13.0	<1
	02/14/17	0.5	-71.1	793	10.5	<1
	04/05/17	0.5	-55.3	680	9.5	7
	07/11/17	0.11	-36.7	762.1	14.54	1.71
BCC-MW-15019	12/02/15	1.46	-88.0	646	12.09	8
	02/18/16	0.2	-122.7	727	6.6	<1
	04/14/16	0.5	-105.9	707	9.5	<1
	07/13/16	0.2	-106.7	733	17.5	<1
	09/30/16	0.6	-70.7	762	13.0	<1
	02/15/17	0.6	-119.2	692	9.7	<1
	04/05/17	0.0	-125.9	821	9.0	<1
	07/11/17	0.09	-78.9	843.2	14.50	1.56
BCC-MW-15020	12/02/15	0.77	-97.2	475	12.61	2.1
	02/18/16	0.1	-112.5	526	9.8	<1
	04/14/16	2.7	-79.8	555	11.3	<1
	07/14/16	0.4	-95.3	549	15.7	<1
	09/30/16	0.6	-65.9	560	13.7	<1
	02/15/17	0.5	-96.7	540	9.8	<1
	04/05/17	0.5	-79.3	507	10.0	<1
	07/11/17	0.12	-76.7	604.3	15.57	3.42

Notes:
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[DRAFT - ELECTRONIC REVIEW]

Table 3
Summary of Field Parameters
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen	Oxidation Reduction Potential	Specific Conductivity	Temperature	Turbidity
		mg/L	mV	umhos/cm	°C	NTU
BCC-MW-15021	12/02/15	0.33	-144.3	1,019	13.17	2.29
	02/18/16	0.2	-111.7	1,032	9.1	<1
	04/14/16	0.3	-101.2	1,018	12.6	<1
	07/13/16	0.2	-97.6	1,040	17.3	<1
	10/05/16	0.6	-15.8	1,114	14.8	1
	02/15/17	0.5	-108.6	962	10.9	<1
	04/06/17	0.1	-122.1	1,189	7.3	<1
	07/12/17	0.11	-83.0	1,038.8	13.76	1.05
BCC-MW-15022	12/02/15	0.53	-72.3	383	10.47	0.34
	02/18/16	0.2	-91.2	377	5.0	<1
	04/14/16	0.4	-64.5	422	11.6	<1
	07/14/16	0.3	-74.4	356	14.6	<1
	10/05/16	0.3	-172.3	365	13.9	<1
	02/15/17	0.5	-121.4	421	9.6	<1
	04/06/17	0.5	-163.8	380	10.1	<1
	07/12/17	0.10	-271.2	413.5	15.20	1.30
BCC-MW-15023	12/02/15	0.27	-139.1	493	13.49	0.89
	02/18/16	0.2	-82.7	456	6.8	<1
	04/14/16	0.3	-79.0	436	10.7	<1
	07/14/16	0.5	-72.7	447	16.9	<1
	10/05/16	0.5	-75.0	480	14.8	<1
	02/15/17	0.6	-53.4	446	7.3	<1
	04/05/17	0.1	-83.6	600	8.1	2
	07/11/17	0.13	-46.3	451.7	12.84	0.56

Notes:
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[DRAFT - ELECTRONIC REVIEW]

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT MONITORING WELL
- APPROXIMATE POND BOUNDARY
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)
- GROUNDWATER ELEVATION CONTOUR (1' INTERVAL, DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO & PARTNERS, 04/04/2016.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.
3. NU= NOT USED. WELL SCREENED AT DEEPER INTERVAL RELATIVE TO ADJACENT WELLS, NOT USED TO CONSTRUCT CONTOUR MAP.

N

0 300 600 Feet

1" = 300'

1:3,600

PROJECT: CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE: GROUNDWATER CONTOUR MAP
NOVEMBER 30, 2015

DRAWN BY:	B DEEGAN	PROJ NO:	269767-001
CHECKED BY:	S HOLMSTROM		FIGURE 1
APPROVED BY:	G. CROCKFORD		
DATE:	JANUARY 2018		

TRC

1540 Eisenhower Place
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FILE NO.: 269767-001-005.mxd

Plot Date: 1/12/2018, 16:58:15 PM by SMAJOR – LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\269767-001-005.mxd

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

TRC - GIS

[DRAFT - ELECTRONIC REVIEW]

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT MONITORING WELL
- APPROXIMATE POND BOUNDARY
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)
- GROUNDWATER ELEVATION CONTOUR (1' INTERVAL, DASHED WHERE INFERRED)

NOTES

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2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.
3. NU = NOT USED. WELL SCREENED AT DEEPER INTERVAL RELATIVE TO ADJACENT WELLS, NOT USED TO CONSTRUCT CONTOUR MAP.

N

0 300 600 Feet

1" = 300'

1:3,600

PROJECT:

CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:

GROUNDWATER CONTOUR MAP
FEBRUARY 16, 2016

DRAWN BY:	J. PAPEZ	PROJ NO.:	269767-001
CHECKED BY:	S HOLMSTROM		
APPROVED BY:	G. CROCKFORD		**FIGURE 2**
DATE:	JANUARY 2018		

TRC

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FILE NO.: 269767-001-003.mxd

Plot Date: 1/12/2018, 17:01:20 PM by SMAJOR – LAYOUT: ANSI B (11"x17")
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Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

TRC - GIS

[DRAFT - ELECTRONIC REVIEW]

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT MONITORING WELL
- APPROXIMATE POND BOUNDARY
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)
- GROUNDWATER ELEVATION CONTOUR (1' INTERVAL, DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO & PARTNERS, 04/04/2016.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.
3. NU= NOT USED. WELL SCREENED AT DEEPER INTERVAL RELATIVE TO ADJACENT WELLS, NOT USED TO CONSTRUCT CONTOUR MAP.

N

0 300 600 Feet

1" = 300 '

1:3,600

PROJECT: CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE: GROUNDWATER CONTOUR MAP
APRIL 12, 2016

DRAWN BY:	B DEEGAN	PROJ NO:	269767-001
CHECKED BY:	S HOLMSTROM		
APPROVED BY:	G. CROCKFORD		FIGURE 3
DATE:	JANUARY 2018		

TRC

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FILE NO.: 269767-001-006.mxd

Plot Date: 1/12/2018, 17:02:52 PM by SMAJOR – LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\269767-001-006.mxd

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

TRC - GIS

[DRAFT - ELECTRONIC REVIEW]

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT MONITORING WELL
- APPROXIMATE POND BOUNDARY
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)
- GROUNDWATER ELEVATION CONTOUR (0.5' INTERVAL, DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.

N

0 300 600 Feet

1" = 300'

1:3,600

PROJECT: CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE: GROUNDWATER CONTOUR MAP
JULY 11, 2016

DRAWN BY:	B DEEGAN	PROJ NO.:	269767-001
CHECKED BY:	S HOLMSTROM		FIGURE 4
APPROVED BY:	G. CROCKRFORD		
DATE:	JANUARY 2018		

TRC

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Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

Plot Date: 1/12/2018, 17:05:55 PM by SMAJOR – LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\269767-001-007.mxd

TRC - GIS

[DRAFT - ELECTRONIC REVIEW]

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT MONITORING WELL
- APPROXIMATE POND BOUNDARY
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)
- GROUNDWATER ELEVATION CONTOUR (0.5' INTERVAL, DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.

N

0 300 600 Feet

1" = 300'

1:3,600

PROJECT:

CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:

GROUNDWATER CONTOUR MAP
SEPTEMBER 27, 2016

DRAWN BY:	J. PAPEZ	PROJ NO:	269767-001
CHECKED BY:	S HOLMSTROM		
APPROVED BY:	G. CROCKFORD		
DATE:	JANUARY 2018		

FIGURE 5

TRC

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Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

Plot Date: 1/12/2018, 17:08:06 PM by SMAJOR - LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\269767-001-004.mxd

TRC - GIS

[DRAFT - ELECTRONIC REVIEW]

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT MONITORING WELL
- APPROXIMATE POND BOUNDARY
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)
- GROUNDWATER ELEVATION CONTOUR (0.5' INTERVAL, DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.

