2021 Annual Groundwater Monitoring and Corrective Action Report

CCR Landfill

R.M. Heskett Station
Mandan, North Dakota

Prepared for
Montana-Dakota Utilities Co.

January 2022

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2021 Annual Groundwater Monitoring and Corrective Action Report

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R.M. Heskett Station
Mandan, North Dakota

January 31, 2022

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Acronyms

Acronym	Description
ASD	Alternative Source Demonstration
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
MDU	Montana Dakota Utilities Co.
SSI	Statistically Significant Increase
TDS	Total Dissolved Solids

Executive Summary

This 2021 Annual Groundwater Monitoring and Corrective Action Report (Annual Report) describes the monitoring program and results for the CCR landfill at MDU's R.M. Heskett Station (Site). The permitted landfill is the only CCR Unit at this Site.

At the beginning, end, and throughout 2021, the CCR Unit was operating under a detection monitoring program as described in 40 CFR 257.94. Pursuant to §257.94, statistically significant increases (SSIs) were determined for:

- March 2021: fluoride at MW-2-90, sulfate at MW-104, and total dissolved solids (TDS) at MW-104
- August 2021: fluoride at MW-2-90, chloride at MW-105, sulfate at MW-104, and TDS at MW-104

Successful alternative source demonstrations (ASDs) were completed for the September 2020 and March 2021 SSIs. The ASD documentation is included in this report under Appendix B. An ASD for the August 2021 SSIs is anticipated in 2022. Therefore, no assessment monitoring program (§257.95), or related corrective or remedial measures (§§257.96, 257.97, and 257.98), were necessary.

1.0 Introduction

Montana-Dakota Utilities Co. (MDU) owns and operates R.M. Heskett Station, a coal-fired generating station and a gas-fired turbine located in Mandan, North Dakota (Figure 1). One CCR landfill, as defined by 40 CFR 257.53, is located on the property. Wastes contained in the CCR landfill primarily consist of coal combustion by-products, asbestos wastes generated from construction activity associated with MDU-owned facilities, and ash derived from the burning of tire-derived fuel at the facility.

This 2021 Annual Groundwater Monitoring and Corrective Action Report (Annual Report) describes the monitoring program and results for the CCR landfill at MDU's R.M. Heskett Station (Site).

1.1 Purpose

As stated in Section §257.90 (e), the Annual Report must:

- Document the status of groundwater monitoring and any corrective action programs for the CCR unit,
- Summarize key actions completed,
- Describe any problems encountered,
- Discuss actions to resolve the problems, and
- Project key activities for the upcoming year.

1.2 CCR Rule Requirements

Additional requirements for the Annual Report, as outlined in §257.90 (e) of the CCR Rule and this Site's compliance with the CCR Rule, are summarized in Table 1.

Table 1 CCR Rule Requirements and Compliance

CCR Rule Reference	Content Required in Report	Location
§257.90(e)(1)	**Monitoring System Figure:** A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit.	Section 2.1 Groundwater Monitoring System; see Figure 1.
§257.90(e)(2)	**Monitoring System Adjustments**: 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.	Not applicable – no wells were installed or decommissioned.
§257.90(e)(3)	**Data and Collection Summary**: In addition to all the monitoring data obtained under §257.90 through §257.98, a summary including the number of groundwater samples that were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs.	Section 2.3 Data and Collection Summary
§257.90(e)(4)	**Monitoring Program**: A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels).	Not applicable – No transition between monitoring programs was necessary.
§257.90(e)(5)	**Other Information**: Other information required, if applicable, to be included in the annual report as specified in §257.90 through §257.98.	Section 2.2 Actions Completed/Problems Encountered
§257.90(e)(6)	**Executive Summary:** A section at the beginning of the annual report that provides an overview of the current status of groundwater monitoring and corrective action programs for the CCR unit.	Executive Summary

2.0 Groundwater Monitoring Program

This section documents the status of the groundwater monitoring and corrective action program for the CCR unit in 2021. A description of the groundwater monitoring system is included in Section 2.1, key actions completed and problems encountered are described in Section 2.2, the monitoring and analytical results are described in Section 2.3, and key activities planned for 2022 are described in Section 2.4.

2.1 Groundwater Monitoring System

The groundwater monitoring system is consistent with the Groundwater Monitoring System Certification (Barr, 2017a), as seen in Figure 1; no adjustments or changes were made to the groundwater monitoring system in 2021.

2.2 Actions Completed/Problems Encountered

The following actions were completed in 2021:

- **Detection Monitoring Sampling**: Groundwater samples were collected from each well in the groundwater monitoring system on March 22-23, 2021 and from 11 of the 12 wells in the groundwater monitoring system on August 23-24, 2021. Downgradient monitoring well MW-3-90 could not be sampled in August 2021 due to insufficient volume. Groundwater samples were analyzed for Appendix III constituents, per the detection monitoring program of the CCR Rule (§257.94).
- **SSI Evaluation:** SSI evaluations were conducted in accordance with the Groundwater Statistical Method Selection Certification (Statistical Certification; Barr, 2017b) for the March 2021 and August 2021 detection monitoring events, both of which resulted in potential SSIs.
- **Verification Retesting:** No verification retesting was conducted in 2021.
- **Alternative Source Demonstration (ASD):** ASDs were conducted on the verified SSIs for the September 2020 and March 2021 detection monitoring events. Both ASDs were able to demonstrate an alternative source, as allowed by the CCR rule (§257.94(e)(2)). More details are provided in Section 2.3.

2.3 Data and Collection Summary

2.3.1 September 2020 Detection Monitoring Event

As mentioned in the 2020 Annual Report (Barr, 2021), an SSI evaluation was conducted on the results of the September 2020 detection monitoring event. Four potential SSIs (fluoride at MW-2-90, chloride at MW-105, and sulfate and TDS at MW-104) were identified.

An Appendix III ASD was conducted on the verified SSIs and was able to successfully demonstrate that a natural variation in groundwater quality resulted in the SSIs, as allowed by §257.94(e)(4). The Alternative Source Demonstration: September 2020 Event Report is included in Appendix B.

2.3.2 March 2021 Detection Monitoring Event

Groundwater samples were collected from all 12 monitoring wells at the Site on March 22-23, 2021. Three potential SSIs (fluoride at MW-2-90 and sulfate and TDS at MW-104) were identified. A summary of results is included in Table 2. Field data sheets and analytical laboratory reports for detection monitoring sampling and verification resampling are included in Appendix A.

An Appendix III ASD was conducted on the verified SSIs and was able to successfully demonstrate that a natural variation in groundwater quality and/or "a source other than the CCR unit" resulted in the SSIs, as allowed by §257.94(e)(4). The Alternative Source Demonstration: March 2021 Event is included in Appendix B.

2.3.3 August 2021 Detection Monitoring Event

Groundwater samples were collected from 11 monitoring wells at the Site on August 23-24, 2021. Downgradient monitoring well MW-3-90 could not be sampled due to insufficient volume. Four potential SSIs (fluoride at MW-2-90, chloride at MW-105, and sulfate and TDS at MW-104) were identified. A summary of results is included in Table 2. Field data sheets and analytical laboratory reports for detection monitoring sampling are included in Appendix A. An ASD for the SSIs identified in the August 2021 detection monitoring event is anticipated in 2022.

2.4 Activities for Upcoming Year

The following key activities for analytical results and statistical evaluations are planned for 2022:

- Complete ASD evaluation for the August 2021 detection monitoring event in accordance with the Statistical Certification (Barr, 2017b).
- Evaluate analytical results from 2022 semi-annual detection monitoring events for SSIs according to the Statistical Certification (Barr, 2017b).

3.0 References

Barr Engineering Co. (Barr), 2017a, Groundwater Monitoring System Certification, October 2017.

Barr, 2017b, Statistical Method Selection Certification, October 2017.

Barr, 2021, 2020 Annual Groundwater Monitoring and Corrective Action Report, January 2021.

Table

Table 2
Water Quality Analytical Data Summary
2021 Annual Report
Heskett CCR Groundwater Compliance

		Location	MW101	MW101	MW102	MW102	MW103	MW103	MW104	MW104		MW105	MW105	MW13	
		Date	3/22/2021	8/23/2021	3/22/2021	8/23/2021	3/23/2021	8/23/2021	3/23/2021	8/24/2021		3/23/2021	8/24/2021	3/22/2021	
		Sample Type	N	N	N	N	N	N	N	N	FD	N	N	N	FD
Parameter	Analysis Location	Units													
Appendix III															
Boron	Lab	mg/l	< 0.5 U	**0.80**	**1.16**	**1.27**	< 0.1 U	< 0.5 U	**0.64**	**0.84**	**0.86**	< 0.5 U	< 0.5 U	< 0.5 U	< 0.5 U
Calcium	Lab	mg/l	**463**	**442**	**441**	**470**	**510**	**500**	**419**	**422**	**443**	**316**	**339**	**392**	**399**
Chloride	Lab	mg/l	**21.5**	**20.8**	**5.4**	**6.1**	**108**	**119**	**87.2**	**94.1**	**93.0**	**261**	**280**	**73.0**	**73.1**
Fluoride	Lab	mg/l	**0.26**	**0.13**	**0.17**	**0.16**	**0.27**	**0.30**	**0.56**	**0.54**	**0.54**	**0.26**	**0.25**	**0.85**	**0.84**
pH	Field	pH units	**6.71**	**6.57 H**	**6.85**	**6.75 H**	**6.84**	**6.58 H**	**7.01**	**6.89 H**	--	**6.84**	**6.67 H**	**7.05**	--
Solids, total dissolved	Lab	mg/l	**5620**	**5530**	**8440**	**7920**	**5020**	**4900**	**18000**	**17500**	**17400**	**6060**	**6760**	**10400**	**10600**
Sulfate, as SO4	Lab	mg/l	**3190**	**3420**	**5170**	**4880**	**2780**	**3000**	**11000**	**11600**	**11600**	**3360**	**4130**	**6260**	**6450**

-- Not analyzed/Not available.
N Sample Type: Normal
FD: Sample Type: Field Duplicate

H: Recommended sample preservation, extraction or analysis holding time was exceeded.

U: The analyte was analyzed for, but was not detected.

Table 2
Water Quality Analytical Data Summary
2021 Annual Report
Heskett CCR Groundwater Compliance

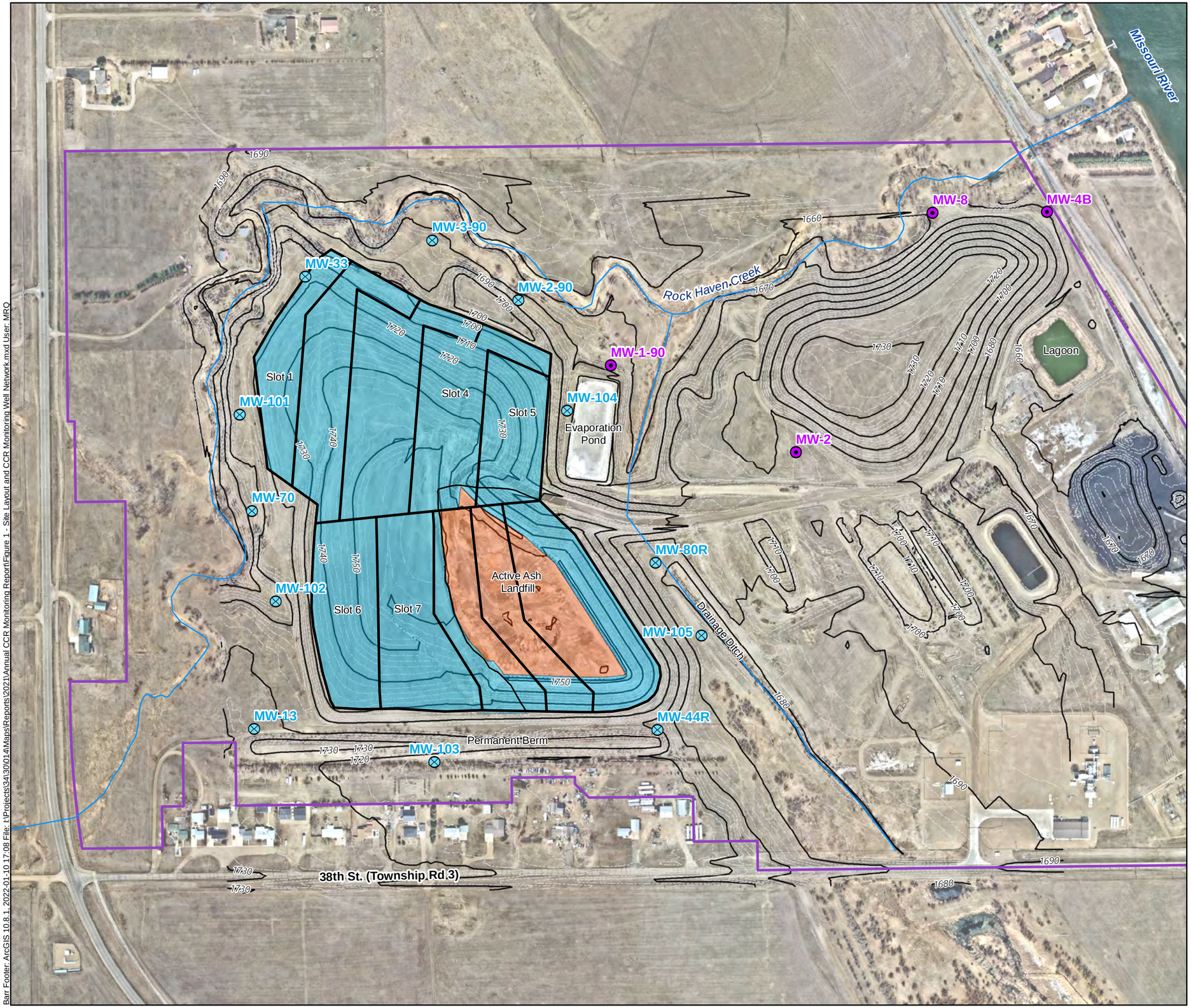
		Location	MW13		MW2-90		MW2-90	MW3-90	MW33	MW33	MW44R	MW44R	MW70	MW70	MW80R	MW80R
		Date	8/23/2021		3/22/2021		8/24/2021	3/22/2021	3/22/2021	8/24/2021	3/23/2021	8/24/2021	3/22/2021	8/23/2021	3/23/2021	8/25/2021
		Sample Type	N	FD	N	FD	N	N	N	N	N	N	N	N	N	N
Parameter	Analysis Location	Units														
Appendix III																
Boron	Lab	mg/l	**0.63**	**0.63**	< 0.5 U	< 0.5 U	< 0.5 U	< 0.5 U	**0.27**	< 0.5 U	< 0.5 U	< 0.5 U	**0.44**	**0.44**	< 0.5 U	< 0.5 U
Calcium	Lab	mg/l	**391**	**385**	**500**	**490**	**505**	**505**	**458**	**467**	**384**	**410**	**344**	**320**	**336**	**340**
Chloride	Lab	mg/l	**76.0**	**77.6**	**78.8**	**77.8**	**89.5**	**36.9**	**12.3**	**13.3**	**197**	**203**	**51.9**	**56.3**	**134**	**155**
Fluoride	Lab	mg/l	**0.83**	**0.81**	**1.04**	**1.02**	**1.02**	**0.13**	**0.24**	**0.19**	**0.65**	**0.63**	**0.32**	**0.30**	**0.25**	**0.23**
pH	Field	pH units	**6.90 H**	--	**7.01**	--	**6.90 H**	**6.93**	**6.64**	**6.42 H**	**6.66**	**6.52 H**	**7.03**	**6.84 H**	**7.09**	**6.92 H**
Solids, total dissolved	Lab	mg/l	**10400**	**10500**	**9640**	**9530**	**10400**	**5190**	**5070**	**5310**	**10400**	**10800**	**3650**	**3340**	**5710**	**5610**
Sulfate, as SO4	Lab	mg/l	**6820**	**6800**	**5990**	**5520**	**6650**	**3020**	**2870**	**3440**	**5950**	**6830**	**2000**	**1960**	**2890**	**3150**

-- Not analyzed/Not available.
N Sample Type: Normal
FD: Sample Type: Field Duplicate

H: Recommended sample preservation, extraction or analysis holding time was exceeded.

U: The analyte was analyzed for, but was not detected.

Figure



- Monitoring Well Location
- Monitoring Well Location - Water Level Only
- Existing Slot Boundaries
- Streams
- Property Line
- 10' Contour
- 2' Contour
- Active CCR Landfill Limits
- Closed CCR Landfill Limits

Image Source: NearMap May 2021

CAD Data Source: Slot Linework.dwg

N

Feet

350 0 350

BARR

Figure 1

SITE LAYOUT AND CCR MONITORING WELL NETWORK
R. M. Heskett Station

Montana Dakota Utilities
Mandan, North Dakota

Barr Footer: ArcGIS 10.8.1, 2022-01-10 17:08 File: I:\Projects\34130\014\Maps\Reports\2021\Annual CCR Monitoring Report\Figure 1 - Site Layout and CCR Monitoring Well Network.mxd User: MRQ

Appendix A

Laboratory Reports and Field Sheets

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2 North German St. ~ New Ulm, MN 56073 ~ 800-782-3557 ~ Fax 507-359-2890
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APP III

CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 31 Mar 21
Lab Number: 21-W501
Work Order #: 82-0597
Account #: 002800
Date Sampled: 23 Mar 21 9:29
Date Received: 23 Mar 21 14:00
Sampled By: MVTL Field Services

PO #: 185968 OP

Temp at Receipt: 3.6C ROI

Project Name: MDU Heskett

Sample Description: MW1-90

Event and Year: Spring 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	6.89	units	NA	SM 4500 H+ B	23 Mar 21 9:29	DJN
pH	* 7.1	units	0.1	SM4500-H+-B-11	23 Mar 21 17:00	RAA
Temperature - Field	6.26	Degrees C	NA	SM 2550B	23 Mar 21 9:29	DJN
Conductivity - Field	10530	umhos/cm	1	EPA 120.1	23 Mar 21 9:29	DJN
Fluoride	1.03	mg/l	0.10	SM4500-F-C	23 Mar 21 17:00	RAA
Sulfate	7030	mg/l	5.00	ASTM D516-11	24 Mar 21 10:47	SD
Chloride	82.7	mg/l	2.0	SM4500-Cl-E-11	24 Mar 21 8:47	SD
Total Dissolved Solids	12200	mg/l	10	USGS I1750-85	25 Mar 21 14:00	RAA
Calcium - Total	397	mg/l	1.0	6010D	26 Mar 21 10:32	MDE
Boron - Total	< 0.5 @	mg/l	0.10	6010D	24 Mar 21 12:46	MDE

* Holding time exceeded

Approved by: Claudette K. Carroll CC 8 Apr 21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

RL = Method Reporting Limit

The reporting limit was elevated for any analyte requiring a dilution as coded below:
@ = Due to sample matrix # = Due to concentration of other analytes
! = Due to sample quantity + = Due to internal standard response

CERTIFICATION: ND # ND-00016

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MINNESOTA VALLEY TESTING LABORATORIES, INC.

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1201 Lincoln Highway ~ Nevada, IA 50201 ~ 800-362-0855 ~ Fax 515-382-3885
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MEMBER
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Quality Control Report

Lab ID: 21-W501 **Project:** MDU Heskett **Work Order:** 202182-0597

Analyte	LCS Spike Amt	LCS Rec %	LCS % Rec Limits	Matrix Spike Amt	Matrix Spike ID	Matrix Spike Orig Result	Matrix Spike Result	Matrix Spike Rec %	Matrix Spike % Rec Limits	MSD/ Dup Orig Result	MSD/ Dup Result	MSD Rec %	MSD/ Dup RPD	MSD/ Dup RPD Limit (<)	Known Rec (%)	Known % Rec Limits	Method Blank
Boron - Total mg/l	0.40	90	80-120	0.400	21-W477	0.36	0.74	95	75-125	0.74	0.72	90	2.7	20	-	-	< 0.1
															-	-	< 0.1
Calcium - Total mg/l	100	109	80-120	500	21D763q	34.4	560	105	75-125	560	560	105	0.0	20	-	-	< 1
				2000	21-M1496	< 20	2040	102	75-125	2040	2040	102	0.0	20	-	-	< 1
				500	21W501q	397	900	101	75-125	900	895	100	0.6	20	-	-	
Chloride mg/l	30.0	95	80-120	30.0	21-W511	< 2	29.0	97	80-120	29.0	29.0	97	0.0	20	-	-	< 2
	30.0	95	80-120												-	-	< 2
Fluoride mg/l	0.50	104	90-110	0.500	21-D689	1.59	2.05	92	80-120	2.05	2.08	98	1.5	20	-	-	< 0.1
				0.500	21-W507	0.24	0.70	92	80-120	0.70	0.71	94	1.4	20	-	-	< 0.1
pH units	-	-	-	-	-	-	-	-	-	12.4	12.4	-	0.0	20	-	-	-
	-	-	-	-	-	-	-	-	-	7.2	7.4	-	2.7	20	-	-	-
Sulfate mg/l	100	103	80-120	100	21-W503	< 5	100	100	80-120	100	100	100	0.0	20	-	-	< 5
Total Dissolved Solids mg/l	-	-	-	-	-	-	-	-	-	10600	10500	-	0.9	20	-	-	< 10
	-	-	-	-	-	-	-	-	-	10400	10400	-	0.0	20	-	-	

Samples were received on 23 Mar 2021 at 1400.
Temperature upon receipt at the Bismarck laboratory was 3.6°C.
All samples were properly preserved unless noted here and/or flagged on the individual analytical laboratory report.
With the exception of pH, all holding times were met.
Approved methodology was followed for all sample analyses.
All acceptance criteria were met for calibration, method blanks, laboratory control samples, laboratory fortified matrix/duplicates unless noted here:

- For some analytes, the reported results were elevated due to additional dilutions required to minimize the effects of sample matrix.

Approved by: C. Caufield
7 Apr 21

MVTL

2616 E. Broadway Ave
Bismarck, ND 58501
(701) 258-9720

Chain of Custody Record

Project Name:	Event:	Work Order Number:
MDU Heskett	Spring 2021	82-0597

Report To:	**Montana-Dakota Utilities**	CC:	Collected By: Darren Wiesmann
Attn:	Todd Peterson		
Address:	400 North 4th St. Bismarck, ND 58501		
Phone:	701-425-2427		
Email:	todd.peterson@mdu.com		

Lab Number	Sample ID	Date	Time	Sample Type	1 Liter Raw	500 mL Nitric	500 mL Nitric (filtered)	250 mL Sulfuric	1 Liter Nitric	Temp (°C)	Spec. Cond.	pH	Turbidity (NTU)	Analysis Required
WS01	**MW1-90**	23Mar21	0929	GW	X	X	X	X		6.26	10530	6.89	0.65	MDU Heskett Spring 2021

Comments:

Relinquished By		Sample Condition		Received By		
Name	Date/Time	Location	Temp (°C)	Name		Date/Time
1	23Mar21 1400	~~Log In~~ Walk In #2	TM562 / ~~TM805~~ ROI 3.6	C. Cantu		23Mar21 1400
2						

MVTL

2616 E. Broadway Ave, Bismarck, ND

Phone: (701) 258-9720

Field Datasheet

Groundwater Assessment

Company:	**MDU Heskett**
Event:	**Spring 2021**
Sample ID:	1-90
Sampling Personal:	Darren Wieswag

Weather Conditions: Temp: 39 °F Wind: Light @ Precip: **Sunny / Partly Cloudy / Cloudy**

WELL INFORMATION

Well Locked?	YES	~~NO~~	
Well Labeled?	~~YES~~	NO	
Casing Strait?	~~YES~~	NO	
Grout Seal Intact?	YES	NO	Not Visible
Repairs Necessary?			
Casing Diameter:	2"		
Water Level Before Purge:	11.99	ft	
Total Depth of Well:	-	ft	
Well Volume:	-	liters	
Depth to Top of Pump:	-	ft	
Water Level After Sample:	12.10	ft	
Measurement Method:	Electric Water Level Indicator		

SAMPLING INFORMATION

Purging Method:	Bladder	
Sampling Method:	Bladder	
Dedicated Equipment?	YES	NO

Duplicate Sample?	YES	NO
Duplicate Sample ID:	-	

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

Control Settings:		
Purge:	2	Sec.
Recover:	58	Sec.
PSI:	-	

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	Liters Removed	Appearance or Comment Clarity, Color, Odor, Ect.
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		clear, slightly turbid, turbid
23Mar21	0904	Start of Well Purge									
	~~0909~~ 0909	6.41	10451	6.88	2.71	20.0	2.34	12.09	100	500	clr
	0914	6.16	10507	6.89	1.86	0.7	0.86	12.09	100	500	clr
	0919	6.19	10505	6.88	1.82	-5.3	0.90	12.09	100	500	clr
	0924	6.24	10537	6.88	1.98	-10.9	0.74	12.12	100	500	clr
	0929	6.26	10530	6.89	1.91	-12.7	0.65	12.10	100	500	clr

Well Stabilized? YES NO

Total Volume Purged: 2500 Liters

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment Clarity, Color, Odor, Ect.
23Mar21	0929	6.26	10530	6.89			0.65				clr

Comments:	

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MEMBER ACIL

APP III

CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 31 Mar 21
Lab Number: 21-W502
Work Order #: 82-0598
Account #: 002800
Date Sampled: 22 Mar 21
Date Received: 23 Mar 21 14:00
Sampled By: MVTL Field Services

Project Name: MDU Heskett

PO #: 185968 OP

Sample Description: Dup2

Temp at Receipt: 3.6C

Event and Year: Spring 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH	* 7.1	units	0.1	SM4500-H+-B-11	23 Mar 21 17:00	RAA
Fluoride	1.02	mg/l	0.10	SM4500-F-C	23 Mar 21 17:00	RAA
Sulfate	5520	mg/l	5.00	ASTM D516-11	24 Mar 21 10:47	SD
Chloride	77.8	mg/l	2.0	SM4500-Cl-E-11	24 Mar 21 8:47	SD
Total Dissolved Solids	9530	mg/l	10	USGS I1750-85	25 Mar 21 14:00	RAA
Calcium - Total	490	mg/l	1.0	6010D	26 Mar 21 10:32	MDE
Boron - Total	< 0.5 @	mg/l	0.10	6010D	24 Mar 21 12:46	MDE

* Holding time exceeded

Approved by: Claudette K. Carroll 9 April 21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

RL = Method Reporting Limit

The reporting limit was elevated for any analyte requiring a dilution as coded below:
@ = Due to sample matrix
! = Due to sample quantity
= Due to concentration of other analytes
+ = Due to internal standard response

CERTIFICATION: ND # ND-00016

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CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 31 Mar 21
Lab Number: 21-W503
Work Order #: 82-0598
Account #: 002800
Date Sampled: 23 Mar 21
Date Received: 23 Mar 21 14:00
Sampled By: MVTL Field Services

PO #: 185968 OP

Temp at Receipt: 3.6C

Project Name: MDU Heskett

Sample Description: FB2

Event and Year: Spring 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH	* 5.8	units	0.1	SM4500-H+-B-11	23 Mar 21 17:00	RAA
Fluoride	< 0.1	mg/l	0.10	SM4500-F-C	23 Mar 21 17:00	RAA
Sulfate	< 5	mg/l	5.00	ASTM D516-11	24 Mar 21 10:47	SD
Chloride	< 2	mg/l	2.0	SM4500-Cl-E-11	24 Mar 21 8:47	SD
Total Dissolved Solids	< 10	mg/l	10	USGS I1750-85	25 Mar 21 14:00	RAA
Calcium - Total	< 1	mg/l	1.0	6010D	26 Mar 21 11:32	MDE
Boron - Total	< 0.1	mg/l	0.10	6010D	24 Mar 21 12:46	MDE

* Holding time exceeded

Approved by: Claudette K. Carroll CC 9 Apr 21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

RL = Method Reporting Limit

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= Due to concentration of other analytes
+ = Due to internal standard response

CERTIFICATION: ND # ND-00016

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CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 31 Mar 21
Lab Number: 21-W504
Work Order #: 82-0598
Account #: 002800
Date Sampled: 22 Mar 21 13:56
Date Received: 23 Mar 21 14:00
Sampled By: MVTL Field Services

PO #: 185968 OP

Temp at Receipt: 3.6C

Project Name: MDU Heskett

Sample Description: MW2-90

Event and Year: Spring 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	7.01	units	NA	SM 4500 H+ B	22 Mar 21 13:56	DJN
pH	* 7.1	units	0.1	SM4500-H+-B-11	23 Mar 21 17:00	RAA
Temperature - Field	9.26	Degrees C	NA	SM 2550B	22 Mar 21 13:56	DJN
Conductivity - Field	8600	umhos/cm	1	EPA 120.1	23 Mar 21 13:56	DJN
Fluoride	1.04	mg/l	0.10	SM4500-F-C	23 Mar 21 17:00	RAA
Sulfate	5990	mg/l	5.00	ASTM D516-11	24 Mar 21 10:47	SD
Chloride	78.8	mg/l	2.0	SM4500-Cl-E-11	24 Mar 21 8:47	SD
Total Dissolved Solids	9640	mg/l	10	USGS I1750-85	25 Mar 21 14:00	RAA
Calcium - Total	500	mg/l	1.0	6010D	26 Mar 21 11:32	MDE
Boron - Total	< 0.5 @	mg/l	0.10	6010D	24 Mar 21 12:46	MDE

* Holding time exceeded

CC

Approved by: Claudette K. Carroll 9 Apr 21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

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CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 31 Mar 21
Lab Number: 21-W505
Work Order #: 82-0598
Account #: 002800
Date Sampled: 22 Mar 21 12:46
Date Received: 23 Mar 21 14:00
Sampled By: MVTL Field Services

PO #: 185968 OP

Temp at Receipt: 3.6C

Project Name: MDU Heskett

Sample Description: MW3-90

Event and Year: Spring 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	6.93	units	NA	SM 4500 H+ B	22 Mar 21 12:46	DJN
pH	* 7.1	units	0.1	SM4500-H+-B-11	23 Mar 21 17:00	RAA
Temperature - Field	8.10	Degrees C	NA	SM 2550B	22 Mar 21 12:46	DJN
Conductivity - Field	5343	umhos/cm	1	EPA 120.1	22 Mar 21 12:46	DJN
Fluoride	0.13	mg/l	0.10	SM4500-F-C	23 Mar 21 17:00	RAA
Sulfate	3020	mg/l	5.00	ASTM D516-11	24 Mar 21 10:47	SD
Chloride	36.9	mg/l	2.0	SM4500-Cl-E-11	24 Mar 21 8:47	SD
Total Dissolved Solids	5190	mg/l	10	USGS I1750-85	25 Mar 21 14:00	RAA
Calcium - Total	505	mg/l	1.0	6010D	26 Mar 21 11:32	MDE
Boron - Total	< 0.5 @	mg/l	0.10	6010D	24 Mar 21 12:46	MDE

* Holding time exceeded

CC

Approved by: Claudette K. Carroll 9Apr21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

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Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 31 Mar 21
Lab Number: 21-W506
Work Order #: 82-0598
Account #: 002800
Date Sampled: 22 Mar 21 9:50
Date Received: 23 Mar 21 14:00
Sampled By: MVTL Field Services

PO #: 185968 OP

Temp at Receipt: 3.6C

Project Name: MDU Heskett

Sample Description: MW13

Event and Year: Spring 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	7.05	units	NA	SM 4500 H+ B	22 Mar 21 9:50	DJN
pH	* 7.2	units	0.1	SM4500-H+-B-11	23 Mar 21 17:00	RAA
Temperature - Field	6.71	Degrees C	NA	SM 2550B	22 Mar 21 9:50	DJN
Conductivity - Field	9830	umhos/cm	1	EPA 120.1	22 Mar 21 9:50	DJN
Fluoride	0.85	mg/l	0.10	SM4500-F-C	23 Mar 21 17:00	RAA
Sulfate	6260	mg/l	5.00	ASTM D516-11	24 Mar 21 10:47	SD
Chloride	73.0	mg/l	2.0	SM4500-Cl-E-11	24 Mar 21 8:47	SD
Total Dissolved Solids	10400	mg/l	10	USGS I1750-85	25 Mar 21 14:00	RAA
Calcium - Total	392	mg/l	1.0	6010D	26 Mar 21 11:32	MDE
Boron - Total	< 0.5 @	mg/l	0.10	6010D	24 Mar 21 13:46	MDE

* Holding time exceeded

Approved by: Claudette K. Carroll cc 9 Apr 21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

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CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 31 Mar 21
Lab Number: 21-W507
Work Order #: 82-0598
Account #: 002800
Date Sampled: 22 Mar 21 11:46
Date Received: 23 Mar 21 14:00
Sampled By: MVTL Field Services

PO #: 185968 OP

Temp at Receipt: 3.6C

Project Name: MDU Heskett

Sample Description: MW33

Event and Year: Spring 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	6.64	units	NA	SM 4500 H+ B	22 Mar 21 11:46	DJN
pH	* 6.9	units	0.1	SM4500-H+-B-11	23 Mar 21 17:00	RAA
Temperature - Field	7.31	Degrees C	NA	SM 2550B	22 Mar 21 11:46	DJN
Conductivity - Field	4816	umhos/cm	1	EPA 120.1	22 Mar 21 11:46	DJN
Fluoride	0.24	mg/l	0.10	SM4500-F-C	23 Mar 21 17:00	RAA
Sulfate	2870	mg/l	5.00	ASTM D516-11	24 Mar 21 10:47	SD
Chloride	12.3	mg/l	2.0	SM4500-Cl-E-11	24 Mar 21 8:47	SD
Total Dissolved Solids	5070	mg/l	10	USGS I1750-85	25 Mar 21 14:00	RAA
Calcium - Total	458	mg/l	1.0	6010D	26 Mar 21 11:32	MDE
Boron - Total	0.27	mg/l	0.10	6010D	24 Mar 21 13:46	MDE

* Holding time exceeded

cc

Approved by: Claudette K. Carroll 9 Apr 21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

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Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 31 Mar 21
Lab Number: 21-W508
Work Order #: 82-0598
Account #: 002800
Date Sampled: 22 Mar 21 13:18
Date Received: 23 Mar 21 14:00
Sampled By: MVTL Field Services

PO #: 185968 OP

Temp at Receipt: 3.6C

Project Name: MDU Heskett

Sample Description: MW70

Event and Year: Spring 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	7.03	units	NA	SM 4500 H+ B	22 Mar 21 13:18	DJN
pH	* 7.2	units	0.1	SM4500-H+-B-11	23 Mar 21 17:00	RAA
Temperature - Field	9.61	Degrees C	NA	SM 2550B	22 Mar 21 13:18	DJN
Conductivity - Field	3913	umhos/cm	1	EPA 120.1	22 Mar 21 13:18	DJN
Fluoride	0.32	mg/l	0.10	SM4500-F-C	23 Mar 21 17:00	RAA
Sulfate	2000	mg/l	5.00	ASTM D516-11	24 Mar 21 11:11	SD
Chloride	51.9	mg/l	2.0	SM4500-Cl-E-11	24 Mar 21 8:47	SD
Total Dissolved Solids	3650	mg/l	10	USGS I1750-85	25 Mar 21 14:00	RAA
Calcium - Total	344	mg/l	1.0	6010D	26 Mar 21 11:32	MDE
Boron - Total	0.44	mg/l	0.10	6010D	24 Mar 21 13:46	MDE

* Holding time exceeded

Approved by: Claudette K. Carroll CC 9 April 21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

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Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 31 Mar 21
Lab Number: 21-W509
Work Order #: 82-0598
Account #: 002800
Date Sampled: 23 Mar 21 11:24
Date Received: 23 Mar 21 14:00
Sampled By: MVTL Field Services

PO #: 185968 OP

Temp at Receipt: 3.6C

Project Name: MDU Heskett

Sample Description: MW80R

Event and Year: Spring 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	7.09	units	NA	SM 4500 H+ B	23 Mar 21 11:24	DJN
pH	* 7.2	units	0.1	SM4500-H+-B-11	23 Mar 21 17:00	RAA
Temperature - Field	8.02	Degrees C	NA	SM 2550B	23 Mar 21 11:24	DJN
Conductivity - Field	5614	umhos/cm	1	EPA 120.1	23 Mar 21 11:24	DJN
Fluoride	0.25	mg/l	0.10	SM4500-F-C	23 Mar 21 17:00	RAA
Sulfate	2890	mg/l	5.00	ASTM D516-11	24 Mar 21 11:11	SD
Chloride	134	mg/l	2.0	SM4500-Cl-E-11	24 Mar 21 8:47	SD
Total Dissolved Solids	5710	mg/l	10	USGS I1750-85	25 Mar 21 14:00	RAA
Calcium - Total	336	mg/l	1.0	6010D	26 Mar 21 11:32	MDE
Boron - Total	< 0.5 @	mg/l	0.10	6010D	24 Mar 21 13:46	MDE

* Holding time exceeded

cc

Approved by: Claudette K. Carroll 9 Apr 21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

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CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 31 Mar 21
Lab Number: 21-W510
Work Order #: 82-0598
Account #: 002800
Date Sampled: 22 Mar 21
Date Received: 23 Mar 21 14:00
Sampled By: MVTL Field Services

PO #: 185968 OP

Temp at Receipt: 3.6C

Project Name: MDU Heskett

Sample Description: Dup1

Event and Year: Spring 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH	* 7.2	units	0.1	SM4500-H+-B-11	23 Mar 21 17:00	RAA
Fluoride	0.84	mg/l	0.10	SM4500-F-C	23 Mar 21 17:00	RAA
Sulfate	6450	mg/l	5.00	ASTM D516-11	24 Mar 21 11:11	SD
Chloride	73.1	mg/l	2.0	SM4500-Cl-E-11	24 Mar 21 8:47	SD
Total Dissolved Solids	10600	mg/l	10	USGS I1750-85	25 Mar 21 14:00	RAA
Calcium - Total	399	mg/l	1.0	6010D	26 Mar 21 11:32	MDE
Boron - Total	< 0.5 @	mg/l	0.10	6010D	24 Mar 21 13:46	MDE

* Holding time exceeded

CC

Approved by: Claudette K. Carroll 9 Apr 21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

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CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 31 Mar 21
Lab Number: 21-W511
Work Order #: 82-0598
Account #: 002800
Date Sampled: 22 Mar 21
Date Received: 23 Mar 21 14:00
Sampled By: MVTL Field Services

PO #: 185968 OP

Temp at Receipt: 3.6C

Project Name: MDU Heskett

Sample Description: FB1

Event and Year: Spring 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH	* 5.7	units	0.1	SM4500-H+-B-11	23 Mar 21 17:00	RAA
Fluoride	< 0.1	mg/l	0.10	SM4500-F-C	23 Mar 21 17:00	RAA
Sulfate	< 5	mg/l	5.00	ASTM D516-11	24 Mar 21 11:11	SD
Chloride	< 2	mg/l	2.0	SM4500-Cl-E-11	24 Mar 21 8:47	SD
Total Dissolved Solids	< 10	mg/l	10	USGS I1750-85	25 Mar 21 14:00	RAA
Calcium - Total	< 1	mg/l	1.0	6010D	26 Mar 21 11:32	MDE
Boron - Total	< 0.1	mg/l	0.10	6010D	24 Mar 21 13:46	MDE

* Holding time exceeded

Approved by: Claudette K. Carroll 9 Apr 21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

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Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 31 Mar 21
Lab Number: 21-W512
Work Order #: 82-0598
Account #: 002800
Date Sampled: 22 Mar 21 14:48
Date Received: 23 Mar 21 14:00
Sampled By: MVTL Field Services

Project Name: MDU Heskett

PO #: 185968 OP

Sample Description: MW101

Temp at Receipt: 3.6C

Event and Year: Spring 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	6.71	units	NA	SM 4500 H+ B	22 Mar 21 14:48	DJN
pH	* 6.9	units	0.1	SM4500-H+-B-11	23 Mar 21 17:00	RAA
Temperature - Field	10.0	Degrees C	NA	SM 2550B	22 Mar 21 14:48	DJN
Conductivity - Field	5148	umhos/cm	1	EPA 120.1	22 Mar 21 14:48	DJN
Fluoride	0.26	mg/l	0.10	SM4500-F-C	23 Mar 21 17:00	RAA
Sulfate	3190	mg/l	5.00	ASTM D516-11	24 Mar 21 11:11	SD
Chloride	21.5	mg/l	2.0	SM4500-Cl-E-11	24 Mar 21 8:47	SD
Total Dissolved Solids	5620	mg/l	10	USGS I1750-85	25 Mar 21 14:00	RAA
Calcium - Total	463	mg/l	1.0	6010D	26 Mar 21 11:32	MDE
Boron - Total	< 0.5 @	mg/l	0.10	6010D	24 Mar 21 13:46	MDE

* Holding time exceeded

Approved by: Claudette K. Carroll CC 9 Apr 21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

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CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 31 Mar 21
Lab Number: 21-W513
Work Order #: 82-0598
Account #: 002800
Date Sampled: 22 Mar 21 11:46
Date Received: 23 Mar 21 14:00
Sampled By: MVTL Field Services

PO #: 185968 OP

Temp at Receipt: 3.6C

Project Name: MDU Heskett

Sample Description: MW102

Event and Year: Spring 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	6.85	units	NA	SM 4500 H+ B	22 Mar 21 11:46	DJN
pH	* 7.0	units	0.1	SM4500-H+-B-11	23 Mar 21 17:00	RAA
Temperature - Field	8.61	Degrees C	NA	SM 2550B	22 Mar 21 11:46	DJN
Conductivity - Field	8140	umhos/cm	1	EPA 120.1	22 Mar 21 11:46	DJN
Fluoride	0.17	mg/l	0.10	SM4500-F-C	23 Mar 21 17:00	RAA
Sulfate	5170	mg/l	5.00	ASTM D516-11	24 Mar 21 11:11	SD
Chloride	5.4	mg/l	2.0	SM4500-Cl-E-11	24 Mar 21 8:47	SD
Total Dissolved Solids	8440	mg/l	10	USGS I1750-85	25 Mar 21 14:00	RAA
Calcium - Total	441	mg/l	1.0	6010D	26 Mar 21 12:32	MDE
Boron - Total	1.16	mg/l	0.10	6010D	24 Mar 21 13:46	MDE

* Holding time exceeded

Approved by: Claudette K. Carroll CC 9 Apr 21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

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! = Due to sample quantity
= Due to concentration of other analytes
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CERTIFICATION: ND # ND-00016

MINNESOTA VALLEY TESTING LABORATORIES, INC.
1126 North Front St. ~ New Ulm, MN 56073 ~ 800-782-3557 ~ Fax 507-359-2890
2 North German St. ~ New Ulm, MN 56073 ~ 800-782-3557 ~ Fax 507-359-2890
2616 East Broadway Ave. ~ Bismarck, ND 58501 ~ 800-279-6885 ~ Fax 701-258-9724
1201 Lincoln Hwy. ~ Nevada, IA 50201 ~ 800-362-0855 ~ Fax 515-382-3885
www.mvtl.com

MEMBER ACIL

CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 31 Mar 21
Lab Number: 21-W514
Work Order #: 82-0598
Account #: 002800
Date Sampled: 23 Mar 21 9:28
Date Received: 23 Mar 21 14:00
Sampled By: MVTL Field Services

PO #: 185968 OP

Temp at Receipt: 3.6C

Project Name: MDU Heskett

Sample Description: MW103

Event and Year: Spring 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	6.84	units	NA	SM 4500 H+ B	23 Mar 21 9:28	DJN
pH	* 7.0	units	0.1	SM4500-H+-B-11	23 Mar 21 17:00	RAA
Temperature - Field	7.41	Degrees C	NA	SM 2550B	23 Mar 21 9:28	DJN
Conductivity - Field	4964	umhos/cm	1	EPA 120.1	23 Mar 21 9:28	DJN
Fluoride	0.27	mg/l	0.10	SM4500-F-C	23 Mar 21 17:00	RAA
Sulfate	2780	mg/l	5.00	ASTM D516-11	24 Mar 21 11:11	SD
Chloride	108	mg/l	2.0	SM4500-Cl-E-11	24 Mar 21 8:47	SD
Total Dissolved Solids	5020	mg/l	10	USGS I1750-85	25 Mar 21 14:00	RAA
Calcium - Total	510	mg/l	1.0	6010D	26 Mar 21 12:32	MDE
Boron - Total	< 0.1	mg/l	0.10	6010D	24 Mar 21 13:46	MDE

Total and dissolved selenium have been rerun.

* Holding time exceeded

Approved by: Claudette K. Carroll cc 9 Apr 21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

RL = Method Reporting Limit

The reporting limit was elevated for any analyte requiring a dilution as coded below:
@ = Due to sample matrix # = Due to concentration of other analytes
! = Due to sample quantity + = Due to internal standard response

CERTIFICATION: ND # ND-00016

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MEMBER ACIL

CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 31 Mar 21
Lab Number: 21-W515
Work Order #: 82-0598
Account #: 002800
Date Sampled: 23 Mar 21 10:25
Date Received: 23 Mar 21 14:00
Sampled By: MVTL Field Services

PO #: 185968 OP

Temp at Receipt: 3.6C

Project Name: MDU Heskett

Sample Description: MW104

Event and Year: Spring 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	7.01	units	NA	SM 4500 H+ B	23 Mar 21 10:25	DJN
pH	* 7.2	units	0.1	SM4500-H+-B-11	23 Mar 21 17:00	RAA
Temperature - Field	8.51	Degrees C	NA	SM 2550B	23 Mar 21 10:25	DJN
Conductivity - Field	14045	umhos/cm	1	EPA 120.1	23 Mar 21 10:25	DJN
Fluoride	0.56	mg/l	0.10	SM4500-F-C	23 Mar 21 17:00	RAA
Sulfate	11000	mg/l	5.00	ASTM D516-11	24 Mar 21 11:11	SD
Chloride	87.2	mg/l	2.0	SM4500-Cl-E-11	24 Mar 21 8:47	SD
Total Dissolved Solids	18000	mg/l	10	USGS I1750-85	25 Mar 21 14:00	RAA
Calcium - Total	419	mg/l	1.0	6010D	26 Mar 21 12:32	MDE
Boron - Total	0.64	mg/l	0.10	6010D	24 Mar 21 13:46	MDE

* Holding time exceeded

Approved by: Claudette K. Carroll CC 9 Apr 21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

RL = Method Reporting Limit

The reporting limit was elevated for any analyte requiring a dilution as coded below:
@ = Due to sample matrix
! = Due to sample quantity
= Due to concentration of other analytes
+ = Due to internal standard response

CERTIFICATION: ND # ND-00016

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CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 31 Mar 21
Lab Number: 21-W516
Work Order #: 82-0598
Account #: 002800
Date Sampled: 23 Mar 21 12:43
Date Received: 23 Mar 21 14:00
Sampled By: MVTL Field Services

PO #: 185968 OP

Temp at Receipt: 3.6C

Project Name: MDU Heskett

Sample Description: MW105

Event and Year: Spring 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	6.84	units	NA	SM 4500 H+ B	23 Mar 21 12:43	DJN
pH	* 7.2	units	0.1	SM4500-H+-B-11	23 Mar 21 18:00	RAA
Temperature - Field	8.31	Degrees C	NA	SM 2550B	23 Mar 21 12:43	DJN
Conductivity - Field	5906	umhos/cm	1	EPA 120.1	23 Mar 21 12:43	DJN
Fluoride	0.26	mg/l	0.10	SM4500-F-C	23 Mar 21 18:00	RAA
Sulfate	3360	mg/l	5.00	ASTM D516-11	24 Mar 21 11:11	SD
Chloride	261	mg/l	2.0	SM4500-Cl-E-11	24 Mar 21 8:47	SD
Total Dissolved Solids	6060	mg/l	10	USGS I1750-85	25 Mar 21 14:00	RAA
Calcium - Total	316	mg/l	1.0	6010D	26 Mar 21 12:32	MDE
Boron - Total	< 0.5 @	mg/l	0.10	6010D	24 Mar 21 14:46	MDE

* Holding time exceeded

Cc
9 Apr 21

Approved by: Claudette K. Carroll

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

RL = Method Reporting Limit

The reporting limit was elevated for any analyte requiring a dilution as coded below:
@ = Due to sample matrix # = Due to concentration of other analytes
! = Due to sample quantity + = Due to internal standard response

CERTIFICATION: ND # ND-00016

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CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 31 Mar 21
Lab Number: 21-W517
Work Order #: 82-0598
Account #: 002800
Date Sampled: 23 Mar 21 10:42
Date Received: 23 Mar 21 14:00
Sampled By: MVTL Field Services

PO #: 185968 OP

Temp at Receipt: 3.6C

Project Name: MDU Heskett

Sample Description: MW44R

Event and Year: Spring 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	6.66	units	NA	SM 4500 H+ B	23 Mar 21 10:42	DJN
pH	* 6.9	units	0.1	SM4500-H+-B-11	23 Mar 21 18:00	RAA
Temperature - Field	8.47	Degrees C	NA	SM 2550B	23 Mar 21 10:42	DJN
Conductivity - Field	8992	umhos/cm	1	EPA 120.1	23 Mar 21 10:42	DJN
Fluoride	0.65	mg/l	0.10	SM4500-F-C	23 Mar 21 18:00	RAA
Sulfate	5950	mg/l	5.00	ASTM D516-11	24 Mar 21 11:11	SD
Chloride	197	mg/l	2.0	SM4500-Cl-E-11	24 Mar 21 8:47	SD
Total Dissolved Solids	10400	mg/l	10	USGS I1750-85	25 Mar 21 14:00	RAA
Calcium - Total	384	mg/l	1.0	6010D	26 Mar 21 12:32	MDE
Boron - Total	< 0.5 @	mg/l	0.10	6010D	24 Mar 21 14:46	MDE

* Holding time exceeded

Approved by: Claudette K. Carroll CC 9 Apr 21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

RL = Method Reporting Limit

The reporting limit was elevated for any analyte requiring a dilution as coded below:
@ = Due to sample matrix
! = Due to sample quantity
= Due to concentration of other analytes
+ = Due to internal standard response

CERTIFICATION: ND # ND-00016

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Quality Control Report

Lab IDs: 21-W502 to 21-W517 **Project:** MDU Heskett **Work Order:** 202182-0598

Analyte	LCS Spike Amt	LCS Rec %	LCS % Rec Limits	Matrix Spike Amt	Matrix Spike ID	Matrix Spike Orig Result	Matrix Spike Result	Matrix Spike Rec %	Matrix Spike % Rec Limits	MSD/ Dup Orig Result	MSD/ Dup Result	MSD Rec %	MSD/ Dup RPD	MSD/ Dup RPD Limit (<)	Known Rec (%)	Known % Rec Limits	Method Blank
Boron - Total mg/l	0.40 0.40 0.40	90 95 95	80-120 80-120 80-120	0.400 0.400 0.400	21-W477 21-W511 21-W463	0.36 < 0.1 0.50	0.74 0.36 0.96	95 90 115	75-125 75-125 75-125	0.74 0.36 0.96	0.72 0.35 0.93	90 88 108	2.7 2.8 3.2	20 20 20	- - - - - -	- - - - - -	< 0.1 < 0.1 < 0.1 < 0.1 < 0.1 < 0.1
Calcium - Total mg/l	100 100 100	109 111 112	80-120 80-120 80-120	500 2000 500 500 500	21D763q 21-M1496 21W501q 21W512q 21W517q	34.4 < 20 397 463 384	560 2040 900 965 880	105 102 101 100 99	75-125 75-125 75-125 75-125 75-125	560 2040 900 965 880	560 2040 895 965 890	105 102 100 100 101	0.0 0.0 0.6 0.0 1.1	20 20 20 20 20	- - - - - -	- - - - - -	< 1 < 1 < 1 < 1 < 1 < 1
Chloride mg/l	30.0 30.0	95 95	80-120 80-120	30.0	21-W511	< 2	29.0	97	80-120	29.0	29.0	97	0.0	20	- -	- -	< 2 < 2
Fluoride mg/l	0.50 0.50 0.50	104 102 102	90-110 90-110 90-110	0.500 0.500 0.500	21-D689 21-W507 21-W517	1.59 0.24 0.65	2.05 0.70 1.05	92 92 80	80-120 80-120 80-120	2.05 0.70 1.05	2.08 0.71 1.06	98 94 82	1.5 1.4 0.9	20 20 20	- - - -	- - - -	< 0.1 < 0.1 < 0.1 < 0.1
pH units	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	12.4 7.2 7.2	12.4 7.4 7.2	- - -	0.0 2.7 0.0	20 20 20	- - -	- - -	- - -
Sulfate mg/l	100 100	103 101	80-120 80-120	100 100	21-W503 21-W511	< 5 < 5	100 95.4	100 95	80-120 80-120	100 95.4	100 96.2	100 96	0.0 0.8	20 20	- -	- -	< 5 < 5
Total Dissolved Solids mg/l	- -	- -	- -	- -	- -	- -	- -	- -	- -	10600 10400	10500 10400	- -	0.9 0.0	20 20	- -	- -	< 10

Samples were received on 23 Mar 2021 at 1400.
Temperature upon receipt at the Bismarck laboratory was 3.6°C.
All samples were properly preserved unless noted here and/or flagged on the individual analytical laboratory report.
With the exception of pH, all holding times were met.
Approved methodology was followed for all sample analyses.
All acceptance criteria were met for calibration, method blanks, laboratory control samples, laboratory fortified matrix/duplicates unless noted here:

- For some analytes, the reported results were elevated due to additional dilutions required to minimize the effects of sample matrix.