N

0 300 600 Feet

1" = 300'

1:3,600

PROJECT: CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE: GROUNDWATER CONTOUR MAP
FEBRURAY 13, 2017

DRAWN BY:	B DEEGAN	PROJ NO:	269767-001
CHECKED BY:	S HOLMSTROM		FIGURE 6
APPROVED BY:	G. CROCKFORD		
DATE:	JANUARY 2018		

TRC

1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 269767-001-008.mxd

Plot Date: 1/12/2018, 17:10:06 PM by SMAJOR – LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\269767-001-008.mxd

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

TRC - GIS

[DRAFT - ELECTRONIC REVIEW]

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT MONITORING WELL
- APPROXIMATE POND BOUNDARY
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)
- GROUNDWATER ELEVATION CONTOUR (0.5' INTERVAL, DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.

N

0 300 600 Feet

1" = 300'

1:3,600

PROJECT:

CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:

GROUNDWATER CONTOUR MAP
APRIL 04, 2017

DRAWN BY:	B DEEGAN	PROJ NO.:	269767-001
CHECKED BY:	S HOLMSTROM		
APPROVED BY:	G. CROCKFORD		**FIGURE 7**
DATE:	JANUARY 2018		

TRC

1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 269767-001-009.mxd

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

Plot Date: 1/12/2018, 17:11:44 PM by SMAJOR – LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\269767-001-009.mxd

TRC - GIS

[DRAFT - ELECTRONIC REVIEW]

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT MONITORING WELL
- APPROXIMATE POND BOUNDARY
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)
- GROUNDWATER ELEVATION CONTOUR (0.5' INTERVAL, DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.

N

0 300 600 Feet

1" = 300'
1:3,600

PROJECT: CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE: GROUNDWATER CONTOUR MAP
JULY 11, 2017

DRAWN BY:	J. PAPEZ	PROJ NO:	269767-001
CHECKED BY:	S. HOLMSTROM		FIGURE 8
APPROVED BY:	G. CROCKFORD		
DATE:	JANUARY 2018		

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 269767-001-014.mxd

Plot Date: 1/12/2018, 17:15:32 PM by SMAJOR – LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\269767-001-014.mxd

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

TRC - GIS

[DRAFT - ELECTRONIC REVIEW]

Appendix B
Data Quality Review

[DRAFT - ELECTRONIC REVIEW]

Laboratory Data Quality Review
Groundwater Monitoring Event September 2017
CEC BC Cobb

Groundwater samples were collected by TRC for the September 2017 sampling event. Samples were analyzed for anions, total metals, and total dissolved solids by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan. The laboratory analytical results are reported in laboratory report 462581.

During the September 2017 sampling event, a groundwater sample was collected from each of the following wells:

- BCC-MW-15001
- BCC-MW-15002
- BCC-MW-15003
- BCC-MW-15004
- BCC-MW-15005
- BCC-MW-15006
- BCC-MW-15007
- BCC-MW-15008
- BCC-MW-15009
- BCC-MW-15010
- BCC-MW-15011
- BCC-MW-15012
- BCC-MW-15013
- BCC-MW-15014
- BCC-MW-15015
- BCC-MW-15016
- BCC-MW-15017
- BCC-MW-15018
- BCC-MW-15019
- BCC-MW-15020
- BCC-MW-15021
- BCC-MW-15022
- BCC-MW-15023

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Chloride, Fluoride, Sulfate)	EPA 300.0
Total Metals	EPA 6020A, EPA 6010C
Total Dissolved Solids	SM 2540C

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2017). The following items were included in the evaluation of the data:

- Sample receipt, as noted in the cover page or case narrative;
- Technical holding times for analyses;

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- Data for method blanks, equipment blanks, and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD). Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Reporting limits (RLs) compared to project-required RLs;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes;
- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix;
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Findings

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose, with the non-conformances and issues identified in this evaluation noted below.

- Appendix III constituents will be utilized for the purposes of developing a detection monitoring program.
- Data are usable for the purposes of this episodic report.
- When the data are evaluated for preparing a detection monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- Three equipment blanks (EB-01, EB-01, and EB-03) and two field blanks (FB-01 and FB-02) were collected.
- Dup-01 corresponds to BCC-MW-15010, Dup-02 corresponds to BCC-MW-15015, and Dup-03 corresponds to BCC-MW-15018.

- MS/MSDs were performed on samples BCC-MW-15002, BCC-MW-15003, BCC-MW-15008, BCC-MW-15010, and BCC-MW-15014.

Pace Analytical:

- MS/MSD recoveries
  - MS/MSDs were performed on BCC-MW-15003 and BCC-MW-15002 for batch 5122. The recoveries for chloride in the MS/MSD performed on BCC-MW-15003 were below the lower laboratory control limit. The recoveries for sulfate in the MS/MSD performed on BCC-MW-15002 were below the lower laboratory control limit. The chloride and sulfate results for samples analyzed in the same batch may be biased low.
  - MS/MSDs were performed on BCC-MW-15010 and BCC-MW-15014 for batch 5123. The MS/MSD performed on BCC-MW-15010 had chloride and sulfate recoveries that were below the lower laboratory control limits. Chloride and sulfate results for samples analyzed in the same batch may be biased low.
  - MS/MSD was performed on BCC-MW-15003 for batch 5047. The calcium recoveries in the MS/MSD were above the upper laboratory control limit; however, the calcium concentration in the parent sample was >4x the spike concentration, therefore, the laboratory control limits are not applicable.
  - MS/MSD was performed on BCC-MW-15014 for batch 5113. The boron recovery in the MS was below the lower laboratory control limit and the recovery in the MSD was above the upper laboratory control limit. The boron concentration in the parent sample was >4x the spike concentration, therefore, the laboratory control limits are not applicable.
- The RPD for TDS for the sample duplicate pair (BCC-MW-15015/Dup-02) exceeded the 20% acceptance limit. Potential uncertainty exists for TDS results in samples BCC-MW-15015 and Dup-02 due to field duplicate variability.

[DRAFT - ELECTRONIC REVIEW]

Appendix C
Statistical Background Limits

[DRAFT - ELECTRONIC REVIEW]

Technical Memorandum

Date: January 15, 2018

To: Michelle Marion, CEC
J.R. Register, CEC
Brad Runkel, CEC

From: Sarah Holmstrom, TRC
Darby Litz, TRC
Joyce Peterson, TRC

Project No.: 269767.0000 Phase 001, Task 003

Subject: Background Statistical Evaluation (R1-R8) – Consumers Energy, BC Cobb

---

Pursuant to the United States Environmental Protection Agency's (U.S. EPA's) Resource Conservation and Recovery Act (RCRA) Coal Combustion Residual rule ("CCR Rule") promulgated on April 17, 2015, the owner or operator of a CCR Unit must collect a minimum of eight rounds of background groundwater data to initiate a detection monitoring program and evaluate statistically significant increases above background (40 CFR §257.94). This memorandum presents the background statistical limits derived for the Consumers Energy Company (CEC) former BC Cobb Power Plant (BC Cobb site) in Muskegon, Michigan.

There are two RCRA CCR units associated with the plant—the Bottom Ash Pond and Ponds 0-8, both of which are wet ash dewatering areas. From 1984 through plant closure in 2016, CCR has been deposited in the ash ponds by utilizing sluicing methods. In response to the CCR Rule, CEC had 23 groundwater monitoring wells installed at the Bottom Ash Pond and Ponds 0-8 to serve as a multiunit groundwater monitoring system (in accordance with 40 CFR §257.91).

Following the baseline data collection period (November 2015 through July 2017), the background data for the BC Cobb site were evaluated in accordance with the Groundwater Statistical Evaluation Plan (Stats Plan) (TRC, October 2017). The BC Cobb site groundwater data are maintained within a database accessible through Sanitas™ statistical software. Sanitas™ is a software tool that is commercially available for performing statistical evaluation consistent with procedures outlined in U.S.EPA's Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities (Unified Guidance; UG). Within the Sanitas™ statistical program (and the UG), tolerance limits were selected to perform the statistical calculation for background limits. Use of tolerance limits is a streamlined approach that offers adequate statistical power under the current, initial stage of establishing

[DRAFT - ELECTRONIC REVIEW]

background and developing the monitoring program and is an acceptable approach for detection monitoring under the CCR rule. Upper tolerance limits (UTLs) were calculated for each of the CCR Appendix III parameters. The following narrative describes the methods employed and the results obtained and the Sanitas™ output files are included as an attachment.