Approved by: C. Carroll
9 Apr 21

MVTL
2616 E. Broadway Ave
Bismarck, ND 58501
(701) 258-9720

Chain of Custody Record

Project Name:	Event:	Work Order Number:
MDU Heskett	Spring 2021	82-0598

Report To:	Montana-Dakota Utilities	CC:	Collected By: Darren Nieuwsma, Jeremy Mayer
Attn:	Todd Peterson		
Address:	400 North 4th St. Bismarck, ND 58501		
Phone:	701-425-2427		
Email:	todd.peterson@mdu.com		

Lab Number	Sample ID	Date	Time	Sample Type	1 Liter Raw	500 mL Nitric	500 mL Nitric (filtered)	250 mL Sulfuric	1 Liter Nitric	Temp (°C)	Spec. Cond.	pH	Turbidity (NTU)	Analysis Required
WS02	Dup2	22Mar21	NA	GW	X	X	X	X		NA	NA	NA	NA	MDU Heskett Spring 2021
WS03	FB2	~~23~~ 22Mar21	NA	GW	X	X	X	X		NA	NA	NA	NA	
WS04	MW2-90	22Mar21	1356	GW	X	X	X	X		9.26	8600	7.01	0.84	
WS05	MW3-90	22Mar21	1246	GW	X	X	X	X		8.10	5343	6.93	0.86	
WS06	MW13	22Mar21	0950	GW	X	X	X	X		6.71	9830	7.05	2.59	
WS07	MW33	22Mar21	1146	GW	X	X	X	X		7.31	4816	6.64	4.81	
WS08	MW70	22Mar21	1318	GW	X	X	X	X		9.61	3913	7.03	0.41	
WS09	MW80R	23Mar21	1124	GW	X	X	X	X		8.02	5614	7.09	1.12	

Comments:

Relinquished By		Sample Condition		Received By		
Name	Date/Time	Location	Temp (°C)	Name		Date/Time
1 Darren Nieuwsma	23Mar21 1400	~~Log In~~ Walk In #2	TM562 / TM805	Tina Olson		23Mar21 1400
2			3.6			

MVTL

2616 E. Broadway Ave
Bismarck, ND 58501
(701) 258-9720

Chain of Custody Record

Project Name:	Event:	Work Order Number:
MDU Heskett	Spring 2021	82-0598

Report To:	Montana-Dakota Utilities	CC:	Collected By:
Attn:	Todd Peterson		Darren Nieswang
Address:	400 North 4th St. Bismarck, ND 58501		Jeremy Mayer
Phone:	701-425-2427		
Email:	todd.peterson@mdu.com		

Lab Number	Sample ID	Date	Time	Sample Type	1 Liter Raw	500 mL Nitric	500 mL Nitric (filtered)	250 mL Sulfuric	1 Liter Nitric	Temp (°C)	Spec. Cond.	pH	Turbidity (NTU)	Analysis Required
WS10	Dup1	22 Mar 21	NA	GW	X	X	X	X		NA	NA	NA	NA	MDU Heskett Spring 2021
WS11	FB1	22 Mar 21	NA	GW	X	X	X	X		NA	NA	NA	NA	
WS12	MW101	22 Mar 21	1448	GW	X	X	X	X		10.00	5148	6.71	0.67	
WS13	MW102	22 Mar 21	1146	GW	X	X	X	X		8.61	8140	6.85	0.52	
WS14	MW103 (23 Mar 21)	~~22 Mar 21~~	0928	GW	X	X	X	X		7.41	4964	6.84	0.44	
WS15	MW104 (24 Mar 21)	23 Mar 21	1025	GW	X	X	X	X		8.51	14045	7.01	0.73	
WS16	MW105	23 Mar 21	1243	GW	X	X	X	X		8.31	5906	6.84	3.29	
WS17	MW44R	23 Mar 21	1042	GW	X	X	X	X		8.47	8992	6.66	1.82	

Comments:

Relinquished By		Sample Condition		Received By		
Name	Date/Time	Location	Temp (°C)	Name		Date/Time
1	23 Mar 21 1400	~~Log In~~ Walk In #2	TM562 / ~~TM805~~ 3.6			23 Mar 21 1405
2						

MVTL

2616 E. Broadway Ave, Bismarck, ND

Phone: (701) 258-9720

Field Datasheet

Groundwater Assessment

Company:	**MDU Heskett**
Event:	**Spring 2021**
Sample ID:	2-90
Sampling Personal:	Darren Nitsman

Weather Conditions: Temp: 45 °F Wind: SE @ 15 Precip: **Sunny / Partly Cloudy / Cloudy**

WELL INFORMATION

Well Locked?	YES	NO	
Well Labeled?	~~YES~~	NO	
Casing Strait?	~~YES~~	NO	
Grout Seal Intact?	YES	NO	Not Visible
Repairs Necessary?			

Casing Diameter:	2"	
Water Level Before Purge:	21.99	ft
Total Depth of Well:	~	ft
Well Volume:	~	liters
Depth to Top of Pump:	~	ft
Water Level After Sample:	22.26	ft
Measurement Method:	**Electric Water Level Indicator**	

SAMPLING INFORMATION

Purging Method:	**Bladder**	
Sampling Method:	**Bladder**	
Dedicated Equipment?	YES	NO

Duplicate Sample?	YES	NO
Duplicate Sample ID:	Dup-2	

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered) X 2
250mL Sulfuric

Control Settings:		
Purge:	2	Sec.
Recover:	58	Sec.
PSI:		

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	Liters Removed	Appearance or Comment Clarity, Color, Odor, Ect.
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		clear, slightly turbid, turbid
22Mar21	1321	**Start of Well Purge**									
	1326	6.50	8821	7.04	8.51	-23.7	1.24	22.22	100	500	cl
	1341	9.09	8665	7.01	5.43	-22.7	1.95	22.26	100	1500	cl
	1346	9.21	8656	7.01	5.30	-21.9	1.25	22.26	100	500	cl
	1351	9.24	8642	7.01	5.40	-22.6	0.79	22.26	100	500	cl
	1356	9.26	8600	7.01	5.51	-23.2	0.84	22.28	100	500	cl

Well Stabilized? YES NO

Total Volume Purged: 3500 Liters

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment Clarity, Color, Odor, Ect.
22mar21	1356	9.26	8600	7.01			0.84				cl

Comments:	

MVTL

2616 E. Broadway Ave, Bismarck, ND

Phone: (701) 258-9720

Field Datasheet

Groundwater Assessment

Company:	**MDU Heskett**
Event:	**Spring 2021**
Sample ID:	3-90
Sampling Personal:	Darren Nieswang

Weather Conditions: Temp: 45 °F Wind: SE @ 15 Precip: **(Sunny) / Partly Cloudy / Cloudy**

WELL INFORMATION

Well Locked?	(YES)	NO	
Well Labeled?	(YES)	NO	
Casing Strait?	(YES)	NO	
Grout Seal Intact?	YES	NO	~~Not Visible~~
Repairs Necessary?			
Casing Diameter:	2"		
Water Level Before Purge:	20.11 top	ft	
Total Depth of Well:	~	ft	
Well Volume:	~	liters	
Depth to Top of Pump:	~	ft	
Water Level After Sample:	20.11 top	ft	
Measurement Method:	Electric Water Level Indicator		

SAMPLING INFORMATION

Purging Method:	Bladder	
Sampling Method:	Bladder	
Dedicated Equipment?	(YES)	NO

Duplicate Sample?	YES	(NO)
Duplicate Sample ID:		

Control Settings:		
Purge:	2	Sec.
Recover:	58	Sec.
PSI:		

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	Liters Removed	Appearance or Comment Clarity, Color, Odor, Ect.
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		clear, slightly turbid, turbid
22Mar21	1216	**Start of Well Purge**									
	1221	7.99	5350	6.93	2.76	-58.5	3.07	Top	100	500	cl
	1231	8.04	5360	6.93	2.81	-67.7	1.93	Top	100	1500	cl
	1241	8.07	5365	6.93	2.92	-64.4	1.66	Top	100	500	cl
	1246	8.10	5343	6.93	2.95	-59.8	0.186	Top	100	500	cl

Well Stabilized? (YES) NO

Total Volume Purged: 3,000 Liters

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment Clarity, Color, Odor, Ect.
22Mar21	1246	8.10	5343	6.93			0.186				clear

Comments:	

MVTL
2616 E. Broadway Ave, Bismarck, ND
Phone: (701) 258-9720

Field Datasheet

Groundwater Assessment

Company:	**MDU Heskett**
Event:	**Spring 2021**
Sample ID:	13
Sampling Personal:	Jenny Meyer

Weather Conditions: Temp: 20 °F Wind: S @ 5-10 Precip: **Sunny / Partly Cloudy / Cloudy**

WELL INFORMATION

Well Locked?	YES	(NO)	
Well Labeled?	(YES)	NO	
Casing Strait?	(YES)	NO	
Grout Seal Intact?	(YES)	NO	Not Visible
Repairs Necessary?			
Casing Diameter:	2"		
Water Level Before Purge:	31.13	ft	
Total Depth of Well:	—	ft	
Well Volume:	—	liters	
Depth to Top of Pump:	—	ft	
Water Level After Sample:	34.71	ft	
Measurement Method:	Electric Water Level Indicator		

SAMPLING INFORMATION

Purging Method:	Bladder	
Sampling Method:	Bladder	
Dedicated Equipment?	(YES)	NO

Duplicate Sample?	(YES)	NO
Duplicate Sample ID:	Dup 1	

Control Settings:	
Purge: 5	Sec.
Recover: 55	Sec.
PSI: 20	

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	Liters Removed	Appearance or Comment Clarity, Color, Odor, Ect.
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		clear, slightly turbid, turbid
22 Mar 21	0835	**Start of Well Purge**									
	0840	5.67	6511	7.06	11.17	251.9	0.43	31.93	100.0	500.0	Clear
	0850	6.53	9693	7.06	9.73	240.5	6.77	32.58	100.0	1000.0	Clear
	0900	6.15	8469	7.12	10.91	249.0	6.21	32.92	100.0	1000.0	Clear
	0910	6.32	9750	7.13	5.03	253.1	5.48	33.32	100.0	1000.0	Clear
	0930	6.36	9791	7.10	3.74	256.3	2.58	33.82	100.0	2000.0	Clear
	0940	6.47	9814	7.08	3.92	247.4	3.55	34.26	100.0	1000.0	Clear
	0945	6.36	9812	7.07	3.83	245.4	2.18	34.37	100.0	500.0	Clear
	0950	6.71	9830	7.05	3.71	249.2	2.59	34.49	100.0	500.0	Clear

Well Stabilized? (YES) NO Total Volume Purged: 7500.0 Liters

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment Clarity, Color, Odor, Ect.
22 Mar 21	0950	6.71	9830	7.05			2.59				Clear

Comments:	

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Field Datasheet

Groundwater Assessment

Company:	**MDU Heskett**
Event:	**Spring 2021**
Sample ID:	33
Sampling Personal:	Darren Nieswag

Weather Conditions: Temp: 44 °F Wind: @ 5 p 15 Precip: **Sunny / Partly Cloudy / Cloudy**

WELL INFORMATION

Well Locked?	YES	NO	
Well Labeled?	YES	NO	
Casing Strait?	YES	NO	
Grout Seal Intact?	YES	NO	Not Visible
Repairs Necessary?			
Casing Diameter:	2"		
Water Level Before Purge:	41.85	ft	
Total Depth of Well:	—	ft	
Well Volume:	—	liters	
Depth to Top of Pump:	—	ft	
Water Level After Sample:	42.00	ft	
Measurement Method:	Electric Water Level Indicator		

SAMPLING INFORMATION

Purging Method:	Bladder	
Sampling Method:	Bladder	
Dedicated Equipment?	YES	NO

Duplicate Sample?	YES	NO
Duplicate Sample ID:	—	

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

Control Settings:		
Purge:	52	Sec.
Recover:	58	Sec.
PSI:	—	

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	Liters Removed	Appearance or Comment Clarity, Color, Odor, Ect.
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		clear, slightly turbid, turbid
22Mar21	0906	Start of Well Purge									(ST)
	0911	5.29	5121	6.71	4.14	-45.6	149	41.92	100	500	ST
	0931	6.35	4908	6.68	3.42	-65.5	225	41.92	100	2000	ST
	1001	7.00	4776	6.61	2.23	-83.5	34.7	42.00	100	3000	Clear
	1031	6.52	4816	6.62	2.46	-59.9	24.3	42.12	100	2000	cl
	1116	7.14	4812	6.62	2.89	-44.4	8.68	41.94	100	4500	cl
	1136	7.28	4812	6.62	2.70	-42.3	4.61	41.96	100	2000	cl
	1191	7.25	4816	6.63	2.71	-41.5	4.24	41.98	100	500	cl
	1146	7.31	4816	6.64	2.76	-39.6	4.81	41.95	100	500	cl

Well Stabilized? YES NO

Total Volume Purged: 16,000 Liters

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment Clarity, Color, Odor, Ect.
22Mar21	1146	7.31	4816	6.64			4.81				Clear

Comments: Had to pull pump check ball was stuck and the screen needed to be replaced. The pump was rusted up.

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Field Datasheet

Groundwater Assessment

Company:	**MDU Heskett**
Event:	**Spring 2021**
Sample ID:	70
Sampling Personal:	Jerry Meyer

Weather Conditions: Temp: 35°F Wind: S @ 5-10 Precip: **Sunny / Partly Cloudy / Cloudy**

WELL INFORMATION

Well Locked?	**YES**	(NO)	
Well Labeled?	(YES)	**NO**	
Casing Strait?	(YES)	**NO**	
Grout Seal Intact?	(YES)	**NO**	**Not Visible**
Repairs Necessary?			
Casing Diameter:	**2"**		
Water Level Before Purge:	22.32	ft	
Total Depth of Well:	—	ft	
Well Volume:	—	liters	
Depth to Top of Pump:	—	ft	
Water Level After Sample:	24.61	ft	
Measurement Method:	**Electric Water Level Indicator**		

SAMPLING INFORMATION

Purging Method:	**Bladder**	
Sampling Method:	**Bladder**	
Dedicated Equipment?	(YES)	**NO**

Duplicate Sample?	**YES**	(NO)
Duplicate Sample ID:	—	

Control Settings:		
Purge:	5	Sec.
Recover:	55	Sec.
PSI:	20	

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	Liters Removed	Appearance or Comment
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		Clarity, Color, Odor, Ect.
22 Mar 21	1208	**Start of Well Purge**									clear, slightly turbid, turbid
	1213	9.31	4519	7.11	4.39	38.2	96.46	22.70	100.0	500.0	clear
	1243	9.15	4087	7.03	0.57	48.2	0.19	23.62	100.0	3000.0	clear
	1253	9.41	4018	7.03	0.62	65.5	0.64	23.95	100.0	1000.0	Clear
	1258	9.43	3993	7.04	0.71	76.3	0.20	24.01	100.0	500.0	Clear
	1303	9.36	3971	7.03	0.84	76.3	0.23	24.11	100.0	500.0	Clear
	1308	9.82	3933	7.04	0.88	93.8	0.23	24.22	100.0	500.0	Clear
	1313	9.79	3917	7.03	0.85	95.6	0.39	24.27	100.0	500.0	Clear
	1318	9.61	3913	7.03	0.91	93.3	0.41	24.33	100.0	500.0	Clear

Well Stabilized? (YES) **NO** Total Volume Purged: 7000.0 Liters

Sample Date	**Time**	**Temp. (°C)**	**Spec. Cond.**	**pH**			**Turbidity (NTU)**				**Appearance or Comment** Clarity, Color, Odor, Ect.
22 Mar 21	1318	9.61	3913	7.03			0.41				Clear

Comments:	Collected FB1 @ 1210

Field Datasheet

Groundwater Assessment

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Company:	**MDU Heskett**
Event:	**Spring 2021**
Sample ID:	80R
Sampling Personal:	Darren Nissen

Weather Conditions: Temp: 45 °F Wind: Light @ Precip: **Sunny / Partly Cloudy / Cloudy**

WELL INFORMATION

Well Locked?	~~YES~~	NO
Well Labeled?	~~YES~~	NO
Casing Strait?	~~YES~~	NO
Grout Seal Intact?	~~YES~~	NO Not Visible
Repairs Necessary?		

Casing Diameter:	2"	
Water Level Before Purge:	13.31	ft
Total Depth of Well:	–	ft
Well Volume:	–	liters
Depth to Top of Pump:	–	ft
Water Level After Sample:	13.66	ft
Measurement Method:	Electric Water Level Indicator	

SAMPLING INFORMATION

Purging Method:	Bladder	
Sampling Method:	Bladder	
Dedicated Equipment?	(YES)	NO

Duplicate Sample?	YES	(NO)
Duplicate Sample ID:		

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

Control Settings:		
Purge:	2	Sec.
Recover:	58	Sec.
PSI:	–	

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	Liters Removed	Appearance or Comment Clarity, Color, Odor, Ect.
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		clear, slightly turbid, turbid
23Mar21	1054	Start of Well Purge									
	1059	7.87	5625	7.13	3.47	-5.4	1.59	13.60	100	500	Clear
	~~1104~~ 1104	7.94	5622	7.09	1.84	-15.6	1.38	13.63	100	1000	Clear
	1114	8.00	5616	7.09	1.59	-18.9	1.47	13.67	100	500	Clear
	1119	8.05	5612	7.09	1.58	-21.2	1.40	13.65	100	500	Clear
	1124	8.02	5614	7.09	1.54	-23.9	1.12	13.65	100	500	Clear

Well Stabilized? (YES) NO Total Volume Purged: 3000 Liters

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment Clarity, Color, Odor, Ect.
23Mar21	1124	8.02	5614	7.09			1.12				Clear

Comments:	

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Field Datasheet

Groundwater Assessment

Company:	**MDU Heskett**
Event:	**Spring 2021**
Sample ID:	101
Sampling Personal:	

Weather Conditions: Temp: 40°F Wind: S @ 5-10 Precip: **Sunny / Partly Cloudy / Cloudy**

WELL INFORMATION

Well Locked?	YES	(NO)	
Well Labeled?	(YES)	NO	
Casing Strait?	(YES)	NO	
Grout Seal Intact?	(YES)	NO	Not Visible
Repairs Necessary?			
Casing Diameter:	2"		
Water Level Before Purge:	37.68	ft	
Total Depth of Well:	—	ft	
Well Volume:	—	liters	
Depth to Top of Pump:	—	ft	
Water Level After Sample:	40.16	ft	
Measurement Method:	Electric Water Level Indicator		

SAMPLING INFORMATION

Purging Method:	Bladder	
Sampling Method:	Bladder	
Dedicated Equipment?	(YES)	NO

Duplicate Sample?	YES	(NO)
Duplicate Sample ID:	—	

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

Control Settings:		
Purge:	5	Sec.
Recover:	55	Sec.
PSI:	30	

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	Liters Removed	Appearance or Comment Clarity, Color, Odor, Ect.
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		clear, slightly turbid, turbid
22 Mar 21	1358	**Start of Well Purge**									
	1403	10.50	5112	6.72	1.72	199.4	19.83	37.68	100.0	500.0	Clear
	1433	10.11	5148	6.70	0.67	192.2	1.14	39.76	100.0	3000.0	Clear
	1438	10.22	5118	6.71	0.77	189.9	0.72	39.85	100.0	500.0	Clear
	1443	10.33	5189	6.71	0.79	188.5	1.41	39.99	100.0	500.0	Clear
	1448	10.00	5148	6.71	0.78	186.7	0.67	40.05	100.0	500.0	Clear

Well Stabilized? (YES) NO

Total Volume Purged: 5000.0 Liters

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment Clarity, Color, Odor, Ect.
22 Mar 21	1448	10.00	5148	6.71			0.67				Clear

Comments:	

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Field Datasheet

Groundwater Assessment

Company:	**MDU Heskett**
Event:	**Spring 2021**
Sample ID:	102
Sampling Personal:	Jerry Moe

Weather Conditions: Temp: °F Wind: S @ 5-10 Precip: **Sunny / Partly Cloudy / Cloudy**

WELL INFORMATION

Well Locked?	YES	(NO)	
Well Labeled?	(YES)	NO	
Casing Strait?	(YES)	NO	
Grout Seal Intact?	(YES)	NO	Not Visible
Repairs Necessary?			
Casing Diameter:	2"		
Water Level Before Purge:	18.52	ft	
Total Depth of Well:	—	ft	
Well Volume:	—	liters	
Depth to Top of Pump:	—	ft	
Water Level After Sample:	21.45	ft	
Measurement Method:	Electric Water Level Indicator		

SAMPLING INFORMATION

Purging Method:	Bladder	
Sampling Method:	Bladder	
Dedicated Equipment?	(YES)	NO

Duplicate Sample?	YES	(NO)
Duplicate Sample ID:	—	

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

Control Settings:	
Purge: 5	Sec.
Recover: 55	Sec.
PSI: 20	

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	Liters Removed	Appearance or Comment Clarity, Color, Odor, Ect.
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		clear, slightly turbid, turbid
22 Mar 21	1041	**Start of Well Purge**									
	1046	7.83	9380	6.92	0.34	-69.4	2.63	19.23	100.0	500.0	Clear
	1116	8.33	8175	6.82	0.49	-44.6	0.93	20.85	100.0	3000.0	Clear
	1126	8.59	7833	6.84	0.77	-26.9	0.87	21.05	100.0	4000.0	Clear
	1136	8.61	7995	6.85	0.44	-31.2	0.76	21.15	100.0	1000.0	Clear
	1141	8.53	8024	6.85	0.47	-27.8	0.71	21.19	100.0	500.0	Clear
	1146	8.61	8140	6.85	0.52	-36.6	0.52	21.25	100.0	500.0	Clear

Well Stabilized? (YES) NO Total Volume Purged: 55000 Liters

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment Clarity, Color, Odor, Ect.
22 Mar 21	1146	8.61	8140	6.85			0.52				clear

Comments:	

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Field Datasheet

Groundwater Assessment

Company:	**MDU Heskett**
Event:	**Spring 2021**
Sample ID:	103
Sampling Personal:	

Weather Conditions: Temp: 35 °F Wind: N @ 5-10 Precip: **Sunny / Partly Cloudy / (Cloudy)**

WELL INFORMATION

Well Locked?	YES	(NO)	
Well Labeled?	(YES)	NO	
Casing Strait?	(YES)	NO	
Grout Seal Intact?	(YES)	NO	Not Visible
Repairs Necessary?			
Casing Diameter:	2"		
Water Level Before Purge:	32.40	ft	
Total Depth of Well:	—	ft	
Well Volume:	—	liters	
Depth to Top of Pump:	—	ft	
Water Level After Sample:	34.50	ft	
Measurement Method:	Electric Water Level Indicator		

SAMPLING INFORMATION

Purging Method:	Bladder	
Sampling Method:	Bladder	
Dedicated Equipment?	(YES)	NO

Duplicate Sample?	YES	(NO)
Duplicate Sample ID:		

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

Control Settings:		
Purge:	5	Sec.
Recover:	55	Sec.
PSI:	20	

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	Liters Removed	Appearance or Comment Clarity, Color, Odor, Ect.
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		clear, slightly turbid, turbid
23 Mar 21	0848	**Start of Well Purge**									
	0853	7.22	5016	6.84	0.76	193.9	0.22	33.38	100.0	500.0	Clear
	0903	7.44	5019	6.83	0.52	196.1	0.16	34.05	100.0	1000.0	Clear
	0913	7.36	4995	6.83	0.66	176.1	0.33	34.24	100.0	1000.0	Clear
	0918	7.35	4989	6.84	0.76	166.4	0.31	34.29	100.0	500.0	Clear
	0923	7.34	4981	6.84	0.82	159.0	0.42	34.37	100.0	500.0	Clear
	0928	7.41	4964	6.84	0.84	157.3	0.44	34.41	100.0	500.0	Clear

Well Stabilized? (YES) NO

Total Volume Purged: 4000.0 Liters

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment Clarity, Color, Odor, Ect.
23 Mar 21	0928	7.41	4964	6.84			0.44				Clear

Comments:	

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Field Datasheet

Groundwater Assessment

Company:	**MDU Heskett**
Event:	**Spring 2021**
Sample ID:	104
Sampling Personal:	Darren Niesman

Weather Conditions: Temp: 40 °F Wind: Light @ Precip: **Sunny / Partly Cloudy / Cloudy**

WELL INFORMATION

Well Locked?	**YES**	~~NO~~	
Well Labeled?	~~YES~~	**NO**	
Casing Strait?	~~YES~~	**NO**	
Grout Seal Intact?	**YES**	**NO**	**Not Visible**
Repairs Necessary?			

Casing Diameter:	**2"**	
Water Level Before Purge:	13.66	ft
Total Depth of Well:	-	ft
Well Volume:	-	liters
Depth to Top of Pump:	-	ft
Water Level After Sample:	14.10	ft
Measurement Method:	**Electric Water Level Indicator**	

SAMPLING INFORMATION

Purging Method:	**Bladder**	
Sampling Method:	**Bladder**	
Dedicated Equipment?	**YES**	**NO**

Duplicate Sample?	**YES**	**NO**
Duplicate Sample ID:	-	

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

Control Settings:		
Purge:	32	Sec.
Recover:	58	Sec.
PSI:		

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	Liters Removed	Appearance or Comment Clarity, Color, Odor, Ect.
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		clear, slightly turbid, turbid
23Mar21	0955	**Start of Well Purge**									
	1000	8.36	14045	7.11	9.42	10.8	1.52	14.02	100	500	cl
	1010	8.39	14017	7.02	2.88	-0.6	1.22	14.05	100	1000	cl
	1015	8.47	13998	7.02	2.99	-2.4	0.72	14.12	100	500	cl
	1020	8.68	13999	7.01	2.82	-2.8	0.69	14.10	100	500	clear
	1025	8.51	14045	7.01	2.78	-5.2	0.73	14.10	100	500	

Well Stabilized? **YES** **NO** Total Volume Purged: 3000 Liters

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment Clarity, Color, Odor, Ect.
23mar21	1025	8.51	14045	7.01			0.73				cl

Comments:	

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Field Datasheet

Groundwater Assessment

Company:	**MDU Heskett**
Event:	**Spring 2021**
Sample ID:	105
Sampling Personal:	Parker Niswanger

Weather Conditions: Temp: 45 °F Wind: N @ 5 Precip: **Sunny / (Partly Cloudy) / Cloudy**

WELL INFORMATION

Well Locked?	YES	(NO)
Well Labeled?	(YES)	NO
Casing Strait?	(YES)	NO
Grout Seal Intact?	(YES)	NO Not Visible
Repairs Necessary?	—	

Casing Diameter:	2"	
Water Level Before Purge:	12.60	ft
Total Depth of Well:	—	ft
Well Volume:	—	liters
Depth to Top of Pump:	—	ft
Water Level After Sample:	12.92	ft
Measurement Method:	Electric Water Level Indicator	

SAMPLING INFORMATION

Purging Method:	Bladder	
Sampling Method:	Bladder	
Dedicated Equipment?	(YES)	NO

Duplicate Sample?	YES	(NO)
Duplicate Sample ID:	—	

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

Control Settings:	
Purge:	Sec.
Recover: 5	Sec.
PSI:	

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	Liters Removed	Appearance or Comment
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		clear, slightly turbid, turbid
23Mar21	1148	**Start of Well Purge**									
	1153	8.05	2488	7.06	1.04	-22.5	3.21	12.83	100	500	cl
	1208	8.03	3988	6.95	1.14	-32.4	2.74	12.88	100	1500	cl
	1213	8.22	4312	6.92	0.90	-34.3	2.33	12.88	100	1500	cl
	1218	8.41	5443	6.87	0.95	-40.0	2.45	12.82	100	1500	cl
	1223	8.28	5671	6.86	0.90	-38.4	2.57	12.82	100	500	cl
	1238	8.38	5746	6.85	0.98	-43.4	3.93	12.85	100	500	cl
	1243	8.31	5906	6.84	0.94	-48.0	3.29	12.85	100	500	cl

Well Stabilized? (YES) NO Total Volume Purged: 6500 Liters

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment
											Clarity, Color, Odor, Ect.
23Mar21	1243	8.31	5906	6.84			3.29				clear

Comments:	Field blank 2 collected 1155

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Field Datasheet

Groundwater Assessment

Company:	**MDU Heskett**
Event:	**Spring 2021**
Sample ID:	44R
Sampling Personal:	JM

Weather Conditions: Temp: 40 °F Wind: N @ 5-10 Precip: **Sunny / Partly Cloudy / Cloudy**

WELL INFORMATION

Well Locked?	YES	(NO)	
Well Labeled?	(YES)	NO	
Casing Strait?	(YES)	NO	
Grout Seal Intact?	(YES)	NO	Not Visible
Repairs Necessary?			
Casing Diameter:	2"		
Water Level Before Purge:	27.12	ft	
Total Depth of Well:	—	ft	
Well Volume:	—	liters	
Depth to Top of Pump:	—	ft	
Water Level After Sample:	27.27	ft	
Measurement Method:	Electric Water Level Indicator		

SAMPLING INFORMATION

Purging Method:	Bladder	
Sampling Method:	Bladder	
Dedicated Equipment?	(YES)	NO

Duplicate Sample?	YES	(NO)
Duplicate Sample ID:	—	

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

Control Settings:	
Purge: 5	Sec.
Recover: 55	Sec.
PSI: 20	

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	Liters Removed	Appearance or Comment
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		Clarity, Color, Odor, Ect.
23 Mar 21	1002	Start of Well Purge									clear, slightly turbid, turbid
	1007	8.14	8978	6.72	1.77	215.5	3.85	27.23	100.0	500.0	Clear
	1017	8.62	8993	6.67	0.45	191.5	0.76	27.23	100.0	1000.0	clear
	1027	8.56	8981	6.66	0.29	179.6	1.10	27.24	100.0	1000.0	Clear
	1032	8.52	8993	6.66	0.28	175.7	1.72	27.25	100.0	500.0	Clear
	1037	8.49	8996	6.66	0.26	174.3	1.10	27.25	100.0	500.0	Clear
	1042	8.47	8992	6.66	0.25	171.9	1.82	27.25	100.0	500.0	Clear

Well Stabilized? (YES) NO

Total Volume Purged: 4000.0 Liters

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment
											Clarity, Color, Odor, Ect.
23 Mar 21	1042	8.47	8992	6.66			1.82				Clear

Comments:	

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REVISED PT1_APP III

CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 10 Sep 21
Lab Number: 21-W3041
Work Order #: 82-2247
Account #: 002800
Date Sampled: 24 Aug 21
Date Received: 25 Aug 21 9:28
Sampled By: MVTL Field Services

Project Name: MDU Heskett

PO #: 185968 OP

Sample Description: FB1

Temp at Receipt: 4.3C

Event and Year: Fall 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH	* 5.7	units	0.1	SM4500-H+-B-11	25 Aug 21 17:00	RAA
Fluoride	< 0.1	mg/l	0.10	SM4500-F-C	25 Aug 21 17:00	RAA
Sulfate	< 5	mg/l	5.00	ASTM D516-11	1 Sep 21 9:41	SD
Chloride	< 2	mg/l	2.0	SM4500-Cl-E-11	25 Aug 21 13:28	SD
Total Dissolved Solids	< 10	mg/l	10	USGS I1750-85	26 Aug 21 16:00	RAA
Calcium - Total	< 1	mg/l	1.0	6010D	27 Aug 21 11:13	SZ
Boron - Total	< 0.1	mg/l	0.10	6010D	26 Aug 21 10:37	SZ

* Holding time exceeded

Approved by: Claudette K. Carroll CC 15Oct21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

RL = Method Reporting Limit

The reporting limit was elevated for any analyte requiring a dilution as coded below:
@ = Due to sample matrix # = Due to concentration of other analytes
! = Due to sample quantity + = Due to internal standard response

CERTIFICATION: ND # ND-00016

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CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 10 Sep 21
Lab Number: 21-W3042
Work Order #: 82-2247
Account #: 002800
Date Sampled: 23 Aug 21 13:02
Date Received: 25 Aug 21 9:28
Sampled By: MVTL Field Services

Project Name: MDU Heskett

PO #: 185968 OP

Sample Description: MW101

Temp at Receipt: 4.3C

Event and Year: Fall 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	6.57	units	NA	SM 4500 H+ B	23 Aug 21 13:02	JSM
pH	* 7.1	units	0.1	SM4500-H+-B-11	25 Aug 21 18:00	RAA
Temperature - Field	15.2	Degrees C	NA	SM 2550B	23 Aug 21 13:02	JSM
Conductivity - Field	5268	umhos/cm	1	EPA 120.1	23 Aug 21 13:02	JSM
Fluoride	0.13	mg/l	0.10	SM4500-F-C	25 Aug 21 18:00	RAA
Sulfate	3420	mg/l	5.00	ASTM D516-11	1 Sep 21 9:41	SD
Chloride	20.8	mg/l	2.0	SM4500-Cl-E-11	25 Aug 21 13:28	SD
Total Dissolved Solids	5530	mg/l	10	USGS I1750-85	26 Aug 21 16:00	RAA
Calcium - Total	442	mg/l	1.0	6010D	27 Aug 21 11:13	SZ
Boron - Total	0.80	mg/l	0.10	6010D	26 Aug 21 10:37	SZ

* Holding time exceeded

Approved by: Claudette K. Carroll 15 OCT 21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

RL = Method Reporting Limit

The reporting limit was elevated for any analyte requiring a dilution as coded below:
@ = Due to sample matrix # = Due to concentration of other analytes
! = Due to sample quantity + = Due to internal standard response

CERTIFICATION: ND # ND-00016

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CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 10 Sep 21
Lab Number: 21-W3043
Work Order #: 82-2247
Account #: 002800
Date Sampled: 23 Aug 21 10:25
Date Received: 25 Aug 21 9:28
Sampled By: MVTL Field Services

Project Name: MDU Heskett

PO #: 185968 OP

Sample Description: MW102

Temp at Receipt: 4.3C

Event and Year: Fall 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	6.75	units	NA	SM 4500 H+ B	23 Aug 21 10:25	JSM
pH	* 7.2	units	0.1	SM4500-H+-B-11	25 Aug 21 18:00	RAA
Temperature - Field	12.1	Degrees C	NA	SM 2550B	23 Aug 21 10:25	JSM
Conductivity - Field	8066	umhos/cm	1	EPA 120.1	23 Aug 21 10:25	JSM
Fluoride	0.16	mg/l	0.10	SM4500-F-C	25 Aug 21 18:00	RAA
Sulfate	4880	mg/l	5.00	ASTM D516-11	1 Sep 21 9:41	SD
Chloride	6.1	mg/l	2.0	SM4500-Cl-E-11	25 Aug 21 14:06	SD
Total Dissolved Solids	7920	mg/l	10	USGS I1750-85	26 Aug 21 16:00	RAA
Calcium - Total	470	mg/l	1.0	6010D	27 Aug 21 11:13	SZ
Boron - Total	1.27	mg/l	0.10	6010D	26 Aug 21 10:37	SZ

* Holding time exceeded

CC

Approved by: Claudette K. Carroll 15OCT21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

RL = Method Reporting Limit

The reporting limit was elevated for any analyte requiring a dilution as coded below:
@ = Due to sample matrix # = Due to concentration of other analytes
! = Due to sample quantity + = Due to internal standard response

CERTIFICATION: ND # ND-00016

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CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 10 Sep 21
Lab Number: 21-W3044
Work Order #: 82-2247
Account #: 002800
Date Sampled: 23 Aug 21 14:20
Date Received: 25 Aug 21 9:28
Sampled By: MVTL Field Services

PO #: 185968 OP

Temp at Receipt: 4.3C

Project Name: MDU Heskett

Sample Description: MW103

Event and Year: Fall 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	6.58	units	NA	SM 4500 H+ B	23 Aug 21 14:20	JSM
pH	* 7.0	units	0.1	SM4500-H+-B-11	25 Aug 21 18:00	RAA
Temperature - Field	12.0	Degrees C	NA	SM 2550B	23 Aug 21 14:20	JSM
Conductivity - Field	4910	umhos/cm	1	EPA 120.1	23 Aug 21 14:20	JSM
Fluoride	0.30	mg/l	0.10	SM4500-F-C	25 Aug 21 18:00	RAA
Sulfate	3000	mg/l	5.00	ASTM D516-11	1 Sep 21 9:41	SD
Chloride	119	mg/l	2.0	SM4500-Cl-E-11	25 Aug 21 14:06	SD
Total Dissolved Solids	4900	mg/l	10	USGS I1750-85	26 Aug 21 16:00	RAA
Calcium - Total	500	mg/l	1.0	6010D	27 Aug 21 11:13	SZ
Boron - Total	< 0.5 @	mg/l	0.10	6010D	26 Aug 21 10:37	SZ

* Holding time exceeded

Approved by: Claudette K. Carroll CC 15 Oct 21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

RL = Method Reporting Limit

The reporting limit was elevated for any analyte requiring a dilution as coded below:
@ = Due to sample matrix # = Due to concentration of other analytes
! = Due to sample quantity + = Due to internal standard response

CERTIFICATION: ND # ND-00016

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CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 10 Sep 21
Lab Number: 21-W3045
Work Order #: 82-2247
Account #: 002800
Date Sampled: 24 Aug 21 12:50
Date Received: 25 Aug 21 9:28
Sampled By: MVTL Field Services

Project Name: MDU Heskett

PO #: 185968 OP

Sample Description: MW104

Temp at Receipt: 4.3C

Event and Year: Fall 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	6.89	units	NA	SM 4500 H+ B	24 Aug 21 12:50	JSM
pH	* 7.3	units	0.1	SM4500-H+-B-11	25 Aug 21 18:00	RAA
Temperature - Field	12.5	Degrees C	NA	SM 2550B	24 Aug 21 12:50	JSM
Conductivity - Field	14092	umhos/cm	1	EPA 120.1	24 Aug 21 12:50	JSM
Fluoride	0.54	mg/l	0.10	SM4500-F-C	25 Aug 21 18:00	RAA
Sulfate	11600	mg/l	5.00	ASTM D516-11	1 Sep 21 10:00	SD
Chloride	94.1	mg/l	2.0	SM4500-Cl-E-11	25 Aug 21 14:06	SD
Total Dissolved Solids	17500	mg/l	10	USGS I1750-85	26 Aug 21 16:00	RAA
Calcium - Total	422	mg/l	1.0	6010D	27 Aug 21 11:13	SZ
Boron - Total	0.84	mg/l	0.10	6010D	26 Aug 21 10:37	SZ

* Holding time exceeded

Approved by: Claudette K. Carroll CC 15Oct21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

RL = Method Reporting Limit

The reporting limit was elevated for any analyte requiring a dilution as coded below:
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! = Due to sample quantity + = Due to internal standard response

CERTIFICATION: ND # ND-00016

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CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 10 Sep 21
Lab Number: 21-W3046
Work Order #: 82-2247
Account #: 002800
Date Sampled: 24 Aug 21 14:52
Date Received: 25 Aug 21 9:28
Sampled By: MVTL Field Services

PO #: 185968 OP

Temp at Receipt: 4.3C

Project Name: MDU Heskett

Sample Description: MW105

Event and Year: Fall 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	6.67	units	NA	SM 4500 H+ B	24 Aug 21 14:52	JSM
pH	* 7.2	units	0.1	SM4500-H+-B-11	25 Aug 21 18:00	RAA
Temperature - Field	15.7	Degrees C	NA	SM 2550B	24 Aug 21 14:52	JSM
Conductivity - Field	6331	umhos/cm	1	EPA 120.1	24 Aug 21 14:52	JSM
Fluoride	0.25	mg/l	0.10	SM4500-F-C	25 Aug 21 18:00	RAA
Sulfate	4130	mg/l	5.00	ASTM D516-11	1 Sep 21 10:00	SD
Chloride	280	mg/l	2.0	SM4500-Cl-E-11	25 Aug 21 14:06	SD
Total Dissolved Solids	6760	mg/l	10	USGS I1750-85	27 Aug 21 16:00	RAA
Calcium - Total	339	mg/l	1.0	6010D	27 Aug 21 11:13	SZ
Boron - Total	< 0.5 @	mg/l	0.10	6010D	26 Aug 21 10:37	SZ

* Holding time exceeded

Approved by: Claudette K. Carroll 15OCT21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

RL = Method Reporting Limit

The reporting limit was elevated for any analyte requiring a dilution as coded below:
@ = Due to sample matrix # = Due to concentration of other analytes
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CERTIFICATION: ND # ND-00016

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CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 10 Sep 21
Lab Number: 21-W3047
Work Order #: 82-2247
Account #: 002800
Date Sampled: 24 Aug 21 8:15
Date Received: 25 Aug 21 9:28
Sampled By: MVTL Field Services

Project Name: MDU Heskett

PO #: 185968 OP

Sample Description: MW44R

Temp at Receipt: 4.3C

Event and Year: Fall 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	6.52	units	NA	SM 4500 H+ B	24 Aug 21 8:15	JSM
pH	* 7.1	units	0.1	SM4500-H+-B-11	25 Aug 21 18:00	RAA
Temperature - Field	12.0	Degrees C	NA	SM 2550B	24 Aug 21 8:15	JSM
Conductivity - Field	9336	umhos/cm	1	EPA 120.1	24 Aug 21 8:15	JSM
Fluoride	0.63	mg/l	0.10	SM4500-F-C	25 Aug 21 18:00	RAA
Sulfate	6830	mg/l	5.00	ASTM D516-11	1 Sep 21 10:00	SD
Chloride	203	mg/l	2.0	SM4500-Cl-E-11	25 Aug 21 14:06	SD
Total Dissolved Solids	10800	mg/l	10	USGS I1750-85	27 Aug 21 16:00	RAA
Calcium - Total	410	mg/l	1.0	6010D	27 Aug 21 12:23	SZ
Boron - Total	< 0.5 @	mg/l	0.10	6010D	26 Aug 21 10:37	SZ

* Holding time exceeded

Approved by: Claudette K. Carroll CC 15OCT21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

RL = Method Reporting Limit

The reporting limit was elevated for any analyte requiring a dilution as coded below:
@ = Due to sample matrix # = Due to concentration of other analytes
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CERTIFICATION: ND # ND-00016

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CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 10 Sep 21
Lab Number: 21-W3048
Work Order #: 82-2247
Account #: 002800
Date Sampled: 24 Aug 21
Date Received: 25 Aug 21 9:28
Sampled By: MVTL Field Services

Project Name: MDU Heskett

PO #: 185968 OP

Sample Description: Dup2

Temp at Receipt: 4.3C

Event and Year: Fall 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH	* 7.4	units	0.1	SM4500-H+-B-11	25 Aug 21 18:00	RAA
Fluoride	0.54	mg/l	0.10	SM4500-F-C	25 Aug 21 18:00	RAA
Sulfate	11600	mg/l	5.00	ASTM D516-11	1 Sep 21 10:00	SD
Chloride	93.0	mg/l	2.0	SM4500-Cl-E-11	25 Aug 21 14:06	SD
Total Dissolved Solids	17400	mg/l	10	USGS I1750-85	27 Aug 21 16:00	RAA
Calcium - Total	443	mg/l	1.0	6010D	27 Aug 21 12:23	SZ
Boron - Total	0.86	mg/l	0.10	6010D	26 Aug 21 10:37	SZ

* Holding time exceeded

Approved by: Claudette K. Carroll 150 (TST)

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

RL = Method Reporting Limit

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@ = Due to sample matrix # = Due to concentration of other analytes
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CERTIFICATION: ND # ND-00016

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Quality Control Report

Lab IDs: 21-W3041 to 21-W3048 **Project:** MDU Heskett **Work Order:** 202182-2247

Analyte	LCS Spike Amt	LCS Rec %	LCS % Rec Limits	Matrix Spike Amt	Matrix Spike ID	Matrix Spike Orig Result	Matrix Spike Result	Matrix Spike Rec %	Matrix Spike % Rec Limits	MSD/ Dup Orig Result	MSD/ Dup Result	MSD Rec %	MSD/ Dup RPD	MSD/ Dup RPD Limit (<)	Known Rec (%)	Known % Rec Limits	Method Blank
Boron - Total mg/l	0.40	105	80-120	2.00	21-W3048	0.86	2.58	86	75-125	2.58	2.69	92	4.2	20	-	-	< 0.1
															-	-	< 0.1
Calcium - Total mg/l	100	104	80-120	100	21W3037q	2.6	98.9	96	75-125	98.9	97.9	95	1.0	20	-	-	< 1
	100	105	80-120	100	21W3069q	64.5	156	92	75-125	156	154	90	1.3	20	-	-	< 1
															-	-	< 1
															-	-	< 1
Chloride mg/l	30.0	95	80-120	30.0	21-W3030	< 2	28.3	94	80-120	28.3	28.7	96	1.4	20	-	-	< 2
	30.0	95	80-120	30.0	21-W3049	< 2	28.5	95	80-120	28.5	28.6	95	0.4	20	-	-	< 2
	30.0	95	80-120	30.0	21-W2964	31.1	62.3	104	80-120	62.3	62.4	104	0.2	20	-	-	< 2
	30.0	95	80-120												-	-	< 2
Fluoride mg/l	0.50	100	90-110	0.500	21-W3030	< 0.1	0.50	100	80-120	0.50	0.50	100	0.0	20	-	-	< 0.1
	0.50	100	90-110	0.500	21-W3037	2.16	2.68	104	80-120	2.68	2.72	112	1.5	20	-	-	< 0.1
	0.50	100	90-110	0.500	21-W3040	0.81	1.26	90	80-120	1.26	1.27	92	0.8	20	-	-	< 0.1
	0.50	100	90-110	0.500	21-W3053	0.30	0.81	102	80-120	0.81	0.90	120	10.5	20	-	-	< 0.1
pH units	-	-	-	-	-	-	-	-	-	5.7	5.8	-	1.7	20	-	-	-
	-	-	-	-	-	-	-	-	-	8.2	8.5	-	3.6	20	-	-	-
	-	-	-	-	-	-	-	-	-	8.6	8.6	-	0.0	20	-	-	-
	-	-	-	-	-	-	-	-	-	7.6	7.4	-	2.7	20	-	-	-
Sulfate mg/l	100	106	80-120	100	21-W3041	< 5	104	104	80-120	104	106	106	1.9	20	-	-	< 5
	100	104	80-120	100	21-W3049	< 5	105	105	80-120	105	104	104	1.0	20	-	-	< 5
Total Dissolved Solids mg/l	-	-	-	-	-	-	-	-	-	1640	1670	-	1.8	20	-	-	< 10
	-	-	-	-	-	-	-	-	-	2490	2480	-	0.4	20	-	-	< 10
	-	-	-	-	-	-	-	-	-	1740	1740	-	0.0	20	-	-	

Samples were received in good condition on 25 Aug 2021 at 0928.
Temperature upon receipt at the Bismarck laboratory was 4.3°C.
All samples were properly preserved unless noted here and/or flagged on the individual analytical laboratory report.
With the exception of pH, all holding times were met.
Approved methodology was followed for all sample analyses.
All acceptance criteria were met for calibration, method blanks, laboratory control samples, laboratory fortified matrix/duplicates unless noted here:

- For some analytes, the reported results were elevated due to additional dilutions required to minimize the effects of sample matrix.