The set of background wells utilized for the two CCR units at the BC Cobb site includes BCC-MW-15002 through BCC-MW-15008. The background evaluation included the following steps:

- Review of data quality reports for the baseline/background data sets for CCR Appendix III constituents;
- Graphical representation of the baseline data as time versus concentration (T v. C) by well/constituent pair;
- Graphical representation of cumulative baseline background data sorted from lowest to highest concentration for each constituent;
- Outlier testing of individual data points that appear from the graphical representations as potential outliers;
- Evaluation of percentage of nondetects for each baseline/background well-constituent (w/c) pair;
- Distribution of the data; and
- Calculation of the UTL for each cumulative baseline/background data set (upper and lower tolerance limits were calculated for field pH).

The results of these evaluations are presented and discussed below.

Data Quality

Data from each sampling round were evaluated for completeness, overall quality and usability, method-specified sample holding times, precision and accuracy, and potential sample contamination. The review was completed using the following quality control (QC) information which at a minimum included chain-of-custody forms, investigative sample results including blind field duplicates, and matrix spike and matrix spike duplicates (MS/MSDs) recoveries, and, as provided by the laboratory, method blanks, laboratory control spikes, laboratory duplicates. The data were found to be complete and usable for the purposes of the CCR monitoring program.

Time versus Concentration Graphs

The T v. C graphs show a potential outlier for boron (high value for BCC-MW-15003 in April 2016) (Figure 1). This data set will be tested by the Sanitas™ software to assess whether the potential outlier is statistically significant.

While variations in results are present, the graphs do not suggest that data sets as a whole, likely have overall trending or seasonality. The data sets are of relatively short duration for making such observations.

[DRAFT - ELECTRONIC REVIEW]

Cumulative Baseline Data Sets

Ideally, the background data sets provide a continuous concentration distribution. The ideal is rarely achieved by multiple background wells representing a relatively large geographic area, such as in the case at the BC Cobb site. When sorted by concentration, the data generally group by smaller subsets of the overall background well network (Figure 2). Some of the parameters have a relatively consistent distribution, but chloride, sulfate, and TDS clearly have some wells with higher values than the other background wells. These results need to be taken into consideration as they represent potential non-CCR upgradient contributions to downgradient wells.

Outlier Testing

The Dixon's Outlier Test in Sanitas™ was used to test the potential outlier graphs in the boron data set for BCC-MW-15003 that was identified in the T v. C graphs (Figure 1) and in the cumulative concentration distribution (Figure 2). The suspect data point was found to be an outlier at the 0.05 significance level (see attached Sanitas™ output file). With the outlier removed, Sanitas found that the boron data set at BCC-MW-15003 was normally distributed at the 0.01 significance level. The outlier data point will be excluded from the background/baseline UTL calculations.

Percentage of Nondetects

Table 1 summarizes the percentage of results below the reporting limit for each w/c pair.

Table 1
Summary of Percentage of Baseline Results Below Reporting Limit

WELL	CONSTITUENT	PERCENT NON-DETECT
BCC-MW-15002	Boron	0
	Calcium	0
	Chloride	0
	Fluoride	100
	Field pH	0
	Sulfate	0
	Total Dissolved Solids	0
BCC-MW-15003	Boron	0
	Calcium	0
	Chloride	0
	Fluoride	100
	Field pH	0
	Sulfate	0
	Total Dissolved Solids	0

[DRAFT - ELECTRONIC REVIEW]

Table 1
Summary of Percentage of Baseline Results Below Reporting Limit

WELL	CONSTITUENT	PERCENT NON-DETECT
BCC-MW-15004	Boron	0
	Calcium	0
	Chloride	0
	Fluoride	100
	Field pH	0
	Sulfate	25
	Total Dissolved Solids	0
BCC-MW-15005	Boron	12.5
	Calcium	0
	Chloride	0
	Fluoride	100
	Field pH	0
	Sulfate	12.5
	Total Dissolved Solids	0
BCC-MW-15006	Boron	0
	Calcium	0
	Chloride	0
	Fluoride	100
	Field pH	0
	Sulfate	0
	Total Dissolved Solids	0
BCC-MW-15007	Boron	0
	Calcium	0
	Chloride	0
	Fluoride	100
	Field pH	0
	Sulfate	0
	Total Dissolved Solids	0
BCC-MW-15008	Boron	0
	Calcium	0
	Chloride	0
	Fluoride	100
	Field pH	0
	Sulfate	0
	Total Dissolved Solids	0

[DRAFT - ELECTRONIC REVIEW]

Table 1
Summary of Percentage of Baseline Results Below Reporting Limit

WELL	CONSTITUENT	PERCENT NON-DETECT
COMBINED	Boron	1.8
	Calcium	0
	Chloride	0
	Fluoride	100
	Field pH	0
	Sulfate	5.4
	Total Dissolved Solids	0

Distribution of the Data Sets

The distribution of the data sets is determined by the Sanitas™ software during calculation of the upper tolerance limit. The Shapiro-Francia test is used for samples sizes greater than 50. Non-detect/censored data were handled in accordance with the Stats Plan. If the data appear to be non-normal, mathematical transformations of the data may be utilized such that the transformed data follow a normal distribution (e.g., lognormal distributions). Alternatively, non-parametric tests may be utilized when data cannot be normalized. Table 2 summarizes the distributions determined by the Sanitas™ software. The distribution is based on the combined baseline results for all seven background monitoring wells.

Table 2
Summary of Background/Baseline Data Distributions

CONSTITUENT	DISTRIBUTION
Boron (outlier removed)	Nonnormal
Calcium	Nonnormal
Chloride	Normalized by natural log transformation
Fluoride	All ND – use highest RL
Field pH	Nonnormal
Sulfate	Normalized by natural log transformation
Total Dissolved Solids	Normalized by natural log transformation

Upper Tolerance Limits

Table 3 presents the calculated upper tolerance limits for the background/baseline data sets. The UTL for the data set with an observed outlier was calculated with the outlier removed. The UTL is calculated based on the distribution listed above. UTLs are calculated for 95 percent coverage and 95 percent confidence. Verification resampling (1 of 2) is recommended per the Stats Plan and UG to achieve a site-wide false positive rate within the range specified in the CCR rules.

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Table 3
Summary of Baseline Upper Tolerance Limits

CONSTITUENT	UPPER TOLERANCE LIMIT – FROM SANITAS™
Boron (outlier removed)	1,320 µg/L
Calcium	259 mg/L
Chloride	5,980 mg/L
Fluoride	1,000 µg/L
Field pH	6.6 – 8.3 s.u.
Sulfate	200 mg/L
Total Dissolved Solids	5,170 mg/L

Attachments

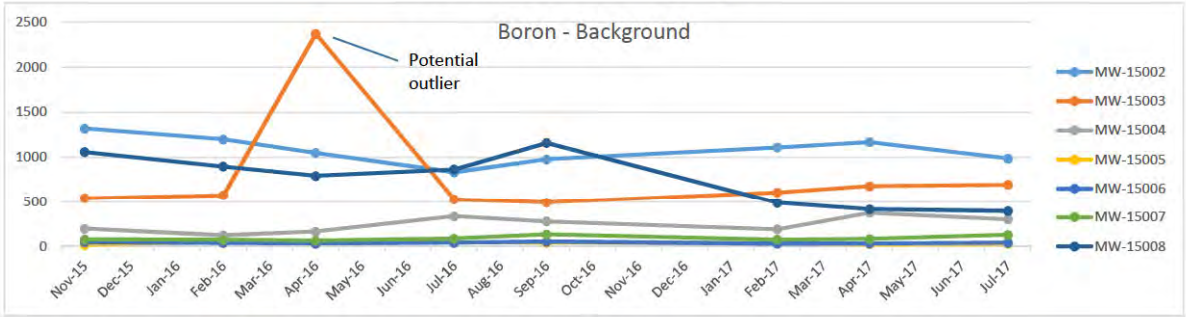
Figure 1 – Background Concentration Time-Series Charts
Figure 2 – Combined Background Distribution
Sanitas™ Output Files