Approved by: C. Crutcher
15 Oct 21

MVTL

2616 E. Broadway Ave, Bismarck, ND

Phone: (701) 258-9720

Field Datasheet

Groundwater Assessment

Company:	**MDU Heskett**
Event:	**Fall 2021**
Sample ID:	101
Sampling Personal:	

Weather Conditions: Temp: 65 °F Wind: N @ 5-10 Precip: **Sunny / Partly Cloudy / Cloudy**

WELL INFORMATION

Well Locked?	YES	(NO)	
Well Labeled?	(YES)	NO	
Casing Strait?	(YES)	NO	
Grout Seal Intact?	(YES)	NO	Not Visible
Repairs Necessary?			

Casing Diameter:	2"	
Water Level Before Purge:	38.12	ft
Total Depth of Well:	—	ft
Well Volume:	—	liters
Depth to Top of Pump:	—	ft
Water Level After Sample:	40.51	ft
Measurement Method:	Electric Water Level Indicator	

SAMPLING INFORMATION

Purging Method:	Bladder	
Sampling Method:	Bladder	
Dedicated Equipment?	(YES)	NO

Duplicate Sample?	YES	(NO)
Duplicate Sample ID:	—	

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

Control Settings:		
Purge:	3	Sec.
Recover:	27	Sec.
PSI:	25	

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	mL Removed	Appearance or Comment
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		clear, slightly turbid, turbid
23 Aug 21	1212	Start of Well Purge									
	1217	15.02	5257	6.59	2.25	251.5	3.26	39.28	100.0	500.0	Clear
	1247	14.95	5234	6.57	1.39	195.4	1.34	40.25	100.0	3000.0	Clear
	1252	15.28	5248	6.58	1.73	185.1	1.07	40.31	100.0	500.0	Clear
	1257	14.90	5250	6.57	1.59	183.2	1.01	40.38	100.0	500.0	Clear
	1302	15.16	5268	6.57	1.58	184.3	0.97	40.42	100.0	500.0	Clear
									~~100.0~~		

Well Stabilized? (YES) NO

Total Volume Purged: 5000.0 mL

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment
											Clarity, Color, Odor, Ect.
23 Aug 21	1302	15.16	5268	6.57			0.97				Clear

Comments:	

Field Datasheet

Groundwater Assessment

2616 E. Broadway Ave, Bismarck, ND

Phone: (701) 258-9720

Company:	**MDU Heskett**
Event:	**Fall 2021**
Sample ID:	102
Sampling Personal:	JM

Weather Conditions: Temp: 60 °F Wind: N @ 5-10 Precip: **Sunny / ~~Partly Cloudy~~ / Cloudy**

WELL INFORMATION

Well Locked?	YES	~~NO~~	
Well Labeled?	~~YES~~	NO	
Casing Strait?	YES	NO	
Grout Seal Intact?	YES	NO	Not Visible
Repairs Necessary?			
Casing Diameter:	2"		
Water Level Before Purge:	19.73	ft	
Total Depth of Well:	—	ft	
Well Volume:	—	liters	
Depth to Top of Pump:	—	ft	
Water Level After Sample:	22.05	ft	
Measurement Method:	Electric Water Level Indicator		

SAMPLING INFORMATION

Purging Method:	Bladder	
Sampling Method:	Bladder	
Dedicated Equipment?	YES	NO

Duplicate Sample?	YES	NO
Duplicate Sample ID:	—	

Control Settings:		
Purge:	3	Sec.
Recover:	27	Sec.
PSI:	20	

Bottle List:

1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	mL Removed	Appearance or Comment
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		clear, slightly turbid, turbid
23 Aug 21	0935	**Start of Well Purge**									
	~~0940~~	11.07	9415	6.79	0.98	6.2	0.01	20.70	100.0	500.0	Clear
	1010	11.92	8034	6.72	1.37	38.2	0.05	21.74	100.0	3000.0	Clear
	1015	11.70	8045	6.74	0.94	20.6	0.18	21.86	100.0	500.0	Clear
	1020	11.88	7957	6.74	1.02	24.2	0.11	21.90	100.0	500.0	Clear
	1025	12.07	8066	6.75	1.08	15.8	0.21	21.92	100.0	500.0	Clear

Well Stabilized? YES NO Total Volume Purged: 5000.0 mL

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment
											Clarity, Color, Odor, Ect.
23 Aug 21	1025	12.07	8066	6.75			0.21				Clear

Comments:	

Field Datasheet

Groundwater Assessment

2616 E. Broadway Ave, Bismarck, ND

Phone: (701) 258-9720

Company:	**MDU Heskett**
Event:	**Fall 2021**
Sample ID:	103
Sampling Personal:	JM

Weather Conditions: Temp: 65 °F Wind: N @ 5-10 Precip: **Sunny / Partly Cloudy / Cloudy**

WELL INFORMATION

Well Locked?	YES	(NO)	
Well Labeled?	(YES)	NO	
Casing Strait?	(YES)	NO	
Grout Seal Intact?	YES	NO	(Not Visible)
Repairs Necessary?			

Casing Diameter:	2"	
Water Level Before Purge:	33.97	ft
Total Depth of Well:	—	ft
Well Volume:	—	liters
Depth to Top of Pump:	—	ft
Water Level After Sample:	38.72	ft
Measurement Method:	Electric Water Level Indicator	

SAMPLING INFORMATION

Purging Method:	Bladder	
Sampling Method:	Bladder	
Dedicated Equipment?	(YES)	NO

Duplicate Sample?	YES	(NO)
Duplicate Sample ID:	—	

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

Control Settings:		
Purge:	3	Sec.
Recover:	27	Sec.
PSI:	25	

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	mL Removed	Appearance or Comment Clarity, Color, Odor, Ect.
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		clear, slightly turbid, turbid
23Aug21	1330	**Start of Well Purge**									
	1335	13.31	5002	6.69	3.25	273.9	1.86	34.98	100.0	500.0	Clear
	1405	11.71	4851	6.61	1.83	270.8	0.51	37.20	100.0	3000.0	Clear
	1410	11.61	4840	6.60	1.66	270.6	0.30	37.84	100.0	500.0	Clear
	1415	11.82	4882	6.60	1.74	275.3	0.21	38.05	100.0	500.0	Clear
	1420	11.98	4910	6.58	1.79	272.3	0.55	38.19	100.0	500.0	Clear

Well Stabilized? (YES) NO Total Volume Purged: 5000.0 mL

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment Clarity, Color, Odor, Ect.
23Aug21	1420	11.98	4910	6.58			0.55				Clear

Comments:	

MVTL
2616 E. Broadway Ave, Bismarck, ND
Phone: (701) 258-9720

Field Datasheet

Groundwater Assessment

Company:	**MDU Heskett**
Event:	**Fall 2021**
Sample ID:	104
Sampling Personal:	JM

Weather Conditions: Temp: 70 °F Wind: N @ 5-10 Precip: **Sunny / Partly Cloudy / Cloudy**

WELL INFORMATION

Well Locked?	YES	(NO)	
Well Labeled?	(YES)	NO	
Casing Strait?	(YES)	NO	
Grout Seal Intact?	(YES)	NO	Not Visible
Repairs Necessary?			

Casing Diameter:	2"	
Water Level Before Purge:	14.98	ft
Total Depth of Well:	—	ft
Well Volume:	—	liters
Depth to Top of Pump:	—	ft
Water Level After Sample:	15.43	ft
Measurement Method:	Electric Water Level Indicator	

SAMPLING INFORMATION

Purging Method:	Bladder	
Sampling Method:	Bladder	
Dedicated Equipment?	(YES)	NO

Duplicate Sample?	(YES)	NO
Duplicate Sample ID:	Dup2	

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

Control Settings:		
Purge:	5	Sec.
Recover:	55	Sec.
PSI:	25	

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	mL Removed	Appearance or Comment Clarity, Color, Odor, Ect.
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		clear, slightly turbid, turbid
	1200	Start of Well Purge									
24 Aug 21	1205	14.70	13988	6.98	3.32	268.7	14.79	15.20	100.0	500.0	Clear
	1235	12.46	14028	6.90	1.15	227.6	0.65	15.38	100.0	3000.0	Clear
	1240	12.32	14068	6.90	1.11	227.7	0.43	15.40	100.0	500.0	Clear
	1245	12.22	14033	6.89	1.20	225.8	0.55	15.40	100.0	500.0	Clear
	1250	12.50	14092	6.89	1.29	224.3	0.61	15.42	100.0	500.0	Clear

Well Stabilized? (YES) NO Total Volume Purged: 5000 mL

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment Clarity, Color, Odor, Ect.
24 Aug 21	1250	12.50	14092	6.89			0.61				Clear

Comments:	

Field Datasheet

Groundwater Assessment

MVTL
2616 E. Broadway Ave, Bismarck, ND
Phone: (701) 258-9720

Company:	**MDU Heskett**
Event:	**Fall 2021**
Sample ID:	105
Sampling Personal:	JM

Weather Conditions: Temp: 70°F Wind: N@ 5-10 Precip: **Sunny / ~~Partly Cloudy~~ / Cloudy**

WELL INFORMATION

Well Locked?	YES	~~NO~~	
Well Labeled?	~~YES~~	NO	
Casing Strait?	~~YES~~	NO	
Grout Seal Intact?	~~YES~~	NO	Not Visible
Repairs Necessary?			

Casing Diameter:	2"	
Water Level Before Purge:	13.85	ft
Total Depth of Well:	—	ft
Well Volume:	—	liters
Depth to Top of Pump:	—	ft
Water Level After Sample:	14.00	ft
Measurement Method:	Electric Water Level Indicator	

SAMPLING INFORMATION

Purging Method:	Bladder	
Sampling Method:	Bladder	
Dedicated Equipment?	~~YES~~	NO

Duplicate Sample?	YES	~~NO~~
Duplicate Sample ID:	—	

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

Control Settings:		
Purge:	5	Sec.
Recover:	55	Sec.
PSI:	20	

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	mL Removed	Appearance or Comment
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		clear, slightly turbid, turbid
24 Aug 21	1332	**Start of Well Purge**									
	1337	16.13	4170	6.73	0.75	217.1	17.94	13.93	100.0	500.0	Clear
	1407	18.00	5005	6.69	0.79	220.0	23.57	13.98	100.0	3000.0	Clear
	1427	17.15	5635	6.67	0.79	222.7	8.63	13.95	100.0	2000.0	Clear
	1437	15.64	6080	6.68	0.69	217.5	4.87	13.97	100.0	1000.0	Clear
	1442	15.84	6086	6.68	0.65	216.7	4.62	13.96	100.0	500.0	Clear
	1447	15.73	6135	6.68	0.67	212.4	4.37	13.96	100.0	500.0	Clear
	1452	15.67	6331	6.67	0.66	211.9	4.29	13.99	100.0	500.0	Clear

Well Stabilized? YES NO

Total Volume Purged: 8000.0 mL

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment
											Clarity, Color, Odor, Ect.
24 Aug 21	1452	15.67	6331	6.67			4.29				Clear

Comments:	

Field Datasheet

Groundwater Assessment

2616 E. Broadway Ave, Bismarck, ND

Phone: (701) 258-9720

Company:	**MDU Heskett**
Event:	**Fall 2021**
Sample ID:	4AB
Sampling Personal:	JM

Weather Conditions: Temp: 55 °F Wind: N @ 5-10 Precip: **Sunny / Partly Cloudy / Cloudy**

WELL INFORMATION

Well Locked?	YES	(NO)	
Well Labeled?	(YES)	NO	
Casing Strait?	(YES)	NO	
Grout Seal Intact?	(YES)	NO	Not Visible
Repairs Necessary?	See Comments		
Casing Diameter:	2"		
Water Level Before Purge:	29.13	ft	
Total Depth of Well:	—	ft	
Well Volume:	—	liters	
Depth to Top of Pump:	—	ft	
Water Level After Sample:	29.22	ft	
Measurement Method:	Electric Water Level Indicator		

SAMPLING INFORMATION

Purging Method:	Bladder	
Sampling Method:	Bladder	
Dedicated Equipment?	(YES)	NO

Duplicate Sample?	YES	(NO)
Duplicate Sample ID:	—	

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

Control Settings:	
Purge: 3	Sec.
Recover: 27	Sec.
PSI: 25	

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	mL Removed	Appearance or Comment Clarity, Color, Odor, Ect.
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		clear, slightly turbid, turbid
24 Aug 21	0715	**Start of Well Purge**									
	0720	11.72	9393	6.55	1.68	252.5	3.16	29.25	100.0	500.0	Clear
	0750	11.27	9215	6.50	1.47	249.5	5.80	29.12	100.0	3000.0	Clear
	0800	11.90	9367	6.51	1.35	238.4	3.83	29.18	100.0	1000.0	Clear
	0805	11.96	9316	6.51	1.52	238.9	2.82	29.21	100.0	500.0	Clear
	0810	12.08	9300	6.51	1.50	233.1	2.97	29.15	100.0	500.0	Clear
	0815	12.04	9336	6.52	1.44	230.2	3.02	29.18	100.0	500.0	Clear

Well Stabilized? (YES) NO Total Volume Purged: 6000.0 mL

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment Clarity, Color, Odor, Ect.
24 Aug 21	0815	12.04	9336	6.52			3.02				Clear

Comments: Outer casing sunk. could not close lid.

Collected Field Blank 1 @ 0730

MVTL

2616 E. Broadway Ave
Bismarck, ND 58501
(701) 258-9720

Chain of Custody Record

Project Name:	Event:	Work Order Number:
MDU Heskett	**Fall 2021**	82-2247

Report To:	**Montana-Dakota Utilities**	CC:	Collected By:
Attn:	Todd Peterson		
Address:	400 North 4th St. Bismarck, ND 58501		
Phone:	701-425-2427		
Email:	todd.peterson@mdu.com		

Lab Number	Sample ID	Date	Time	Sample Type	1 Liter Raw	500 mL Nitric	500 mL Nitric (filtered)	250 mL Sulfuric	1 Liter Nitric	Temp (°C)	Spec. Cond.	pH	Turbidity (NTU)	Analysis Required
~~W3040~~ W3040*	~~Dup1~~ Dup 2 *	~~24 Aug 21~~ 23 Aug 21 *	NA	GW	X	X	X	X		NA	NA	NA	NA	MDU List AA & MDU List C
W3041	FB1	24 Aug 21	NA	GW	X	X	X	X		NA	NA	NA	NA	
W3042	MW101	23 Aug 21	1302	GW	X	X	X	X		15.16	5268	6.57	0.97	
W3043	MW102	23 Aug 21	1025	GW	X	X	X	X		12.07	8066	6.75	0.21	
W3044	MW103	23 Aug 21	1420	GW	X	X	X	X		11.98	4910	6.58	0.55	
W3045	MW104	24 Aug 21	1250	GW	X	X	X	X		12.50	14092	6.89	0.61	
W3046	MW105	24 Aug 21	1452	GW	X	X	X	X		15.67	6331	6.67	4.29	
W3047	MW44R	24 Aug 21	0815	GW	X	X	X	X		12.04	9336	6.52	3.02	

Comments: * = @ CL ISOCT 21

Relinquished By			Sample Condition		Received By		
	Name	Date/Time	Location	Temp (°C)	Name		Date/Time
1		25Aug21 0928	Log In / Walk In #2	4.3 TM562 / TM805			25Aug21 0928
2							

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www.mvtl.com
MEMBER ACIL

REVISED PT2_APP III

CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 10 Sep 21
Lab Number: 21-W3040
Work Order #: 82-2247A
Account #: 002800
Date Sampled: 23 Aug 21
Date Received: 25 Aug 21 9:28
Sampled By: MVTL Field Services

Project Name: MDU Heskett

PO #: 185968 OP

Sample Description: Dup1

Temp at Receipt: 4.3C

Event and Year: Fall 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH	* 7.4	units	0.1	SM4500-H+-B-11	25 Aug 21 18:00	RAA
Fluoride	0.81	mg/l	0.10	SM4500-F-C	25 Aug 21 18:00	RAA
Sulfate	6800	mg/l	5.00	ASTM D516-11	1 Sep 21 9:41	SD
Chloride	77.6	mg/l	2.0	SM4500-Cl-E-11	25 Aug 21 13:28	SD
Total Dissolved Solids	10500	mg/l	10	USGS I1750-85	26 Aug 21 16:00	RAA
Calcium - Total	385	mg/l	1.0	6010D	27 Aug 21 11:13	SZ
Boron - Total	0.63	mg/l	0.10	6010D	26 Aug 21 10:37	SZ

* Holding time exceeded

Approved by: Claudette K. Carroll CC 15OCT21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

RL = Method Reporting Limit

The reporting limit was elevated for any analyte requiring a dilution as coded below:
@ = Due to sample matrix # = Due to concentration of other analytes
! = Due to sample quantity + = Due to internal standard response

CERTIFICATION: ND # ND-00016

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CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 10 Sep 21
Lab Number: 21-W3049
Work Order #: 82-2247A
Account #: 002800
Date Sampled: 25 Aug 21
Date Received: 25 Aug 21 9:28
Sampled By: MVTL Field Services

Project Name: MDU Heskett

PO #: 185968 OP

Sample Description: FB2

Temp at Receipt: 4.3C

Event and Year: Fall 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH	* 5.7	units	0.1	SM4500-H+-B-11	25 Aug 21 17:00	RAA
Fluoride	< 0.1	mg/l	0.10	SM4500-F-C	25 Aug 21 17:00	RAA
Sulfate	< 5	mg/l	5.00	ASTM D516-11	1 Sep 21 10:00	SD
Chloride	< 2	mg/l	2.0	SM4500-Cl-E-11	25 Aug 21 14:06	SD
Total Dissolved Solids	< 10	mg/l	10	USGS I1750-85	27 Aug 21 16:00	RAA
Calcium - Total	< 1	mg/l	1.0	6010D	27 Aug 21 12:23	SZ
Boron - Total	< 0.1	mg/l	0.10	6010D	26 Aug 21 11:37	SZ

* Holding time exceeded

Approved by: Claudette K. Carroll 15 Oct 21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

RL = Method Reporting Limit

The reporting limit was elevated for any analyte requiring a dilution as coded below:
@ = Due to sample matrix
! = Due to sample quantity
= Due to concentration of other analytes
+ = Due to internal standard response

CERTIFICATION: ND # ND-00016

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CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 10 Sep 21
Lab Number: 21-W3050
Work Order #: 82-2247A
Account #: 002800
Date Sampled: 24 Aug 21 11:05
Date Received: 25 Aug 21 9:28
Sampled By: MVTL Field Services

Project Name: MDU Heskett

PO #: 185968 OP

Sample Description: MW2-90

Temp at Receipt: 4.3C

Event and Year: Fall 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	6.90	units	NA	SM 4500 H+ B	24 Aug 21 11:05	JSM
pH	* 7.6	units	0.1	SM4500-H+-B-11	25 Aug 21 18:00	RAA
Temperature - Field	14.6	Degrees C	NA	SM 2550B	24 Aug 21 11:05	JSM
Conductivity - Field	8892	umhos/cm	1	EPA 120.1	24 Aug 21 11:05	JSM
Fluoride	1.02	mg/l	0.10	SM4500-F-C	25 Aug 21 18:00	RAA
Sulfate	6650	mg/l	5.00	ASTM D516-11	1 Sep 21 10:00	SD
Chloride	89.5	mg/l	2.0	SM4500-Cl-E-11	25 Aug 21 14:06	SD
Total Dissolved Solids	10400	mg/l	10	USGS I1750-85	27 Aug 21 16:00	RAA
Calcium - Total	505	mg/l	1.0	6010D	27 Aug 21 12:23	SZ
Boron - Total	< 0.5 @	mg/l	0.10	6010D	26 Aug 21 11:37	SZ

* Holding time exceeded

Approved by: Claudette K. Carroll CC 15 OCT 21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

RL = Method Reporting Limit

The reporting limit was elevated for any analyte requiring a dilution as coded below:
@ = Due to sample matrix # = Due to concentration of other analytes
! = Due to sample quantity + = Due to internal standard response

CERTIFICATION: ND # ND-00016

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CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 10 Sep 21
Lab Number: 21-W3051
Work Order #: 82-2247A
Account #: 002800
Date Sampled: 23 Aug 21 8:30
Date Received: 25 Aug 21 9:28
Sampled By: MVTL Field Services

Project Name: MDU Heskett

PO #: 185968 OP

Sample Description: MW13

Temp at Receipt: 4.3C

Event and Year: Fall 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	6.90	units	NA	SM 4500 H+ B	23 Aug 21 8:30	JSM
pH	* 7.5	units	0.1	SM4500-H+-B-11	25 Aug 21 18:00	RAA
Temperature - Field	12.0	Degrees C	NA	SM 2550B	23 Aug 21 8:30	JSM
Conductivity - Field	10341	umhos/cm	1	EPA 120.1	23 Aug 21 8:30	JSM
Fluoride	0.83	mg/l	0.10	SM4500-F-C	25 Aug 21 18:00	RAA
Sulfate	6820	mg/l	5.00	ASTM D516-11	1 Sep 21 10:00	SD
Chloride	76.0	mg/l	2.0	SM4500-Cl-E-11	25 Aug 21 14:06	SD
Total Dissolved Solids	10400	mg/l	10	USGS I1750-85	27 Aug 21 16:00	RAA
Calcium - Total	391	mg/l	1.0	6010D	27 Aug 21 12:23	SZ
Boron - Total	0.63	mg/l	0.10	6010D	26 Aug 21 11:37	SZ

* Holding time exceeded

Approved by: Claudette K. Carroll CC 15OCT21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

RL = Method Reporting Limit

The reporting limit was elevated for any analyte requiring a dilution as coded below:
@ = Due to sample matrix # = Due to concentration of other analytes
! = Due to sample quantity + = Due to internal standard response

CERTIFICATION: ND # ND-00016

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MEMBER ACIL

CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 10 Sep 21
Lab Number: 21-W3052
Work Order #: 82-2247A
Account #: 002800
Date Sampled: 24 Aug 21 10:00
Date Received: 25 Aug 21 9:28
Sampled By: MVTL Field Services

PO #: 185968 OP

Temp at Receipt: 4.3C

Project Name: MDU Heskett

Sample Description: MW33

Event and Year: Fall 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	6.42	units	NA	SM 4500 H+ B	24 Aug 21 10:00	JSM
pH	* 7.2	units	0.1	SM4500-H+-B-11	25 Aug 21 18:00	RAA
Temperature - Field	13.8	Degrees C	NA	SM 2550B	24 Aug 21 10:00	JSM
Conductivity - Field	5185	umhos/cm	1	EPA 120.1	24 Aug 21 10:00	JSM
Fluoride	0.19	mg/l	0.10	SM4500-F-C	25 Aug 21 18:00	RAA
Sulfate	3440	mg/l	5.00	ASTM D516-11	1 Sep 21 10:00	SD
Chloride	13.3	mg/l	2.0	SM4500-Cl-E-11	25 Aug 21 14:06	SD
Total Dissolved Solids	5310	mg/l	10	USGS I1750-85	27 Aug 21 16:00	RAA
Calcium - Total	467	mg/l	1.0	6010D	27 Aug 21 12:23	SZ
Boron - Total	< 0.5 @	mg/l	0.10	6010D	26 Aug 21 11:37	SZ

* Holding time exceeded

Approved by: Claudette K. Carroll CC 1500+01

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

RL = Method Reporting Limit

The reporting limit was elevated for any analyte requiring a dilution as coded below:
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! = Due to sample quantity + = Due to internal standard response

CERTIFICATION: ND # ND-00016

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CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 10 Sep 21
Lab Number: 21-W3053
Work Order #: 82-2247A
Account #: 002800
Date Sampled: 23 Aug 21 11:45
Date Received: 25 Aug 21 9:28
Sampled By: MVTL Field Services

Project Name: MDU Heskett

PO #: 185968 OP

Sample Description: MW70

Temp at Receipt: 4.3C

Event and Year: Fall 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	6.84	units	NA	SM 4500 H+ B	23 Aug 21 11:45	JSM
pH	* 7.4	units	0.1	SM4500-H+-B-11	25 Aug 21 18:00	RAA
Temperature - Field	13.5	Degrees C	NA	SM 2550B	23 Aug 21 11:45	JSM
Conductivity - Field	3712	umhos/cm	1	EPA 120.1	23 Aug 21 11:45	JSM
Fluoride	0.30	mg/l	0.10	SM4500-F-C	25 Aug 21 18:00	RAA
Sulfate	1960	mg/l	5.00	ASTM D516-11	1 Sep 21 10:00	SD
Chloride	56.3	mg/l	2.0	SM4500-Cl-E-11	25 Aug 21 14:06	SD
Total Dissolved Solids	3340	mg/l	10	USGS I1750-85	27 Aug 21 16:00	RAA
Calcium - Total	320	mg/l	1.0	6010D	27 Aug 21 12:23	SZ
Boron - Total	0.44	mg/l	0.10	6010D	26 Aug 21 11:37	SZ

* Holding time exceeded

Approved by: Claudette K. Carroll CC 150CT21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

RL = Method Reporting Limit

The reporting limit was elevated for any analyte requiring a dilution as coded below:
@ = Due to sample matrix
! = Due to sample quantity
= Due to concentration of other analytes
+ = Due to internal standard response

CERTIFICATION: ND # ND-00016

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CERTIFICATE of ANALYSIS - CCR

Todd Peterson
Montana-Dakota Utilities Co.
400 N 4th St
Bismarck ND 58501

Report Date: 10 Sep 21
Lab Number: 21-W3054
Work Order #: 82-2247A
Account #: 002800
Date Sampled: 25 Aug 21 7:42
Date Received: 25 Aug 21 9:28
Sampled By: MVTL Field Services

Project Name: MDU Heskett

PO #: 185968 OP

Sample Description: MW80R

Temp at Receipt: 4.3C

Event and Year: Fall 2021

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
pH - Field	6.92	units	NA	SM 4500 H+ B	25 Aug 21 7:42	JSM
pH	* 7.5	units	0.1	SM4500-H+-B-11	25 Aug 21 18:00	RAA
Temperature - Field	9.74	Degrees C	NA	SM 2550B	25 Aug 21 7:42	JSM
Conductivity - Field	5656	umhos/cm	1	EPA 120.1	25 Aug 21 7:42	JSM
Fluoride	0.23	mg/l	0.10	SM4500-F-C	25 Aug 21 18:00	RAA
Sulfate	3150	mg/l	5.00	ASTM D516-11	1 Sep 21 10:00	SD
Chloride	155	mg/l	2.0	SM4500-Cl-E-11	25 Aug 21 14:06	SD
Total Dissolved Solids	5610	mg/l	10	USGS I1750-85	27 Aug 21 16:00	RAA
Calcium - Total	340	mg/l	1.0	6010D	27 Aug 21 12:23	SZ
Boron - Total	< 0.5 @	mg/l	0.10	6010D	26 Aug 21 11:37	SZ

* Holding time exceeded

Approved by: Claudette K. Carroll CC 15OCT21

Claudette K. Carroll, Laboratory Manager, Bismarck, ND

RL = Method Reporting Limit

The reporting limit was elevated for any analyte requiring a dilution as coded below:
@ = Due to sample matrix # = Due to concentration of other analytes
! = Due to sample quantity + = Due to internal standard response

CERTIFICATION: ND # ND-00016

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Quality Control Report

Lab IDs: 21-W3040 to 21-W3054 **Project:** MDU Heskett **Work Order:** 202182-2247A

Analyte	LCS Spike Amt	LCS Rec %	LCS % Rec Limits	Matrix Spike Amt	Matrix Spike ID	Matrix Spike Orig Result	Matrix Spike Result	Matrix Spike Rec %	Matrix Spike % Rec Limits	MSD/ Dup Orig Result	MSD/ Dup Result	MSD Rec %	MSD/ Dup RPD	MSD/ Dup RPD Limit (<)	Known Rec (%)	Known % Rec Limits	Method Blank
Boron - Total mg/l	0.40	105	80-120	2.00	21-W3048	0.86	2.58	86	75-125	2.58	2.69	92	4.2	20	-	-	< 0.1
	0.40	100	80-120	0.400	21-W3053	0.44	0.78	85	75-125	0.78	0.79	88	1.3	20	-	-	< 0.1
															-	-	< 0.1
															-	-	< 0.1
Calcium - Total mg/l	100	104	80-120	100	21W3037q	2.6	98.9	96	75-125	98.9	97.9	95	1.0	20	-	-	< 1
	100	105	80-120	100	21W3069q	64.5	156	92	75-125	156	154	90	1.3	20	-	-	< 1
															-	-	< 1
															-	-	< 1
Chloride mg/l	30.0	95	80-120	30.0	21-W3030	< 2	28.3	94	80-120	28.3	28.7	96	1.4	20	-	-	< 2
	30.0	95	80-120	30.0	21-W3049	< 2	28.5	95	80-120	28.5	28.6	95	0.4	20	-	-	< 2
	30.0	95	80-120	30.0	21-W2964	31.1	62.3	104	80-120	62.3	62.4	104	0.2	20	-	-	< 2
	30.0	95	80-120												-	-	< 2
Fluoride mg/l	0.50	100	90-110	0.500	21-W3040	0.81	1.26	90	80-120	1.26	1.27	92	0.8	20	-	-	< 0.1
	0.50	100	90-110	0.500	21-W3053	0.30	0.81	102	80-120	0.81	0.90	120	10.5	20	-	-	< 0.1
	0.50	100	90-110	0.500	21-W3030	< 0.1	0.50	100	80-120	0.50	0.50	100	0.0	20	-	-	< 0.1
	0.50	100	90-110	0.500	21-W3037	2.16	2.68	104	80-120	2.68	2.72	112	1.5	20	-	-	< 0.1
pH units	-	-	-	-	-	-	-	-	-	8.6	8.6	-	0.0	20	-	-	-
	-	-	-	-	-	-	-	-	-	7.6	7.4	-	2.7	20	-	-	-
	-	-	-	-	-	-	-	-	-	5.7	5.8	-	1.7	20	-	-	-
	-	-	-	-	-	-	-	-	-	8.2	8.5	-	3.6	20	-	-	-
Sulfate mg/l	100	106	80-120	100	21-W3041	< 5	104	104	80-120	104	106	106	1.9	20	-	-	< 5
	100	104	80-120	100	21-W3049	< 5	105	105	80-120	105	104	104	1.0	20	-	-	< 5
Total Dissolved Solids mg/l	-	-	-	-	-	-	-	-	-	1640	1670	-	1.8	20	-	-	< 10
	-	-	-	-	-	-	-	-	-	2490	2480	-	0.4	20	-	-	< 10
	-	-	-	-	-	-	-	-	-	1740	1740	-	0.0	20	-	-	

Samples were received in good condition on 25 Aug 2021 at 0928.
Temperature upon receipt at the Bismarck laboratory was 4.3°C.
All samples were properly preserved unless noted here and/or flagged on the individual analytical laboratory report.
With the exception of pH, all holding times were met.
Approved methodology was followed for all sample analyses.
All acceptance criteria were met for calibration, method blanks, laboratory control samples, laboratory fortified matrix/duplicates unless noted here:

- For some analytes, the reported results were elevated due to additional dilutions required to minimize the effects of sample matrix.

Approved by: C. Carlson
15OCT21

MVTL

2616 E. Broadway Ave, Bismarck, ND

Phone: (701) 258-9720

Field Datasheet

Groundwater Assessment

Company:	**MDU Heskett**
Event:	**Fall 2021**
Sample ID:	2-90
Sampling Personal:	

Weather Conditions: Temp: 70 °F Wind: N @ 5-10 Precip: **Sunny / ~~Partly Cloudy~~ / Cloudy**

WELL INFORMATION

Well Locked?	YES	(NO)	
Well Labeled?	(YES)	NO	
Casing Strait?	(YES)	NO	
Grout Seal Intact?	YES	NO	~~Not Visible~~
Repairs Necessary?			

Casing Diameter:	2"	
Water Level Before Purge:	BP	ft
Total Depth of Well:	—	ft
Well Volume:	—	liters
Depth to Top of Pump:	22.40	ft
Water Level After Sample:	BP	ft
Measurement Method:	**Electric Water Level Indicator**	

SAMPLING INFORMATION

Purging Method:	**Bladder**	
Sampling Method:	**Bladder**	
Dedicated Equipment?	(~~YES~~)	NO

Duplicate Sample?	YES	(~~NO~~)
Duplicate Sample ID:	—	

Control Settings:	
Purge: 5	Sec.
Recover: 55	Sec.
PSI: 20	

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	mL Removed	Appearance or Comment Clarity, Color, Odor, Ect.
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		clear, slightly turbid, turbid
24 Aug 21	1045	**Start of Well Purge**									
	1050	14.09	8702	6.95	5.90	237.7	5.51	BP	100.0	500.0	Clear
	1055	14.16	8827	6.92	5.14	249.9	3.33	BP	100.0	500.0	Clear
	1100	14.27	8839	6.91	5.18	256.5	2.64	BP	100.0	500.0	Clear
	1105	14.63	8892	6.90	5.17	260.4	2.30	BP	100.0	500.0	Clear

Well Stabilized? (YES) NO

Total Volume Purged: 2000.0 mL

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment Clarity, Color, Odor, Ect.
24 Aug 21	1105	14.63	8892	6.90			2.30				Clear

Comments:	

BP= water level below top of pump

MVTL
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Field Datasheet

Groundwater Assessment

Company:	**MDU Heskett**
Event:	**Fall 2021**
Sample ID:	3-90
Sampling Personal:	Jerry Meyer

Weather Conditions: Temp: 70 °F Wind: N@5-10 Precip: **Sunny / ~~Partly Cloudy~~ / Cloudy**

WELL INFORMATION

Well Locked?	YES	~~NO~~	
Well Labeled?	~~YES~~	NO	
Casing Strait?	~~YES~~	NO	
Grout Seal Intact?	YES	NO	~~Not Visible~~
Repairs Necessary?			

Casing Diameter:	2"	
Water Level Before Purge:	BP	ft
Total Depth of Well:	—	ft
Well Volume:	—	liters
Depth to Top of Pump:	20.20	ft
Water Level After Sample:	BP	ft
Measurement Method:	**Electric Water Level Indicator**	

SAMPLING INFORMATION

Purging Method:	**Bladder**	
Sampling Method:	**Bladder**	
Dedicated Equipment?	~~YES~~	NO

Duplicate Sample?	YES	~~NO~~
Duplicate Sample ID:	—	

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

Control Settings:	
Purge: 5	Sec.
Recover: 50	Sec.
PSI: 20	

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	mL Removed	Appearance or Comment
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		clear, slightly turbid, turbid
24 Aug 21	1034	**Start of Well Purge**									
	~~1039~~							BP	100.0	~~500.0~~	
	~~1049~~							BP	100.0	~~1000.0~~	

Well Stabilized? **YES** **NO** Total Volume Purged: _____ mL

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment
											Clarity, Color, Odor, Ect.
24 Aug 21	1034										

Comments: Attempted to purge well. Insufficient volume of water to purge & sample well

BP= Below Top of pump

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Field Datasheet

Groundwater Assessment

Company:	**MDU Heskett**
Event:	**Fall 2021**
Sample ID:	13
Sampling Personal:	Jay Mey

Weather Conditions: Temp: 60 °F Wind: NW @ 5-10 Precip: **Sunny / ~~Partly Cloudy~~ / Cloudy**

WELL INFORMATION

Well Locked?	YES	~~NO~~	
Well Labeled?	~~YES~~	NO	
Casing Strait?	~~YES~~	NO	
Grout Seal Intact?	~~YES~~	NO	Not Visible
Repairs Necessary?			

Casing Diameter:	2"	
Water Level Before Purge:	31.35	ft
Total Depth of Well:	—	ft
Well Volume:	—	liters
Depth to Top of Pump:	—	ft
Water Level After Sample:	34.00	ft
Measurement Method:	Electric Water Level Indicator	

SAMPLING INFORMATION

Purging Method:	Bladder	
Sampling Method:	Bladder	
Dedicated Equipment?	~~YES~~	NO

Duplicate Sample?	~~YES~~	NO
Duplicate Sample ID:	Dup1	

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

Control Settings:	
Purge: 3	Sec.
Recover: 25	Sec.
PSI: 20	

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	mL Removed	Appearance or Comment Clarity, Color, Odor, Ect.
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		clear, slightly turbid, turbid
	0720	Start of Well Purge									
23 Aug 21	0725	10.54	10258	6.97	6.25	239.5	11.42	33.35	100.0	500.0	Clear
	0755	11.26	10380	6.89	5.59	292.6	4.31	33.67	100.0	3000.0	Clear
	0815	11.92	10359	6.87	6.29	312.2	1.87	33.92	100.0	2000.0	Clear
	0820	11.84	10360	6.86	5.32	308.6	1.70	33.94	100.0	500.0	Clear
	0825	11.87	10351	6.87	5.27	311.2	1.49	33.95	100.0	500.0	Clear
	0830	12.04	10341	6.90	5.22	312.9	1.52	33.97	100.0	500.0	Clear

Well Stabilized? ~~YES~~ NO Total Volume Purged: 7000.0 mL

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment Clarity, Color, Odor, Ect.
23 Aug 21	0830	12.04	10341	6.90			1.52				Clear

Comments:	

MVTL

2616 E. Broadway Ave, Bismarck, ND

Phone: (701) 258-9720

Field Datasheet

Groundwater Assessment

Company:	**MDU Heskett**
Event:	**Fall 2021**
Sample ID:	33
Sampling Personal:	JM

Weather Conditions: Temp: 70 °F Wind: N @ 5-10 Precip: **Sunny / ~~Partly Cloudy~~ / Cloudy**

WELL INFORMATION

Well Locked?	YES	(NO)	
Well Labeled?	(YES)	NO	
Casing Strait?	(YES)	NO	
Grout Seal Intact?	YES	NO	(Not Visible)
Repairs Necessary?			
Casing Diameter:	2"		
Water Level Before Purge:	43.10	ft	
Total Depth of Well:	—	ft	
Well Volume:	—	liters	
Depth to Top of Pump:	—	ft	
Water Level After Sample:	43.89	ft	
Measurement Method:	Electric Water Level Indicator		

SAMPLING INFORMATION

Purging Method:	Bladder	
Sampling Method:	Bladder	
Dedicated Equipment?	(YES)	NO

Duplicate Sample?	YES	(NO)
Duplicate Sample ID:	—	

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

Control Settings:	
Purge: 5	Sec.
Recover: 55	Sec.
PSI: 30	

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	mL Removed	Appearance or Comment Clarity, Color, Odor, Ect.
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		clear, slightly turbid, turbid
24 Aug 21	0850	**Start of Well Purge**									
	0855	12.74	5050	7.23	7.61	96.0	10.46	43.40	100.0	500.0	Clear
	0925	12.69	5230	6.54	1.09	40.9	15.49	43.90	100.0	3000.0	Clear
	0945	13.95	5228	6.41	1.25	37.0	4.93	43.83	100.0	2000.0	Clear
	0950	13.87	5205	6.41	1.20	32.7	4.87	43.85	100.0	500.0	Clear
	0955	13.62	5178	6.42	1.27	35.6	4.65	43.83	100.0	500.0	Clear
	1000	13.75	5185	6.42	1.31	35.7	4.71	43.81	100.0	500.0	Clear

Well Stabilized? (YES) NO

Total Volume Purged: 7000.0 mL

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment Clarity, Color, Odor, Ect.
24 Aug 21	1000	13.75	5185	6.42			4.71				Clear

Comments:	

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Field Datasheet

Groundwater Assessment

Company:	**MDU Heskett**
Event:	**Fall 2021**
Sample ID:	70
Sampling Personal:	Jerry Myer

Weather Conditions: Temp: 60°F Wind: N @ 5-10 Precip: **Sunny / Partly Cloudy / Cloudy**

WELL INFORMATION

Well Locked?	YES	NO	
Well Labeled?	~~YES~~	NO	
Casing Strait?	YES	NO	
Grout Seal Intact?	YES	NO	Not Visible
Repairs Necessary?			

Casing Diameter:	2"	
Water Level Before Purge:	23.09	ft
Total Depth of Well:	—	ft
Well Volume:	—	liters
Depth to Top of Pump:	—	ft
Water Level After Sample:	25.75	ft
Measurement Method:	Electric Water Level Indicator	

SAMPLING INFORMATION

Purging Method:	Bladder	
Sampling Method:	Bladder	
Dedicated Equipment?	YES	NO

Duplicate Sample?	YES	NO
Duplicate Sample ID:	—	

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

Control Settings:	
Purge: 3	Sec.
Recover: 27	Sec.
PSI: 20	

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	mL Removed	Appearance or Comment Clarity, Color, Odor, Ect.
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		clear, slightly turbid, turbid
	1055	Start of Well Purge									
	1100	12.93	3856	6.91	0.88	75.3	0.85	23.80	100.0	500.0	Clear
23 Aug 21	1130	12.56	3742	6.84	0.76	160.6	1.80	25.05	100.0	3000.0	Clear
	1135	13.09	3715	6.83	0.86	163.6	0.22	25.28	100.0	500.0	Clear
	1140	13.33	3717	6.84	0.97	159.7	0.51	25.37	100.0	500.0	Clear
	1145	13.47	3712	6.84	1.05	155.4	0.84	25.41	100.0	500.0	Clear

Well Stabilized? YES NO

Total Volume Purged: 5000.0 mL

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment Clarity, Color, Odor, Ect.
23 Aug 21	1145	13.47	3712	6.84			0.84				Clear

Comments:	

MVTL
2616 E. Broadway Ave, Bismarck, ND
Phone: (701) 258-9720

Field Datasheet

Groundwater Assessment

Company:	**MDU Heskett**
Event:	**Fall 2021**
Sample ID:	BOR
Sampling Personal:	JM

Weather Conditions: Temp: 50°F Wind: N @ 5-10 Precip: **Sunny / Partly Cloudy / Cloudy**

WELL INFORMATION

Well Locked?	YES	NO	
Well Labeled?	YES	NO	
Casing Strait?	YES	NO	
Grout Seal Intact?	YES	NO	Not Visible
Repairs Necessary?			

Casing Diameter:	2"	
Water Level Before Purge:	15.09	ft
Total Depth of Well:	—	ft
Well Volume:	—	liters
Depth to Top of Pump:	—	ft
Water Level After Sample:	15.25	ft
Measurement Method:	Electric Water Level Indicator	

SAMPLING INFORMATION

Purging Method:	Bladder	
Sampling Method:	Bladder	
Dedicated Equipment?	YES	NO

Duplicate Sample?	YES	NO
Duplicate Sample ID:	—	

Bottle List:
1 Liter Raw
500mL Nitric
500mL Nitric (filtered)
250mL Sulfuric

Control Settings:		
Purge:	5	Sec.
Recover:	55	Sec.
PSI:	20	

FIELD READINGS

Stabilization Parameters (3 Consecutive)		Temp. (°C)	Spec. Cond.	pH	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level	Pumping Rate	mL Removed	Appearance or Comment Clarity, Color, Odor, Ect.
Purge Date	**Time**	±0.5°	±5%	±0.1	±10%	±10		(ft)	mL/Min		clear, slightly turbid, turbid
25Aug21	0652	Start of Well Purge									
	0657	9.19	5643	6.97	1.40	215.4	4.59	15.25	100.0	500	Clear
	0727	9.42	5663	6.93	1.38	222.0	0.99	15.25	100.0	3000	clear
	0732	9.62	5651	6.92	1.08	222.3	1.22	15.26	100.0	500	clear
	0737	9.83	5646	6.92	1.13	220.2	1.35	15.26	100.0	500	clear
	0742	9.74	5656	6.92	1.17	220.1	1.45	15.26	100.0	500	clear

Well Stabilized? YES NO Total Volume Purged: 5000 mL

Sample Date	Time	Temp. (°C)	Spec. Cond.	pH			Turbidity (NTU)				Appearance or Comment Clarity, Color, Odor, Ect.
25Aug21	0742	9.74	5656	6.92			1.45				Clear

Comments:	

MVTL
2616 E. Broadway Ave
Bismarck, ND 58501
(701) 258-9720

Chain of Custody Record

Project Name:	Event:	Work Order Number:
MDU Heskett	Fall 2021	82-2247A

Report To:	Montana-Dakota Utilities	CC:	Collected By:
Attn:	Todd Peterson		
Address:	400 North 4th St. Bismarck, ND 58501		
Phone:	701-425-2427		
Email:	todd.peterson@mdu.com		

Lab Number	Sample ID	Date	Time	Sample Type	1 Liter Raw	500 mL Nitric	500 mL Nitric (filtered)	250 mL Sulfuric	1 Liter Nitric	Temp (°C)	Spec. Cond.	pH	Turbidity (NTU)	Analysis Required
~~W3048~~ W3040 [X]	~~Dup2~~ DUP1 [X]	~~24 Aug 21~~ 23 Aug 21 [X]	NA	GW	X	X	X	X		NA	NA	NA	NA	MDU List AA & MDU List C
W3049	FB2	25 Aug 21	NA	GW	X	X	X	X		NA	NA	NA	NA	
W3050	MW2-90	24 Aug 21	1105	GW	X	X	X	X		14.63	8892	6.90	2.30	
—	MW3-90	24 Aug 21	1034	GW	~~X~~	~~X~~	~~X~~	~~X~~	*	insufficient volume				
W3051	MW13	23 Aug 21	0830	GW	X	X	X	X		12.04	10341	6.90	1.52	
W3052	MW33	24 Aug 21	1000	GW	X	X	X	X		13.75	5185	6.42	4.71	
W3053	MW70	23 Aug 21	1145	GW	X	X	X	X		13.47	3712	6.84	0.64	
W3054	MW80R	25 Aug 21	0742	GW	X	X	X	X		9.74	5656	6.92	1.45	

Comments: * 25 Aug 21 ↓ [X] = (A) CC INJCTZ

Relinquished By		Sample Condition		Received By		
Name	Date/Time	Location	Temp (°C)	Name		Date/Time
1	25 Aug 21 0928	~~Log In~~ Walk In #2	4.3 TM562 / ~~TM805~~			25 Aug 21 0928
2						

Appendix B

Alternative Source Demonstration Reports

Alternative Source Demonstration: September 2020 Event

R.M. Heskett Station

Prepared for
Montana-Dakota Utilities Co.

March 2021

Alternative Source Demonstration: September 2020 Event

R.M. Heskett Station

Prepared for
Montana-Dakota Utilities Co.

March 2021

4300 MarketPointe Drive, Suite 200
Minneapolis, MN 55435
952.832.2600
www.barr.com

Alternative Source Demonstration
September 2020 Event

March 2021

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Certifications

I hereby certify that I, or my agent, have examined this written demonstration and attest that this Coal Combustion Residuals Facility Alternative Source Demonstration (ASD) is accurate and has been prepared in accordance with good engineering practice, including consideration of applicable industry standards and the requirements of 40 CFR §257.94. I further certify that this report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the state of North Dakota.

Revision	Date	Summary of Revisions
0	03-31-2021	March 2021 Alternative Source Demonstration

Thomas J. Radue

1.0 Introduction

Montana-Dakota Utilities Co. (MDU) owns and operates R.M. Heskett Station (Site), a coal-fired generating station and a gas-fired turbine located in Mandan, Morton County, North Dakota (Figure 1). One CCR (coal combustion residual) unit, as defined by 40 CFR 257.53, is located on the property. The CCR unit contains coal combustion by-products, asbestos wastes generated from construction activity associated with MDU-owned facilities, and ash derived from burning tire-derived fuel (TDF) at the facility.

The CCR Rule (US EPA, 2015) §257.94(e)(2) allows for an alternative source demonstration (ASD) in the event of an identified statistically significant increase (SSI) in a water quality parameter in a downgradient monitoring well over background levels:

The owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The owner or operator must complete the written demonstration within 90 days of detecting a statistically significant increase over background levels to include obtaining a certification from a qualified professional engineer verifying the accuracy of the information in the report.

The purpose of this work is to evaluate the data collected as part of the September 2020 monitoring event, along with historical data, to demonstrate if the potential SSIs are the results of a "source other than the CCR unit" or due to natural variation in groundwater quality, an error in sampling, analysis, or statistical evaluation.

2.0 September 2020 SSIs

Sampling for the second detection monitoring event in 2020 was conducted September 14-15, 2020. Four potential SSIs over background were identified: sulfate and total dissolved solids (TDS) at MW-104, chloride at MW-105, and fluoride at MW2-90 (see time series plots in Appendix A and prediction limit plots in Appendix B).

Evaluations were undertaken to review potential alternative sources for the SSIs. These evaluations included comparing leaching tests of on-site CCR materials, leachate collected in the Evaporation Pond (non-CCR unit), regional (background) groundwater quality data, and groundwater quality collected at the site prior to construction of the CCR unit.

Several characteristics of the CCR unit site geology, groundwater monitoring well locations, and historic groundwater quality data prompted consideration of potential alternative sources for the potential SSIs, including elevated water quality parameters in pre-landfill groundwater monitoring data, site-specific geologic conditions, and/or leakage from the Evaporation Pond (non-CCR unit).

A successful demonstration of alternative source(s) for the potential SSIs are discussed in Section 3.0.

2.1 September Sampling Event

Methods used to evaluate potential alternative sources as the basis for water quality parameter concentrations over background from the September 2020 detection monitoring event are discussed below. Concentrations for potential SSIs observed in September 2020 are less than those observed during the prior four detection monitoring events (Table 1).

Table 1. Detection Monitoring Results for Potential SSI Well-Parameter Pairs

Well	Parameter	Interwell Prediction Limit (mg/L)	Detection Monitoring Results (mg/L)					
			April 2018	October 2018	April 2019	September 2019	April 2020	September 2020
MW-105	Chloride	271	**333**	**384**	**282**	**290**	**278**	**339**
MW-104	Sulfate	7,300	**10,700**	**11,000**	**11,100**	**11,300**	**10,300**	**10,700**
MW-104	TDS	10,400	**17,400**	**18,000**	**17,700**	**17,200**	**16,500**	**17,900**
MW2-90	Fluoride	0.98	**1.03**	**1.00**	**1.02**	**1.03**	0.98	**1.01**

Bolded values indicate concentrations exceed the associated interwell predication limits.