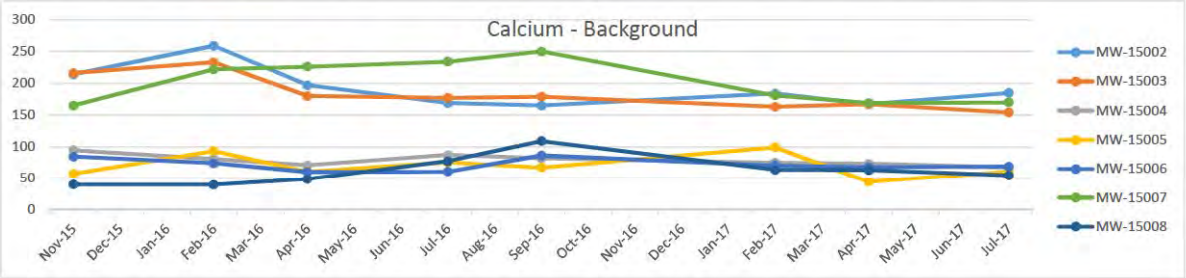
[DRAFT - ELECTRONIC REVIEW]

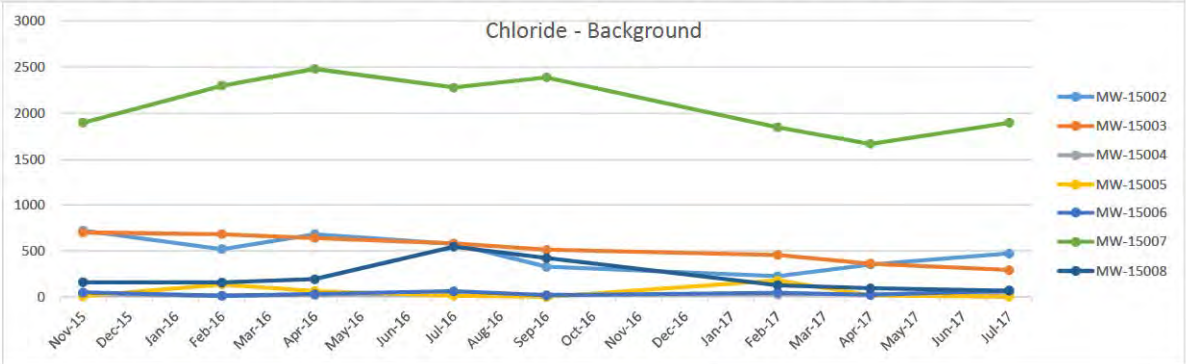
Figures

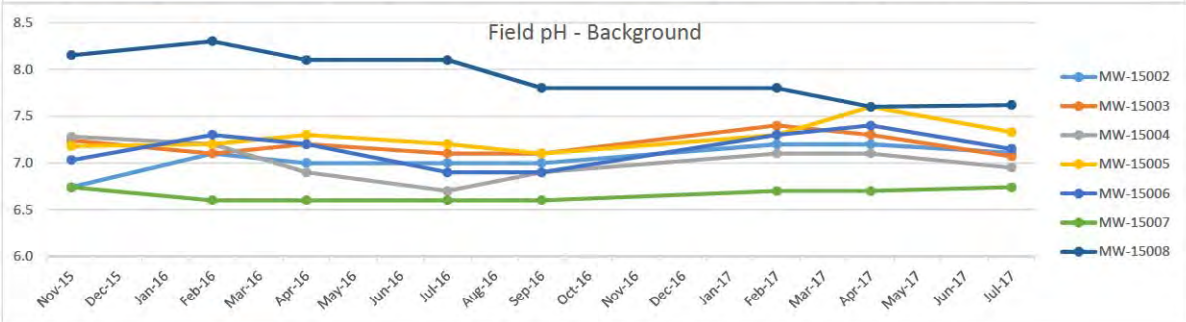
[DRAFT - ELECTRONIC REVIEW]

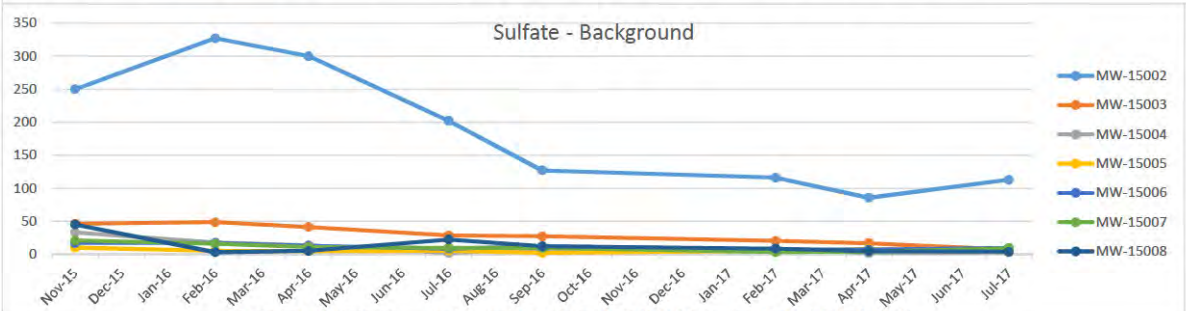
Figure 1
Background Concentration Time-Series Charts
BC Cobb - RCRA CCR Monitoring Program











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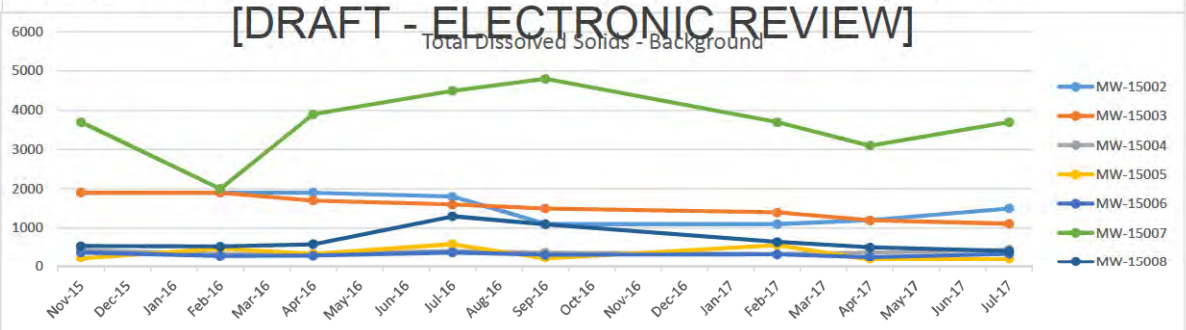
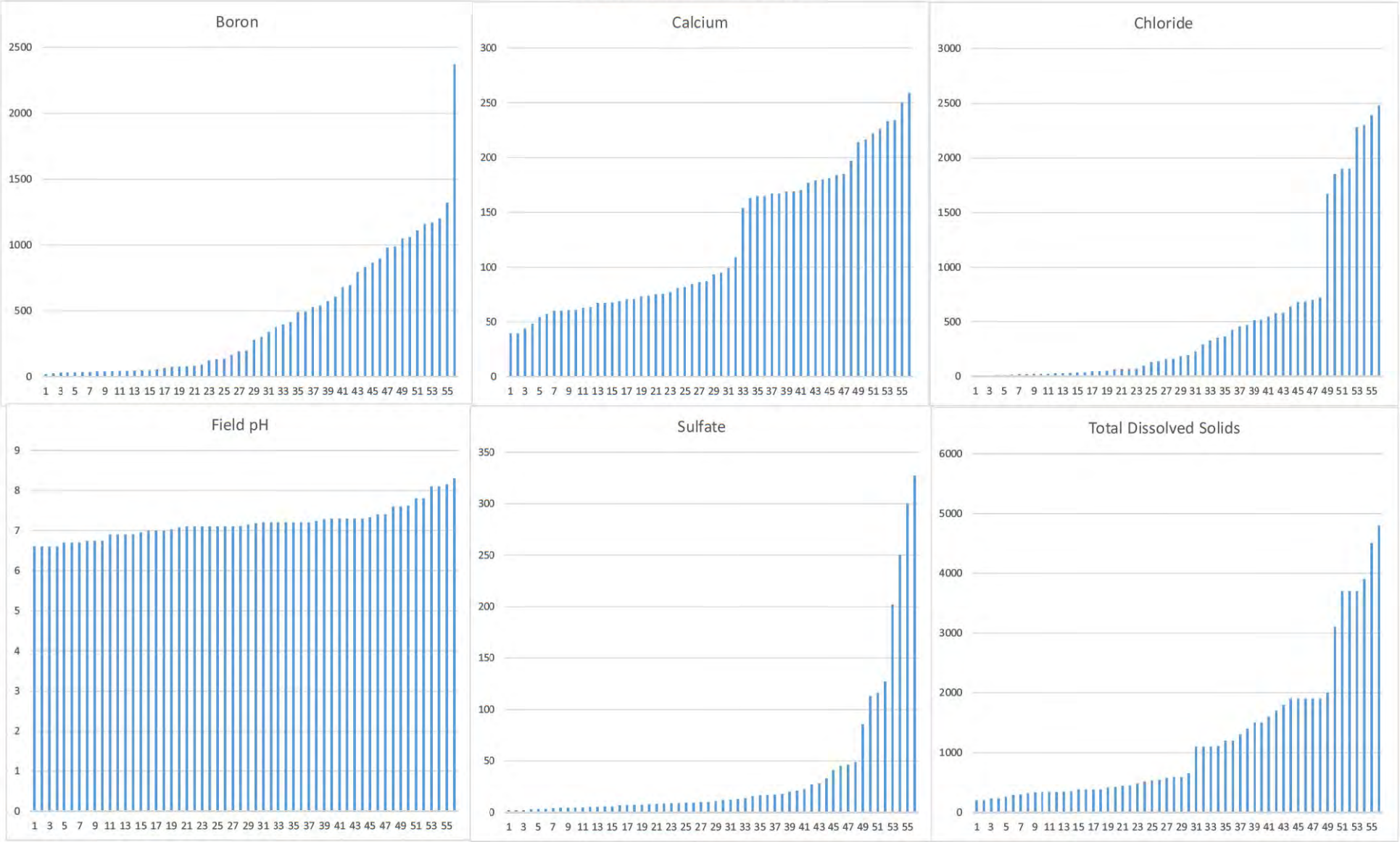