Trend analysis results indicate chloride at MW-105 has a statistically significant decreasing trend (95% confidence level) whereas TDS at MW-104 has a statistically significant increasing trend (95% confidence level).

2.2 Verification Sampling

No verification sampling was conducted on the potential SSIs.

3.0 Alternative Source Demonstration

Successful demonstrations of alternative sources have previously been documented for the four potential SSIs. The associated ASD Reports (Barr, 2018a; Barr, 2018b; Barr, 2019a; Barr, 2019b; Barr, 2020a; Barr, 2020b) documented that each of the SSIs could be explained by natural groundwater quality variability based on concentrations that were either present at the Site before the landfill was constructed, consistent with regional groundwater quality data, and/or associated with a release from the Evaporation Pond (non-CCR unit).

The purpose of this ASD Report is to validate the results of prior findings with the September 2020 data. For each potential SSI, three hypotheses regarding the potential source of the SSI are assessed: 1) a release of leachate from the CCR unit is the source of one or more of the potential SSIs; 2) natural variations of pre-landfill or regional groundwater quality is the source of one or more of the potential SSIs; or 3) a release of leachate from the Evaporation Pond (non-CCR unit) is the source of one or more of the potential SSIs.

3.1 Source Hypothesis #1: CCR Unit Release

To accept the hypothesis that a release of leachate from the CCR unit is the source of one or more of the potential SSIs, it would be assumed that groundwater chemistry at one or more of the potentially impacted wells (MW2-90, MW-104, and/or MW-105) would be geochemically similar to impacted water from the CCR unit represented by leach tests results. However, if they are geochemically dissimilar, this indicates that a source "other than the CCR unit" may be responsible for the potential SSI. Therefore, major ion chemistry from the CCR monitoring locations (upgradient and downgradient) was compared to CCR Synthetic Precipitation Leaching Procedure (SPLP; EPA Method 1312) data collected July 2011 (Appendix C).

To test this hypothesis, piper diagrams were used to visually compare the CCR SPLP results (Appendix C) and the measured groundwater quality at the Site (Figure 2). Piper diagrams are plots of major ion chemistry of water samples (calcium, magnesium, potassium, sodium, chloride, sulfate, and alkalinity) that are used to differentiate between water types and to identify potential mixing of water types. This method is a means to identify or "fingerprint" water samples by their common characteristics (major ions) to assess which types of water are similar or dissimilar to potential source water types (Helsel and Hirsch, 2002). On the piper diagram depicted in Figure 2, downgradient well compositions are shown as circular points, CCR SPLP compositions as red triangles, and the range of upgradient compositions as a blue polygon.

Downgradient water quality (including the potential SSI parameter-well pairs) is characterized as a Mg-SO_4 type water, whereas the ash SPLP results are Na-SO_4 type water. The major difference observed between the downgradient water quality and the SPLP results is the dominant cation concentration (magnesium vs. sodium). Because water quality data from SSI well-parameter pairs are clustered with data from that of the upgradient wells, which are Na-Mg-SO_4 to Mg-SO_4 type water, rather than near the SPLP results, it indicates that the water chemistry at those locations are more like upgradient groundwater than

a potential release from the CCR unit. **Therefore, we reject the hypothesis that the CCR unit is the source of the sulfate and TDS observed at MW-104, chloride at MW-105, and fluoride at MW2-90.**

3.2 Source Hypothesis #2: Natural Variations of Pre-Landfill or Regional Groundwater Quality

As Source Hypothesis #1 (CCR Unit Release) was rejected as a potential source of the SSIs, natural variations of pre-landfill conditions and/or regional groundwater quality were evaluated for each of the potential SSIs. The second hypothesis evaluated is that concentrations of sulfate and TDS at MW-104 and chloride at MW-105 are consistent with historical (pre-landfill) or regional (background) groundwater data. To test this hypothesis, results of September 2020 detection monitoring event were compared to pre-landfill data and/or regional groundwater quality data from the Cannonball Formation and associated units to determine if natural variation is a potential alternative source for the SSIs.

3.2.1 Chloride at MW-105

Results from groundwater samples collected in 1986 were included in the 1989 Special Use Disposal Site Permit Application (Permit Application; MDU, 1989). The 1986 samples were collected prior to construction of the CCR unit; an aerial photograph from March 30, 1988 shows the area of the CCR unit, which appears undisturbed (Appendix D).

Pre-landfill chloride concentrations collected from groundwater at the Site were measured as high as 558 mg/L (Well 44, 1986), indicating that high chloride concentrations pre-date construction of the CCR unit. Additionally, the North Dakota State Water Commission conducted a groundwater study in Morton County (Ackerman, 1980); 45 wells screened in the Cannonball and Ludlow Formations were sampled for various parameters including chloride. Chloride concentrations ranged from 0 to 500 mg/L (37% of which had concentrations greater than 250 mg/L).

Historic data shows that concentrations of chloride in groundwater at the Site measured prior to the construction of the CCR unit (558 mg/L) as well as regional groundwater quality data (0 to 500 mg/L) are consistent with and/or higher than chloride measured at MW-105 in September 2020 (329 mg/L). This supports the hypothesis that the SSI for chloride at MW-105 is due to a "source other than the CCR unit." **Therefore, we accept the hypothesis that chloride concentrations observed at MW-105 are consistent with regional (background) groundwater data.**

3.2.2 Fluoride at MW2-90

Source Hypothesis #2 was tested by comparing fluoride concentrations collected as part of several regional groundwater quality studies on the Cannonball Formation and associated units. A summary of the range of fluoride concentrations in the Cannonball Formation and associated units are included in the table below.

Table 3. Fluoride Concentrations in Morton County, North Dakota

Reference	Fluoride Conc. Range	Formation/Units	Data Source Location
Ackerman, D.J., 1980. Ground-Water Resources of Morton County, North Dakota. North Dakota Geological Survey Bulletin 72, Part III. 51 p.	0.0 to 4.0 mg/L	Cannonball and Ludlow formations, undifferentiated	Morton County
Crosby, O.A. and Klausing, R.L., 1984. Hydrology of Area 47, Northern Great Plains and Rocky Mountain Coal Provinces, North Dakota, South Dakota, and Montana. USGS Water-Resources Investigations Open-File Report 83-221, 93 p.	0.1 to 6.3 mg/L	Entire Fort Union Formation (includes Cannonball Formation)	Morton County

The Ackerman study provides summary statistics for the fluoride concentrations observed in Morton County. Forty-six samples were analyzed for fluoride; of those, 20 (or 43%) had concentrations greater than 1.3 mg/L (Ackerman, 1980). The fluoride concentration observed at MW-2-90 in September 2020 (1.01 mg/L) is within the range of values consistent with naturally-occurring concentrations of fluoride associated with the Cannonball Formation in Morton County. **Therefore, we accept the hypothesis that fluoride concentrations observed at MW-2-90 are consistent with regional (background) groundwater data.**

3.2.3 Sulfate and TDS at MW-104

Analyses of groundwater samples collected prior to construction of the CCR unit included in the Permit Application notes that high sulfate and TDS was observed at the Site. Maximum sulfate and TDS concentrations reported in 1986 (pre-landfill) were 11,632 mg/L and 14,917 mg/L, respectively, in Well 60 (approximately 700 feet southwest of MW-104), with similar concentrations observed two years later. Sulfate concentrations reported in September 2020 at MW-104 (10,700 mg/L) are within range of historically observed concentrations (Figure 3), but TDS concentrations (17,900 mg/L) are somewhat higher than historically observed (Figure 4). Figures 3 and 4 show the range of sulfate and TDS concentrations, respectively, across the Site, including recent and historical monitoring well data.

The mineralogy of the underlying Fort Union Formation may yield an explanation for the elevated sulfate concentrations (which leads to elevated TDS concentrations). The dominant lithology observed at the Site is unconsolidated silt in a clay matrix with interspersed fine to medium-grained sand (10% to 30%). Small gypsum crystals are documented discontinuously throughout the upper 30 feet of the surface materials, which have been presumed to be the result of diagenetic processes which occur above the water table during alternating wetting and drying cycles (Groenewold et al., 1983). Gypsum is a hydrated calcium sulfate mineral that can be a source of high sulfate concentrations in groundwater.

The boring log for MW-104 (Appendix E) notes gypsum present throughout the upper layer of the screened interval. Boring logs for other CCR wells and pre-landfill wells note gypsum occurrences across the Site (Appendix E). The water level and screened interval in MW-104 are within the gypsum-bearing unit. In other wells with lower sulfate and TDS concentrations, the water levels and/or screened units are

below the documented gypsum occurrences. As groundwater fluctuates and surface water infiltration occurs, periodic dissolution of gypsum into the water column may occur, resulting in elevated sulfate concentrations (and therefore elevated TDS, too).

Based on presence of gypsum in native subsurface deposits and documentation of elevated sulfate and TDS in pre-landfill groundwater, the hypothesis that the SSI for sulfate and TDS at MW-104 may be due to natural conditions (a "source other than the CCR unit") is possible. However, a statistically significant increasing trend for TDS at MW-104 was observed. Natural/background groundwater can be affected by seasonality and/or site-wide aquifer changes, resulting in trending data; two other monitoring wells at the site have statistically significant increasing trends at the site: upgradient well MW-13 and downgradient well MW2-90 (conversely, MW-13 has a long-term (late 1980s to present) statistically significant decreasing trend). Seasonality was not detected in TDS or sulfate at MW-104. **Sulfate and TDS concentrations at MW-104 may be due to natural conditions, however additional source considerations were evaluated.**

3.3 Source Hypothesis #3: Evaporation Pond Release

Two conditions are necessary in order to accept the hypothesis that a release of Evaporation Pond water is the source of one or more of the potential SSIs: (1) mechanism of release (such as an issue with Evaporation Pond liner integrity) and (2) geochemically similar groundwater chemistry at one or more of the potentially impacted wells with water from the Evaporation Pond. Based on proximity, only the SSIs observed at MW-104 (TDS and sulfate) are being evaluated for this potential source.

3.3.1 TDS and Sulfate at MW-104

A statistically significant increasing trend in TDS was observed at MW-104 following the September 2020 detection monitoring event. No other statistically significant trends were observed for other Appendix III parameters at this location. Past ASD Reports (Barr, 2019b; Barr, 2020a; Barr, 2020b) attributed elevated sulfate and TDS concentrations at MW-104 to either natural conditions or a release from the Evaporation Pond. MW-104 is located between the CCR unit and the Evaporation Pond (a non-CCR unit). The Evaporation Pond was constructed to collect surface water run-off from the Site as well as leachate from the CCR Unit. Due to the relative proximity of MW-104 to the Evaporation Pond, an evaluation was conducted to assess the Evaporation Pond liner integrity, potential impacts to downgradient wells, and determine the geochemical feasibility of Evaporation Pond water contributing to the conditions observed at MW-104.

Liner Integrity Evaluation

In the 2010 Annual Report for the Special Waste Disposal Permit (SP-087), it was noted that erosion was encountered at the Evaporation Pond. More specifically, "cuts in the banks of the pond ranged from 8 to 24-inches. Erosion was caused from storm water running into the evaporation pond from closed Slots and the haul road" (MDU, 2011). No repairs were made at that time due to standing water in the pond. Similar erosional features were noted in the 2011 and 2012 Annual Reports, citing erosion cuts of 8 to 48-inches (MDU, 2012 and MDU, 2013). These erosion cuts were repaired in 2013 during the construction of Slot 10. Additionally, the 2013 Annual Report stated that "the west wall of the evaporation pond was raised and

graded to reroute storm water that accumulates outside of the ash disposal area from the cover of Phase I ash disposal site away from the pond during rain events" (MDU, 2014).

These reports did not specify if the erosional cuts were 8 to 48-inches wide or 8 to 48-inches deep. Based on the Phase I Development "as-constructed" Plan Sheets (January and November 1990), the Evaporation Pond was built with a 3-foot-thick compacted clay liner (MDU, 1989 Exhibit 6-B). If the erosional cuts were up to 48-inches deep, then the cuts would extend through the entirety of the liner thickness, creating a conduit for Evaporation Pond water to enter the groundwater. Additionally, no details were provided on the materials used for repairing the Evaporation Pond (i.e. if the liner was impacted, were the erosion cuts filled in with a comparable clay liner material).

Additionally, the integrity of the Evaporation Pond liner may have been compromised due to cation exchange. Time series plots of groundwater quality at nearby well MW1-90 (Appendix F) show an increase in sodium; this increase is most apparent at MW1-90 between 2012 and 2019. The Evaporation Pond liner may be composed of a clay with sodium as its main interlayer cation (e.g., sodium-montmorillonite and/or sodium-bentonite, which are common in the area (Groenewold et al., 1983)), and cation exchange processes can occur between the sodium in the clay and positively charged cations concentrated in the evaporation pond water (calcium, magnesium, potassium, and aluminum), increasing the concentration of dissolved sodium as it is released from the clay structure. Over time this exchange may decrease swelling potential and increase hydraulic conductivity of the clay constituting the pond liner, resulting in increased leakage of Evaporation Pond water.

Downgradient Impacts

The base of the Evaporation Pond sits at approximately 1675 feet above MSL whereas the most recent groundwater elevations in MW-104 and MW1-90 were measured at roughly 1670.92 feet above MSL and 1663.63 feet above MSL, respectively. Therefore, any water leaking from the Evaporation Pond would report radially downward into the groundwater, toward both MW-104 and MW1-90, reaching both wells downgradient of the Pond.

As MW-104 was installed on August 20, 2015, it is not possible to determine if the erosional cuts observed in the early 2010s impacted the water quality at this location. However, data has consistently been collected from nearby well MW1-90, also downgradient of the Evaporation Pond. As seen in the time series plots (Appendix F; 1990-2020), in approximately 2010 concentrations of chloride, sulfate, TDS, magnesium, sodium, and specific conductance at MW1-90 began increasing more rapidly. To a lesser extent, changes in concentrations were observed around this same time for potassium, nitrogen, and total alkalinity. This timing corresponds to when the erosional cuts at the Evaporation Pond were first observed in the Annual Monitoring Reports. The increasing trends have since continued, despite reports of the erosional cuts being repaired in 2013, except for chloride, which has since leveled off and is now decreasing.

Geochemical Feasibility

A simple mixing model was developed in April 2019 (Barr, 2019b) to determine the potential of producing a similar water quality observed at MW-104 (and MW1-90, as a historical analogue) when mixing

Evaporation Pond water with unimpacted upgradient water. This mixing model was conducted in Geochemist's Workbench® v.12.0, using a water sample collected from the Evaporation Pond in September 2014 and a water sample from upgradient monitoring well MW-103 in April 2019. The mixing model assumes a starting concentration equal to the upgradient groundwater concentrations and then iteratively mixes it with incremental amounts of Evaporation Pond water.

The results of the April 2019 model are provided in Appendix G. Figure G.1 shows the results of the mixing model on a stiff diagram for MW-103. Downgradient wells MW-104 and MW1-90 are shown as gray and green diamonds, respectively. The blue line represents the various possible outcomes when mixing the upgradient water quality with the Evaporation Pond. The black circles (G.3) represent specific proportions (1-part upgradient water to 0.01-, 0.05-, 0.1-, 0.5-, and 1-part Evaporation Pond water). Figure G.2 shows the results as Stiff plots. Table E.1 provides the numerical inputs and results of the various mixing proportions.

As shown on Figure G.1, the downgradient well compositions are similar to the chemistry anticipated if the Evaporation Pond is mixing with upgradient groundwater emanating from the proximity of monitoring well MW-103. The path of the mixing reaction from MW-103 to the Evaporation Pond transects MW-104 when 1-part upgradient (MW-103) water is mixed with as little as 0.05-part Evaporation Pond water. Therefore, it appears plausible that a relatively small portion of Evaporation Pond water would be needed to "impact" upgradient groundwater to get a similar chemistry as observed in MW-104. The geometry of the Stiff plots in Figure G.2 show the similarity in anionic concentrations and calcium in the mixing models.

Based on the description of erosional features extending upwards of 48 inches into the liner of the Evaporation Pond in 2010-2013 corresponding with the increased concentrations of several parameters observed in downgradient monitoring well MW1-90, it is possible that a release from the Evaporation Pond occurred starting in approximately 2011. Furthermore, the results of the geochemical model along with the general proximity and hydraulic position of MW-104 relative to the Evaporation Pond supports the hypothesis that the SSI for TDS and sulfate at MW-104 is due to a "source other than the CCR unit." **Therefore, we accept the hypothesis that TDS and sulfate concentrations observed at MW-104 are consistent with a potential release from the Evaporation Pond, a non CCR unit.**

4.0 Conclusions

Four SSIs were identified from the September 2020 detection monitoring event. This report demonstrates that a "source other than the CCR unit" caused the potential SSIs (natural variation in regional and/or pre-landfill groundwater quality and the Evaporation Pond), as allowed by §257.94(e)(2). The results of this alternative source demonstration are summarized in the table below.

Table 3. Summary of SSIs and Alternative Sources

Well	Parameter	Report Section	Evidence for Alternative Source
MW-105	Chloride	3.2.1	Natural variability (pre-landfill values and geologic background)
MW-104	Sulfate	3.2.2, 3.3.1	Natural variability and/or Other (Evaporation Pond, a non CCR unit)
MW-104	Total Dissolved Solids	3.2.2, 3.3.1	Natural Variability and/or Other (Evaporation Pond, a non CCR unit)
MW-2-90	Fluoride	3.2.2	Natural variability (pre-landfill values and geologic background)

Based on the foregoing, the alternative source demonstration presented herein meets the requirements of CCR Rule §257.94(e)(2). As coal unit operations will cease around March 2022, MDU will work with the North Dakota Department of Environmental Quality (NDDEQ) on closure options for the Evaporation Pond as it is regulated under a permit through the NDDEQ.

5.0 References

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Figures

Monitoring Well Location

Monitoring Well Location - Water Level Only

Existing Slot Boundaries

Streams

Property Line

10ft Contours

2ft Contours

Active Portion of Landfill

Image Source: 2019 Statewide Imagery (ND GIS Hub)

CAD Data Source: Slot Linework.dwg

Feet

350 0 350

BARR

Figure 1

SITE LAYOUT AND CCR MONITORING WELL NETWORK
R. M. Heskett Station
Alternative Source Demonstration: September 2020 Event
Montana Dakota Utilities
Mandan, North Dakota

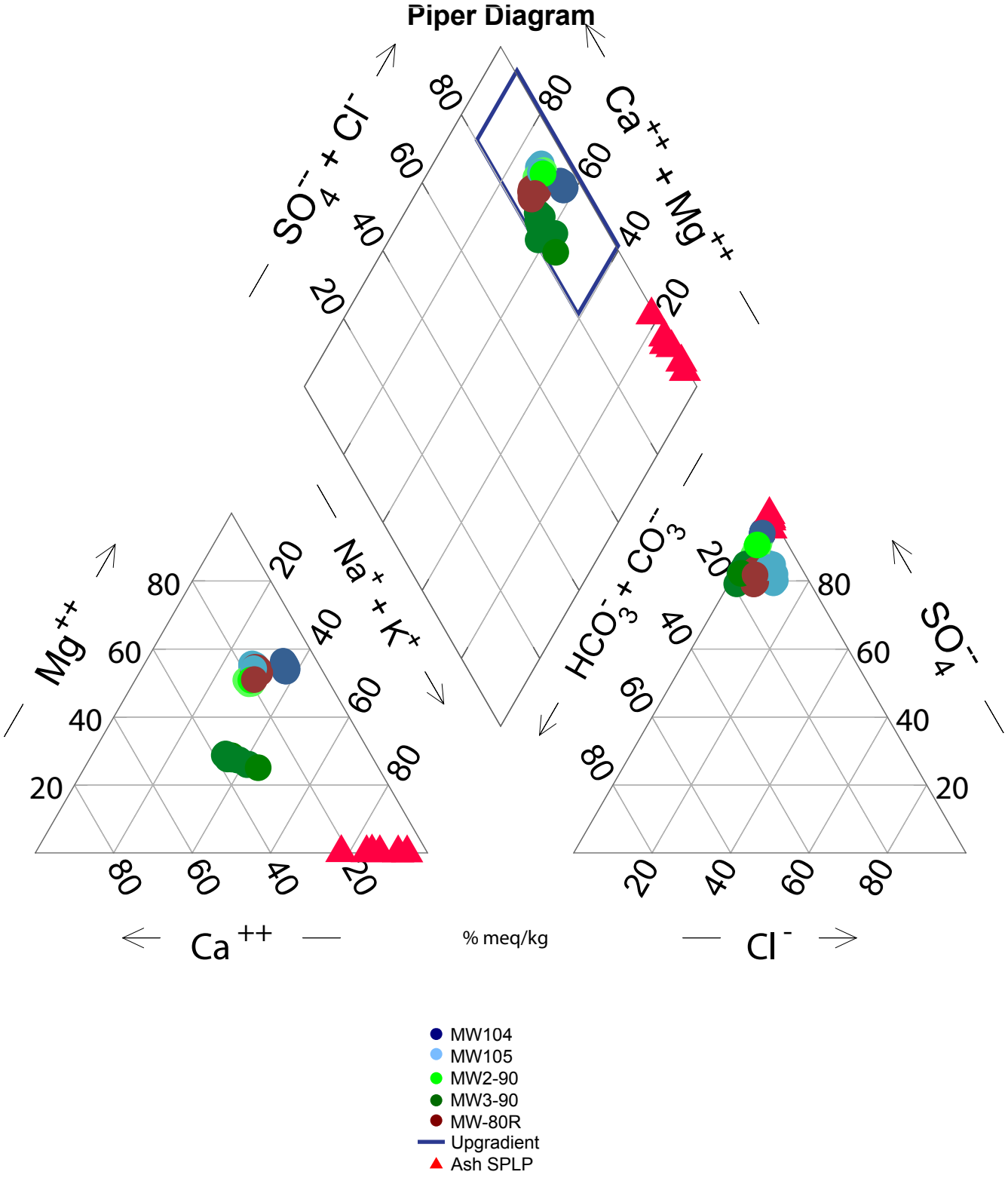
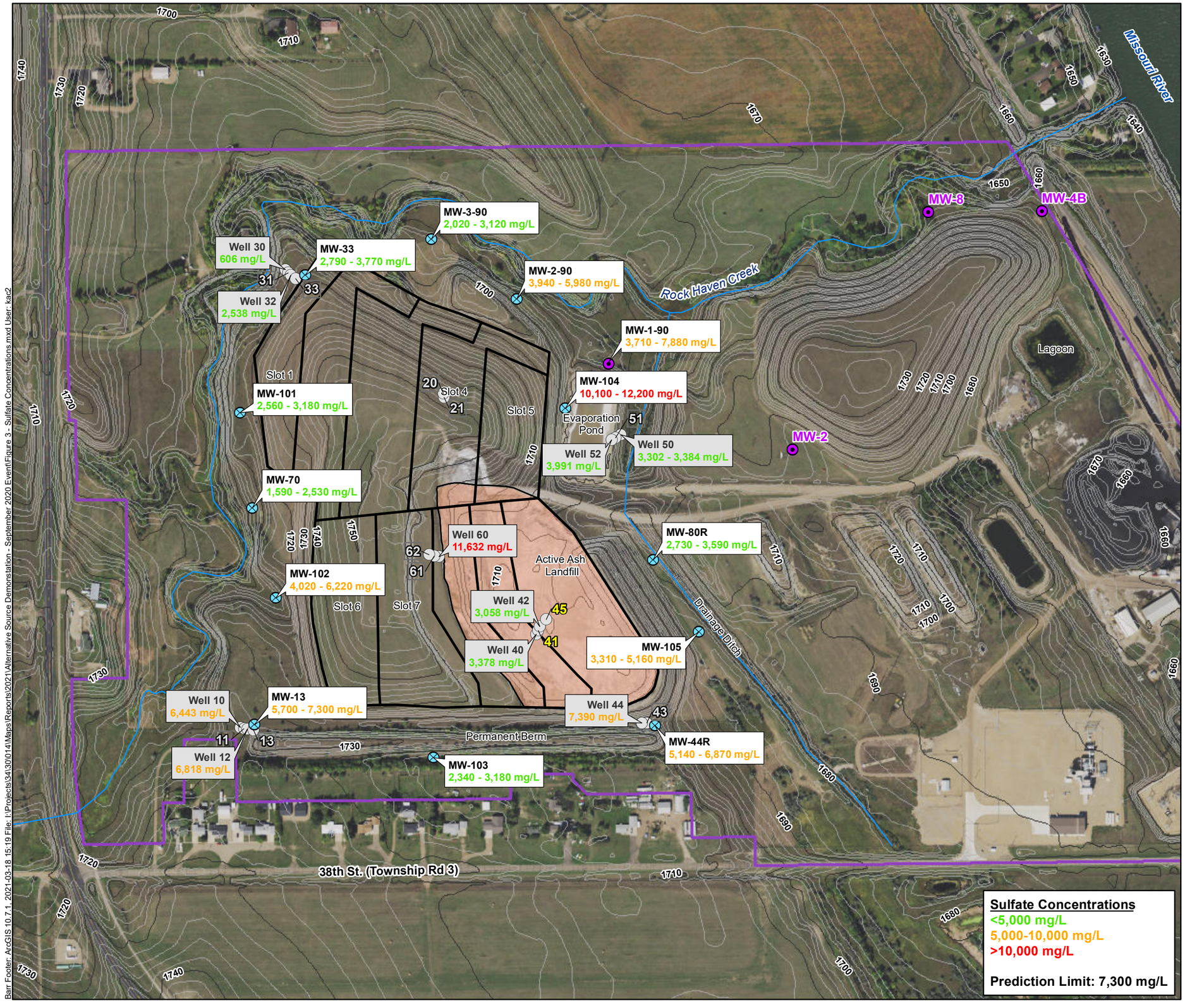