Figure 2
Combined Background Distribution
BC Cobb - RCRA CCR Monitoring Program



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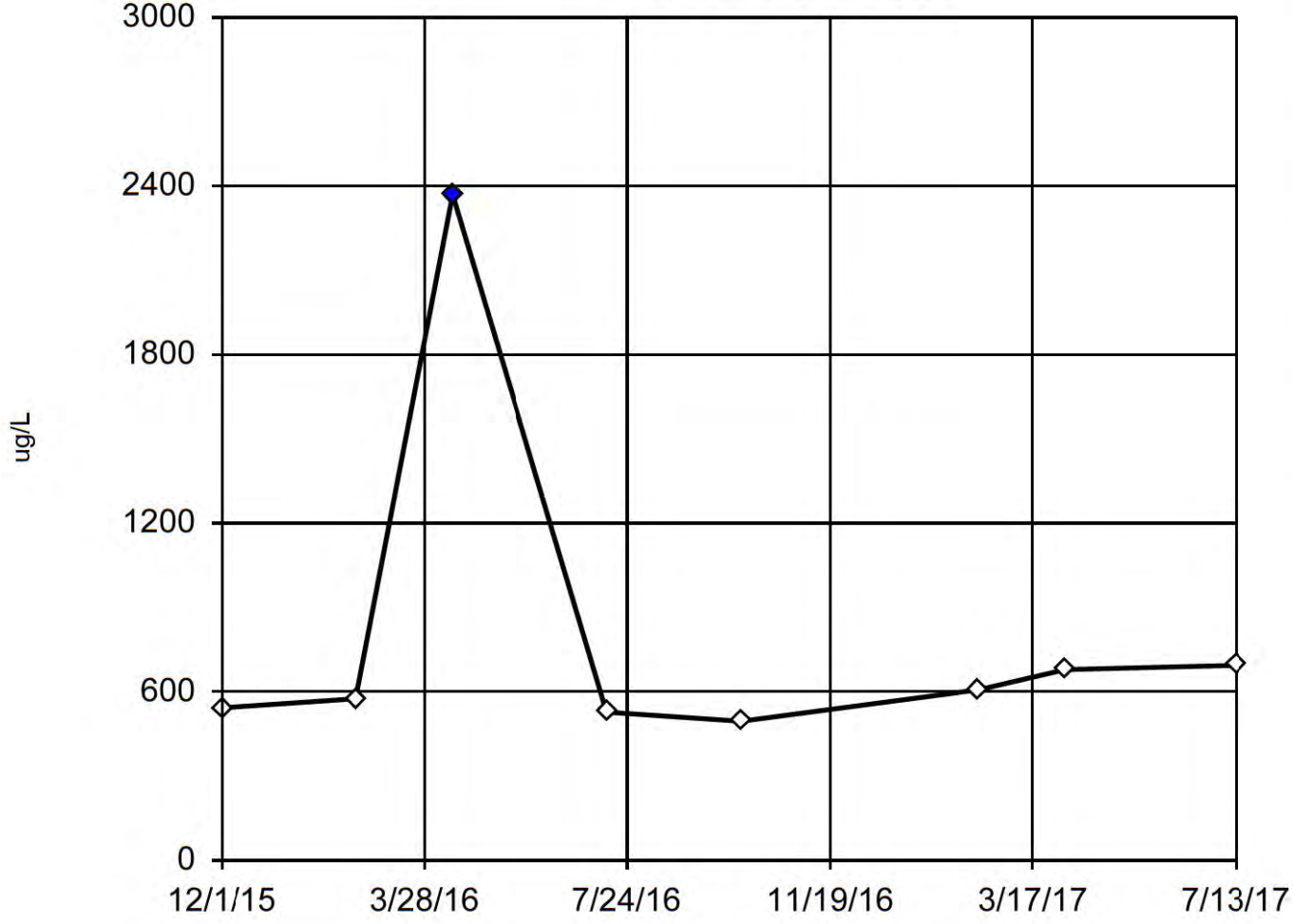
Technical Memorandum

Sanitas™ Output Files

[DRAFT - ELECTRONIC REVIEW]

Dixon's Outlier Test

BCC-MW-15003 (bg)



n = 8

Statistical outlier is drawn as solid.
Testing for 1 high outlier.
Mean = 811.3.
Std. Dev. = 633.8.
2370: c = 0.9093
tabl = 0.554.
Alpha = 0.05.

Normality test used:
Shapiro Wilk@alpha = 0.1
Calculated = 0.9321
Critical = 0.838
The distribution, after removal of suspect value, was found to be normally distributed.

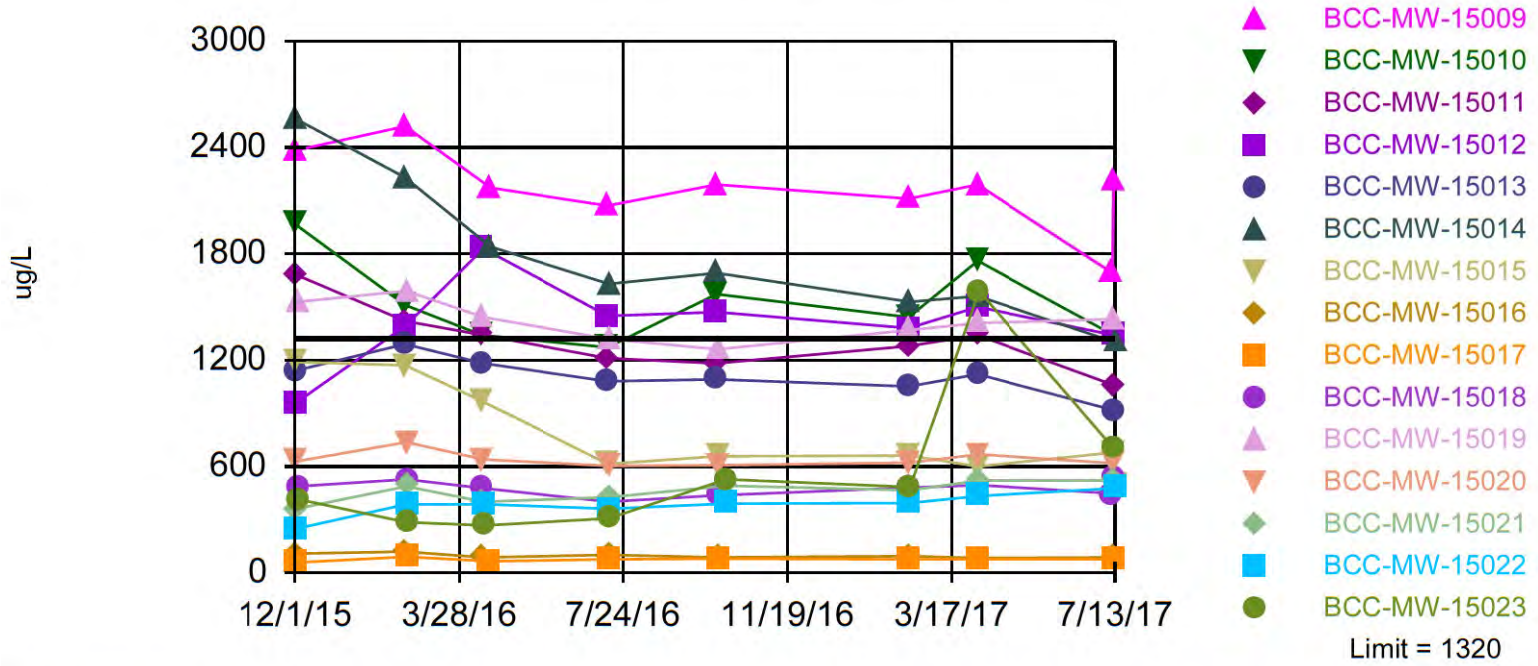
Constituent: Boron, Total Analysis Run 11/13/2017 3:03 PM

Client: Consumers Energy Data: BCC_Sanitas

Exceeds Limit: BCC-MW-15009, BCC-MW-15010, BCC-MW-15012, BCC-MW-15019

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.01 alpha level. Most recent observation is compared with limit. Limit is highest of 55 background values. 1.818% NDs. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at alpha=0.5. Report alpha = 0.05954.

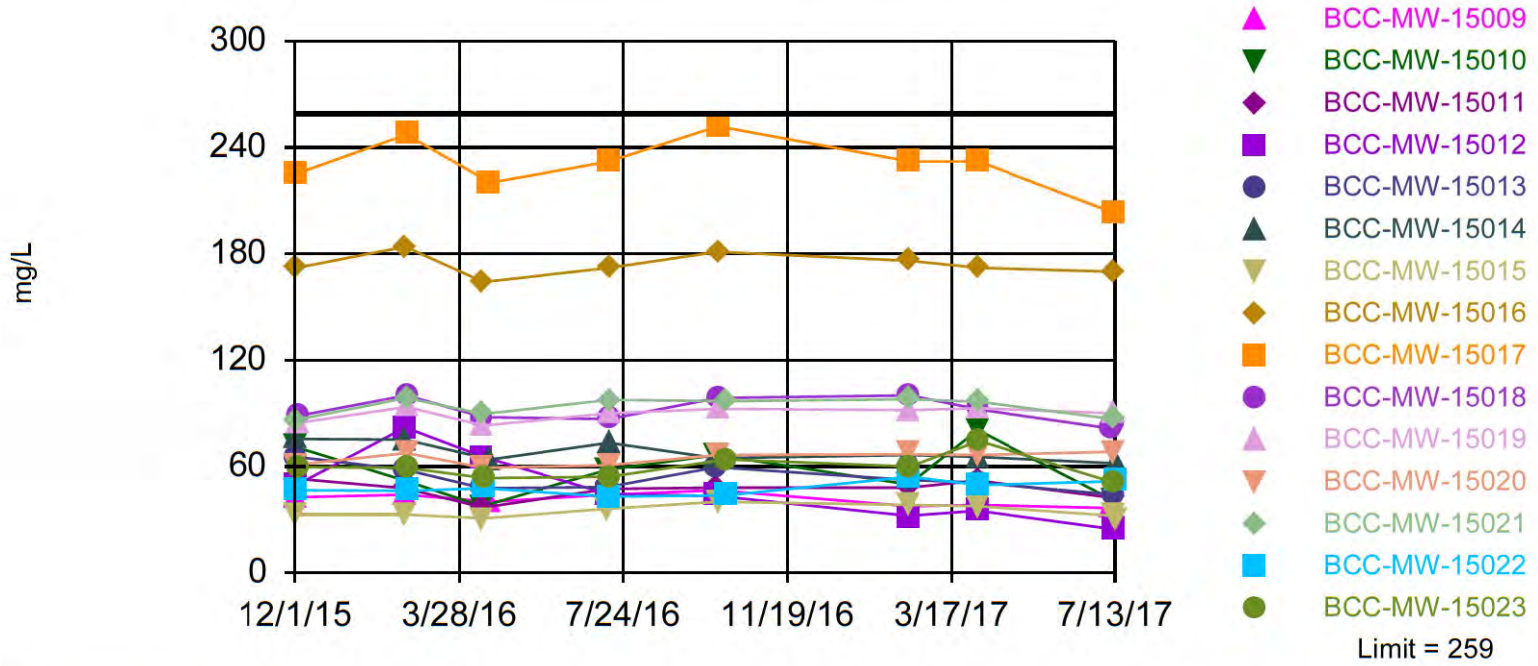
Constituent: Boron, Total Analysis Run 11/14/2017 9:18 AM

Client: Consumers Energy Data: BCC_Sanitas

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.01 alpha level. Most recent observation is compared with limit. Limit is highest of 56 background values. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at alpha=0.5. Report alpha = 0.05656.

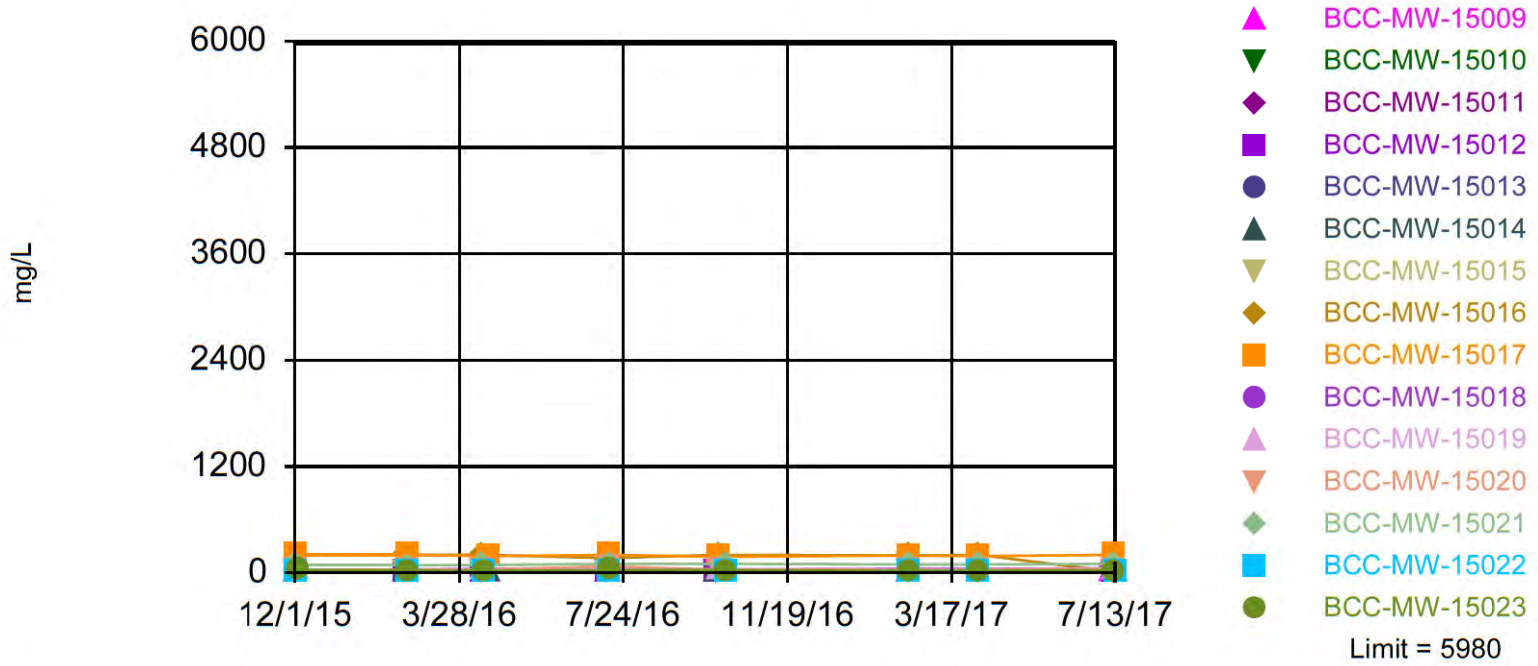
Constituent: Calcium, Total Analysis Run 11/14/2017 9:18 AM

Client: Consumers Energy Data: BCC_Sanitas

Within Limit

Tolerance Limit

Interwell Parametric



95% coverage. Most recent observation is compared with limit. Background Data Summary (based on natural log transformation): Mean=4.993, Std. Dev.=1.822, n=56. Normality test: Shapiro Francia @alpha = 0.01, calculated = 0.9681, critical = 0.942. Report alpha = 0.05.

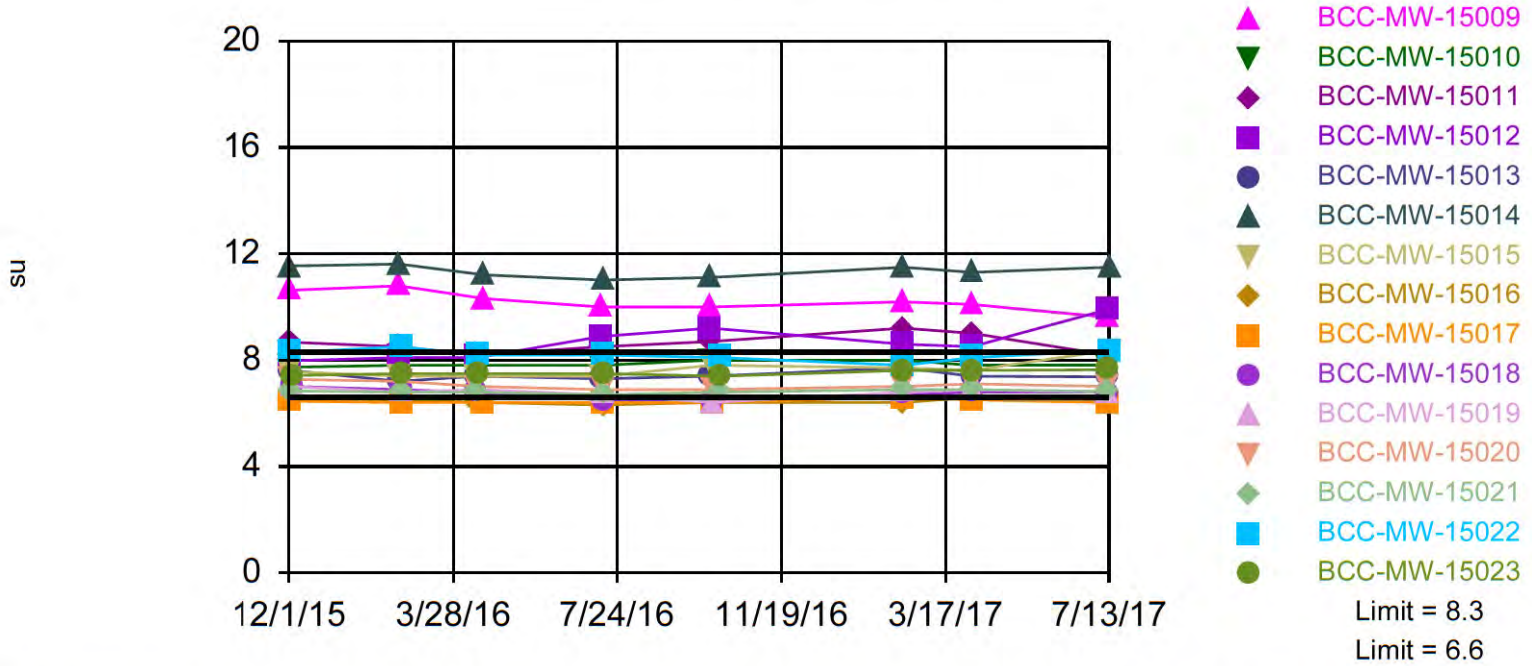
Constituent: Chloride Analysis Run 11/14/2017 9:18 AM

Client: Consumers Energy Data: BCC_Sanitas

Exceeds Limits: BCC-MW-15009, BCC-MW -15012, BCC-MW-15014, BCC-MW-15015...

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.01 alpha level. Most recent observation is compared with limit. Limits are highest and lowest of 56 background values. 88.87% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 97.07% coverage at alpha=0.5. Report alpha = 0.2233 (0.1116 per tail).

Constituent: pH, Field Analysis Run 11/14/2017 9:19 AM

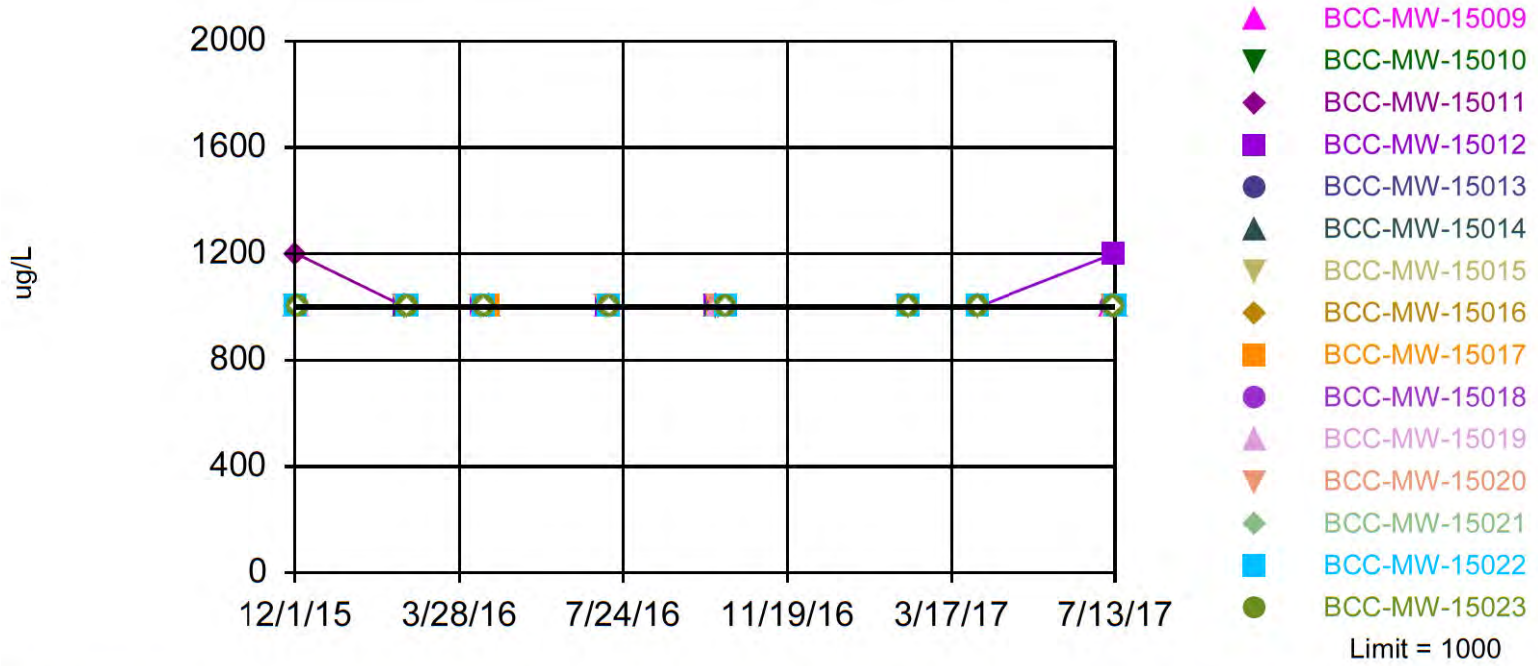
Client: Consumers Energy Data: BCC_Sanitas

Sanitas™ v.9.5.32 Sanitas software licensed to Consumers Energy. UG
Hollow symbols indicate censored values.

Exceeds Limit: BCC-MW-15012

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at alpha=0.5. Report alpha = 0.05656.

Constituent: Fluoride Analysis Run 11/14/2017 9:19 AM

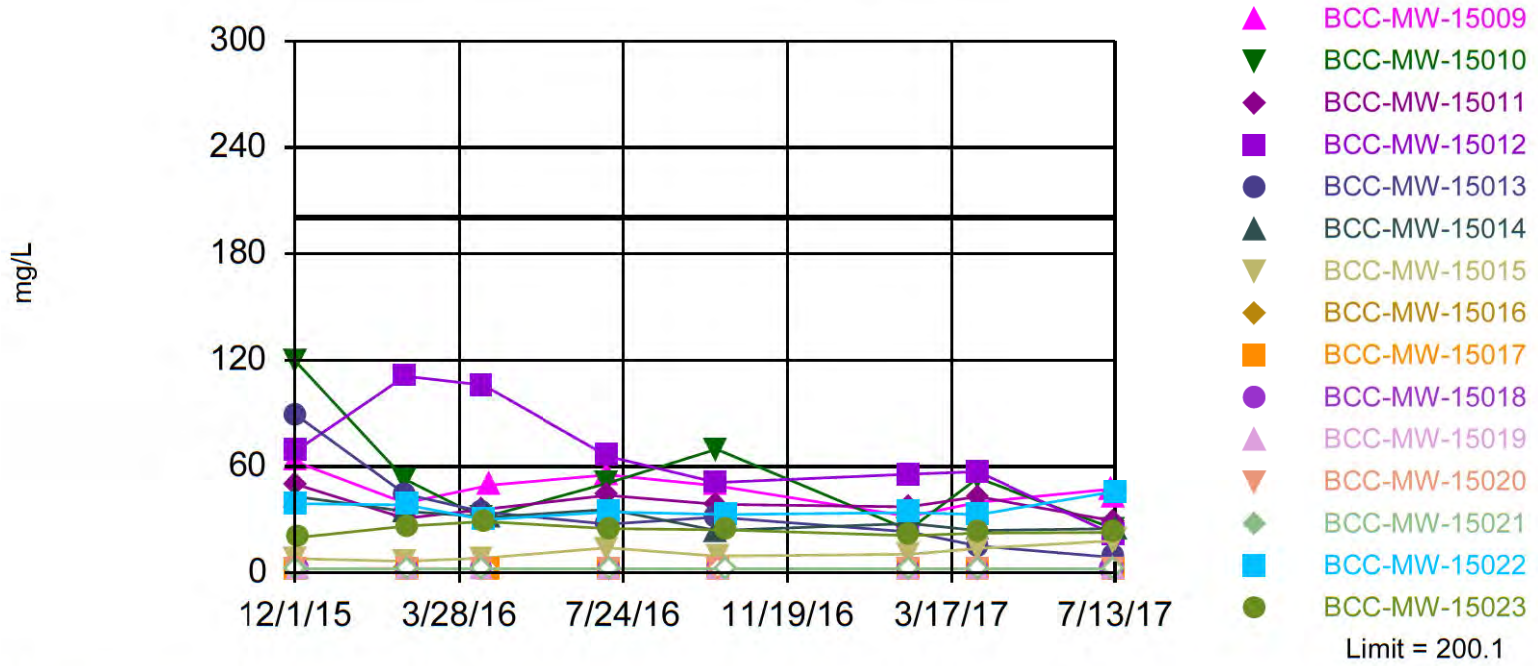
Client: Consumers Energy Data: BCC_Sanitas

Sanitas™ v.9.5.32 Sanitas software licensed to Consumers Energy. UG
Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Parametric



95% coverage. Most recent observation is compared with limit. Background Data Summary (based on natural log transformation): Mean=2.666, Std. Dev.=1.295, n=56, 5.357% NDs. Normality test: Shapiro Francia @alpha = 0.01, calculated = 0.9429, critical = 0.942. Report alpha = 0.05.

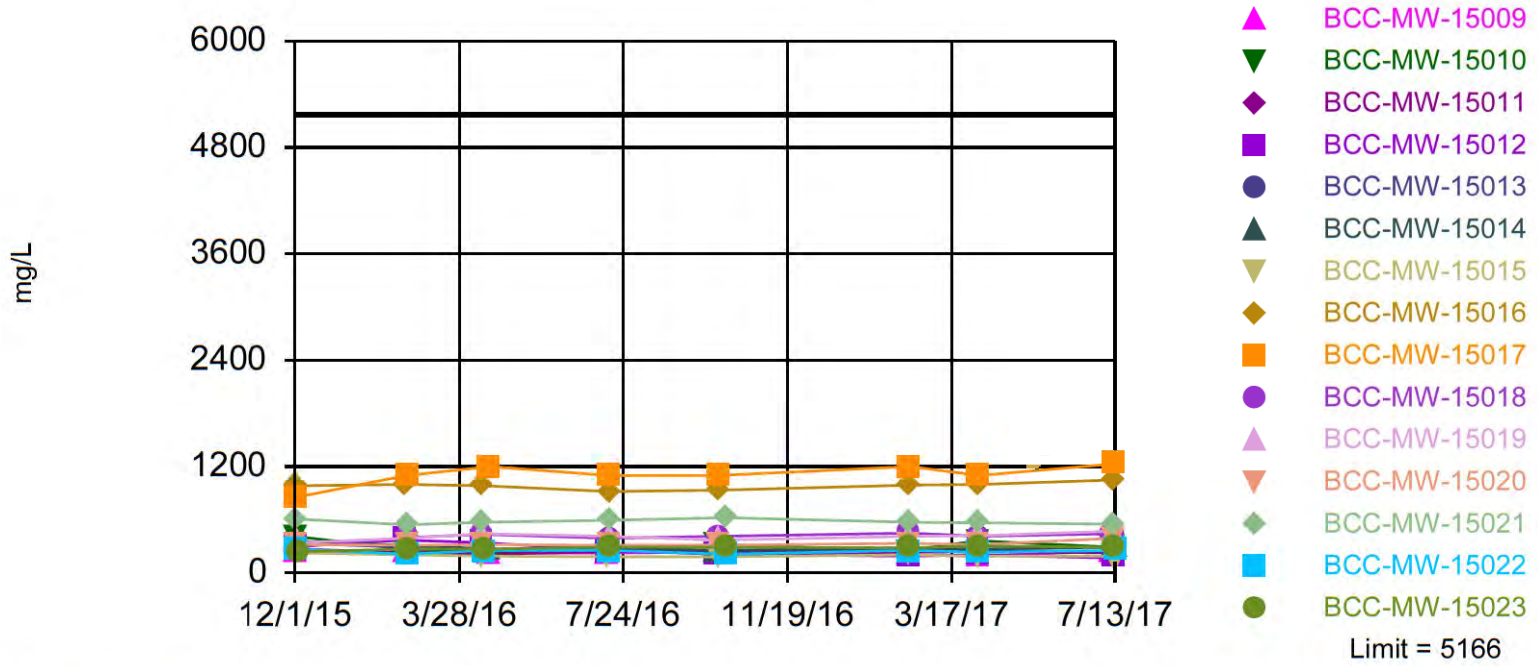
Constituent: Sulfate Analysis Run 11/14/2017 9:19 AM

Client: Consumers Energy Data: BCC_Sanitas

Within Limit

Tolerance Limit

Interwell Parametric



95% coverage. Most recent observation is compared with limit. Background Data Summary (based on natural log transformation): Mean=6.688, Std. Dev.=0.9164, n=56. Normality test: Shapiro Francia @alpha = 0.01, calculated = 0.9447, critical = 0.942. Report alpha = 0.05.

Constituent: Total Dissolved Solids, Dissolved Analysis Run 11/14/2017 9:20 AM

Client: Consumers Energy Data: BCC_Sanitas