Figure 2

PIPER PLOT
R.M. Heskett Station
Alternative Source Demonstration
September 2020 Event
Montana Dakota Utilities Mandan, North Dakota



Monitoring Well Location

Monitoring Well Location - Water Level Only

Pre-Landfill Wells (Approximate)

Existing Slot Boundaries

Streams

Property Line

10ft Contours

2ft Contours

Active Portion of Landfill

Image Source: 2018 Statewide Imagery (ND GIS Hub)

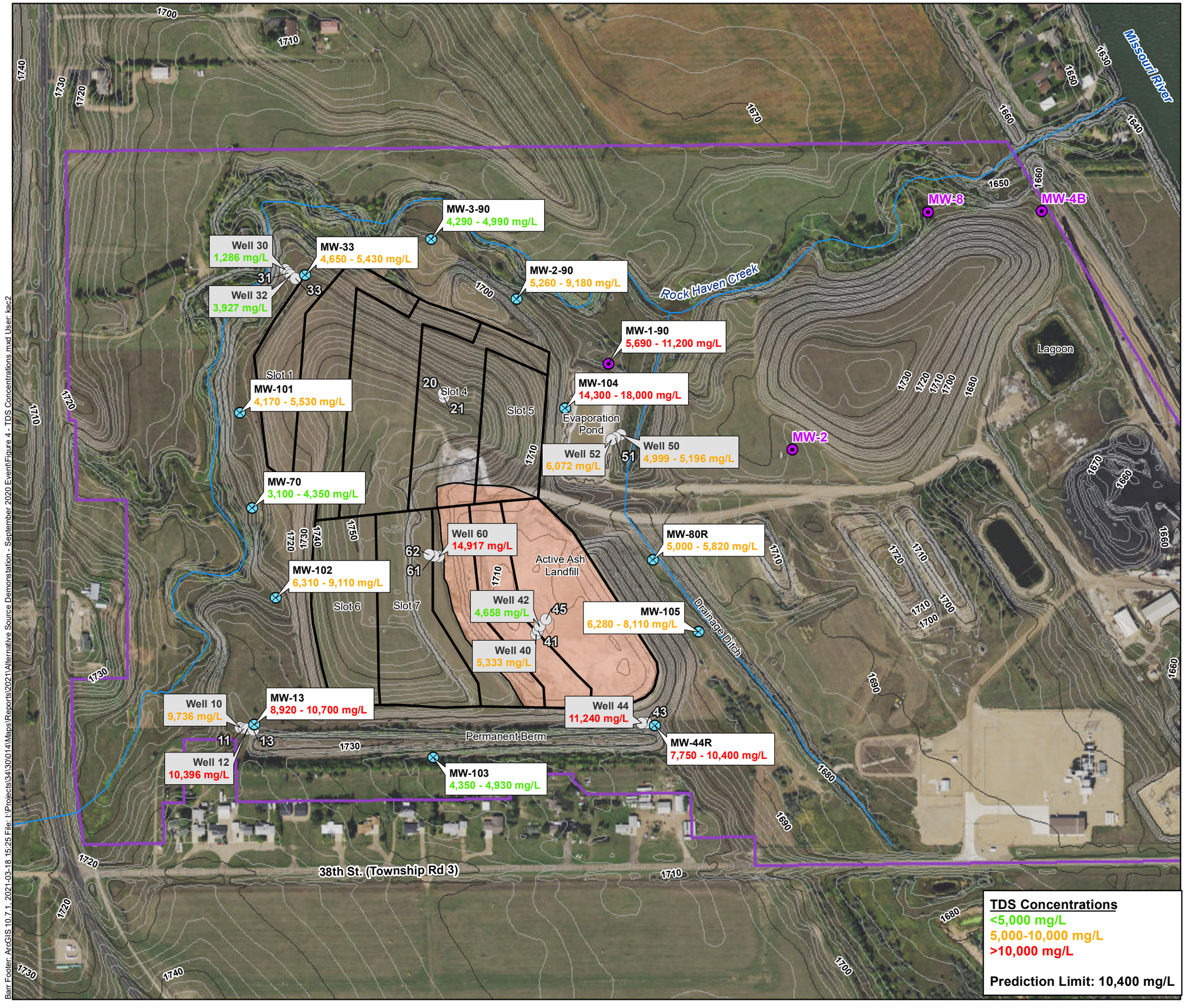
CAD Data Source: Slot Linework.dwg
Pre-Landfill well concentrations are from 9/11/1986, 11/21/1986 (MDU, 1989), and CCR Rule monitoring well concentrations are from 2016-2019.

Feet
350 0 350

BARR

Figure 3

SULFATE CONCENTRATIONS
R. M. Heskett Station
Alternative Source Demonstration:
September 2020 Event
Montana Dakota Utilities
Mandan, North Dakota



Monitoring Well Location

Monitoring Well Location - Water Level Only

Pre-Landfill Wells (Approximate)

Existing Slot Boundaries

Streams

Property Line

10ft Contours

2ft Contours

Active Portion of Landfill

Image Source: 2018 Statewide Imagery (ND GIS Hub)

CAD Data Source: Slot Linework.dwg
Pre-Landfill well concentrations are from 9/11/1986, 11/21/1986 (MDU, 1989), and CCR Rule monitoring well concentrations are from 2016-2019.

N

Feet

350 0 350

BARR

Figure 4

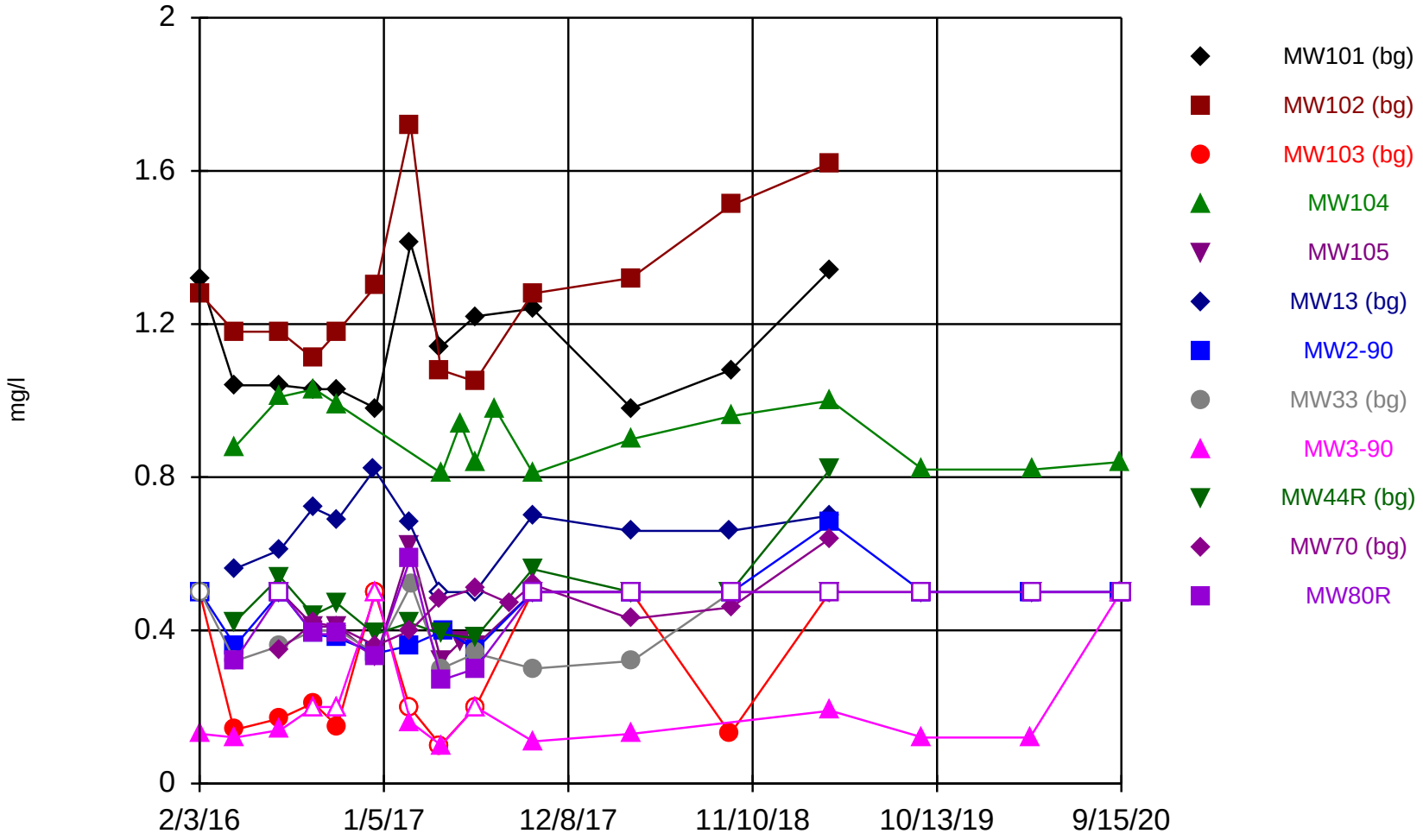
TDS CONCENTRATIONS
R. M. Heskett Station
Alternative Source Demonstration:
September 2020 Event
Montana Dakota Utilities
Mandan, North Dakota

Appendix A

Appendix III Time Series Plots

Sanitas™ v.9.6.27 For the statistical analyses of ground water by Barr Engineering Company only. UG
Hollow symbols indicate censored values.

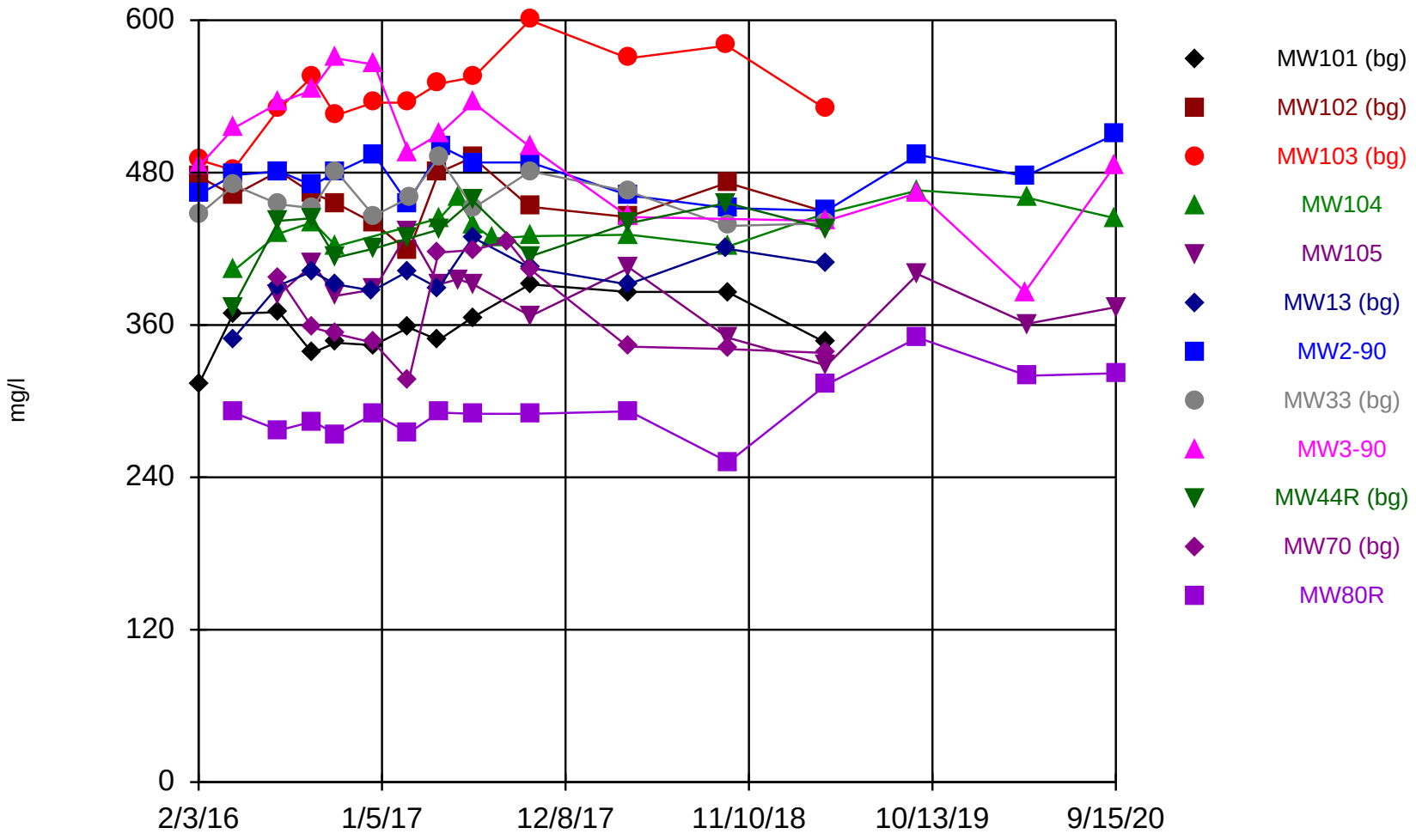
Time Series



Constituent: Boron, total Analysis Run 12/7/2020 2:59 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

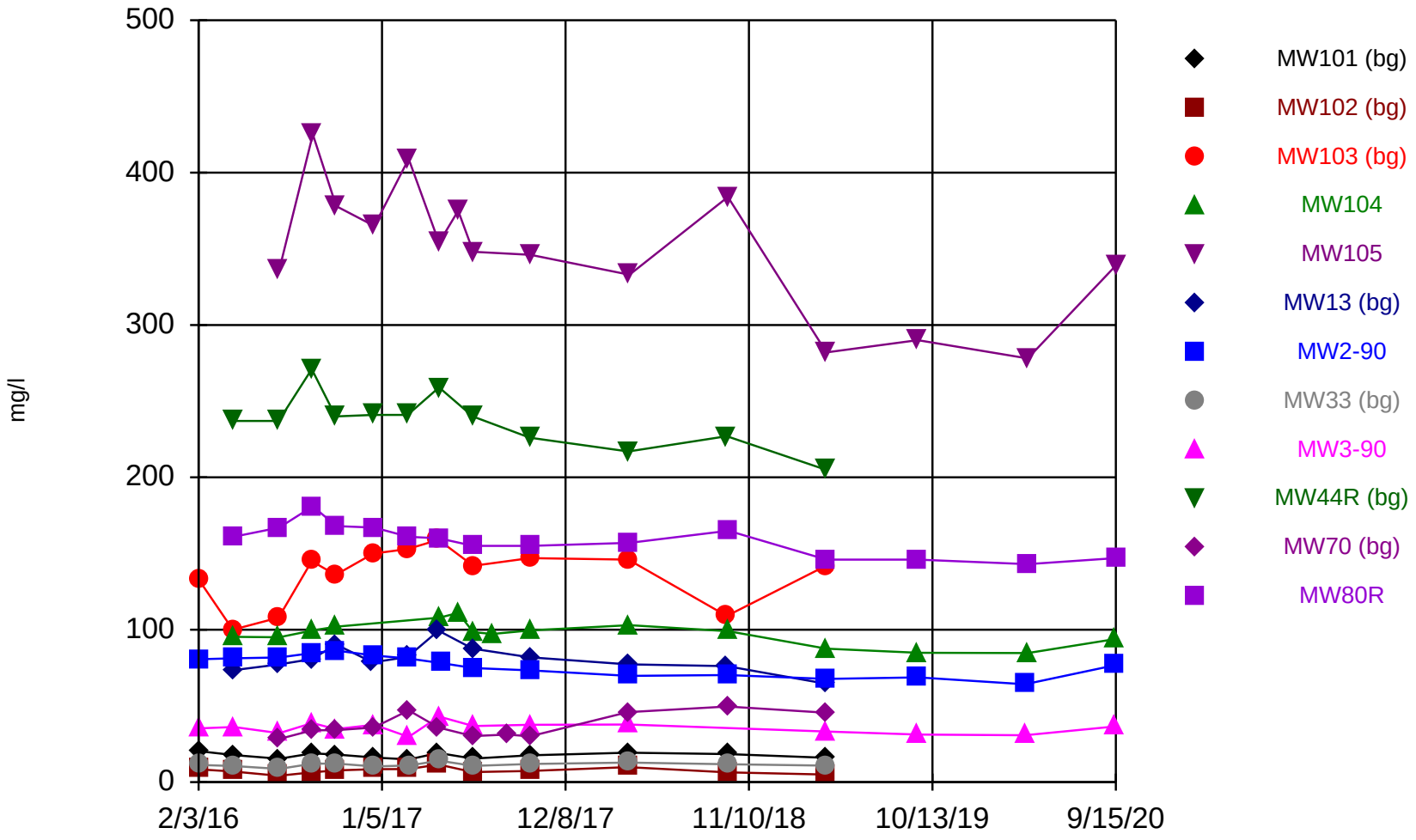
Time Series



Constituent: Calcium, Total Analysis Run 12/7/2020 2:59 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Time Series

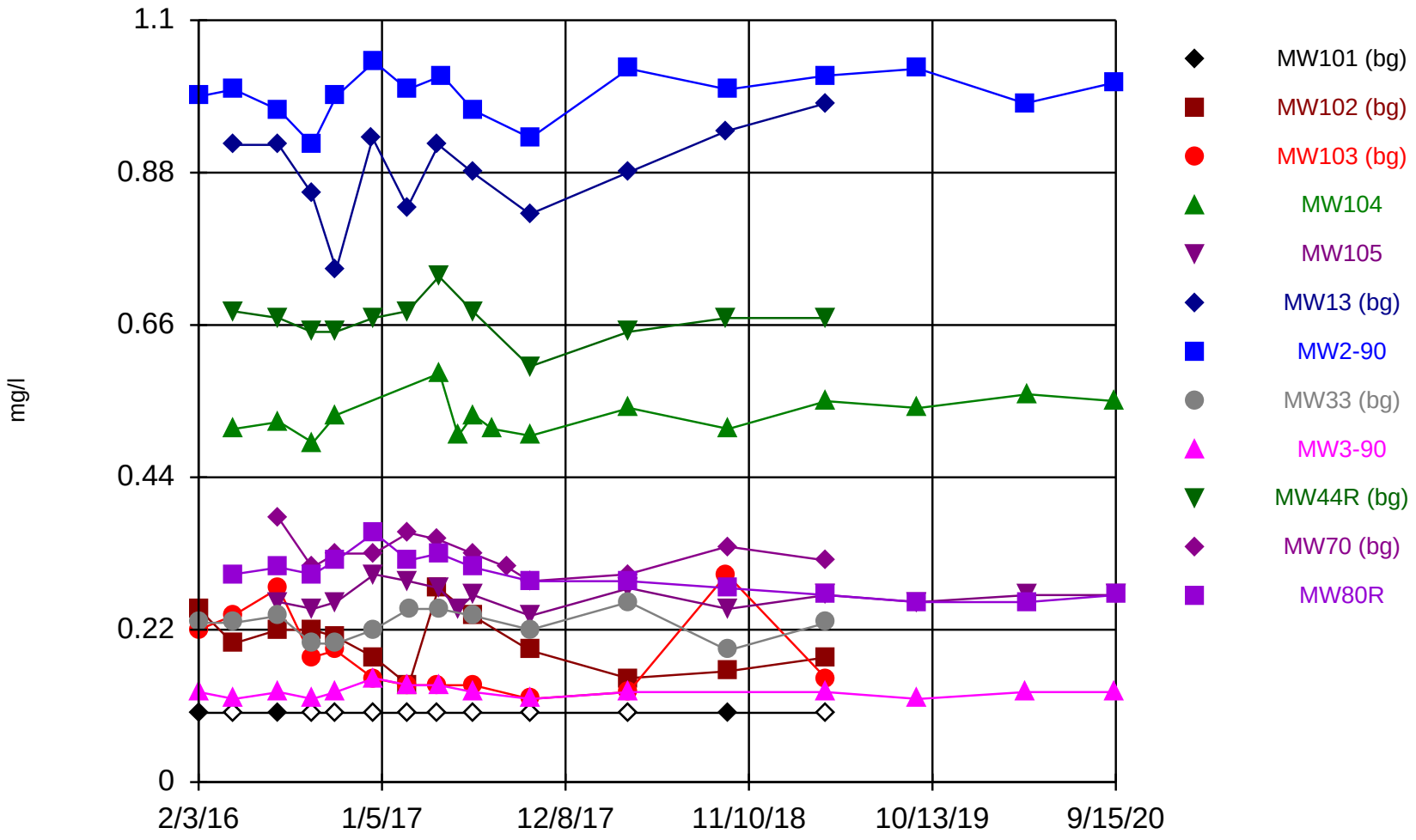


Constituent: Chloride Analysis Run 12/7/2020 3:00 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Sanitas™ v.9.6.27 For the statistical analyses of ground water by Barr Engineering Company only. UG
Hollow symbols indicate censored values.

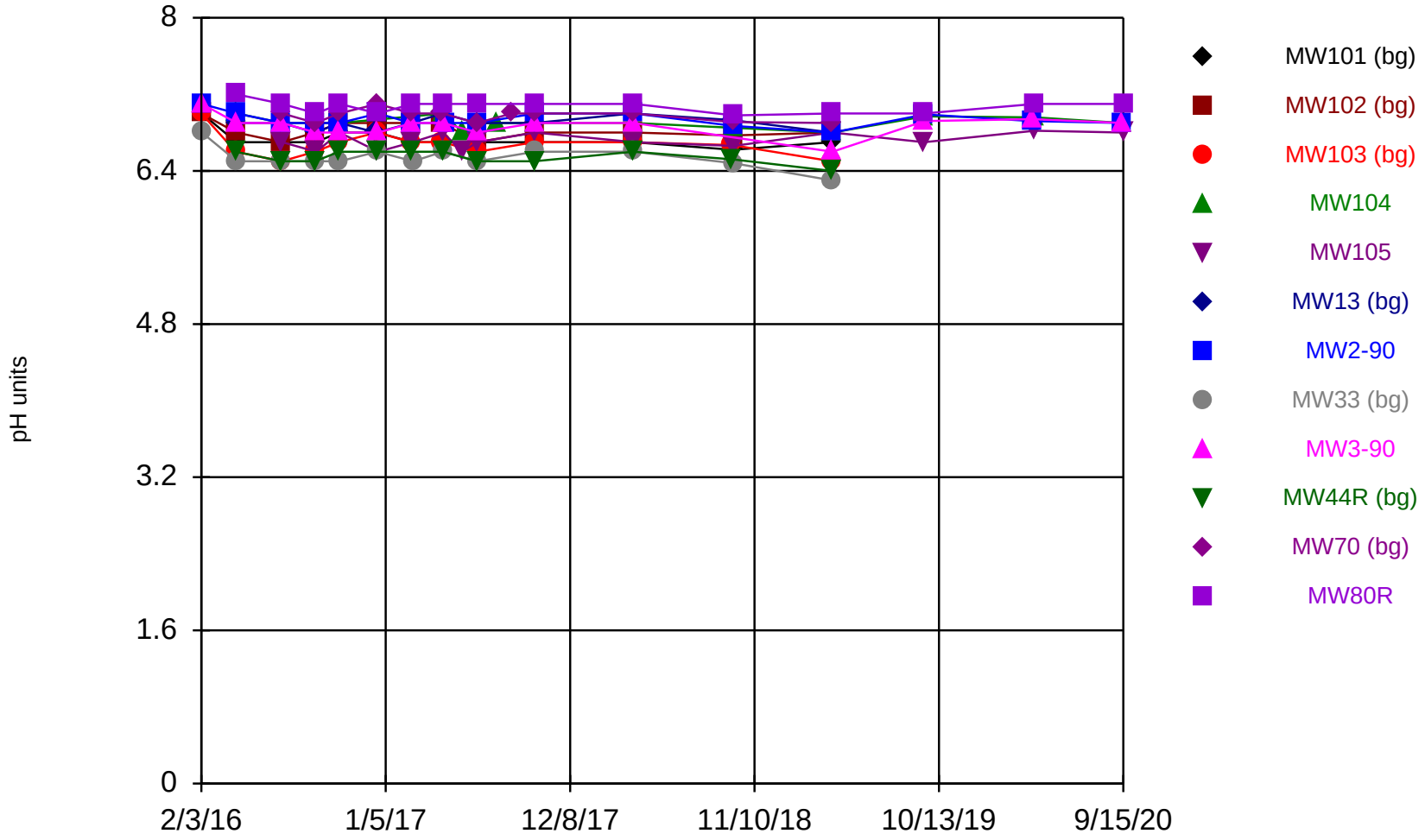
Time Series



Constituent: Fluoride Analysis Run 12/7/2020 3:00 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

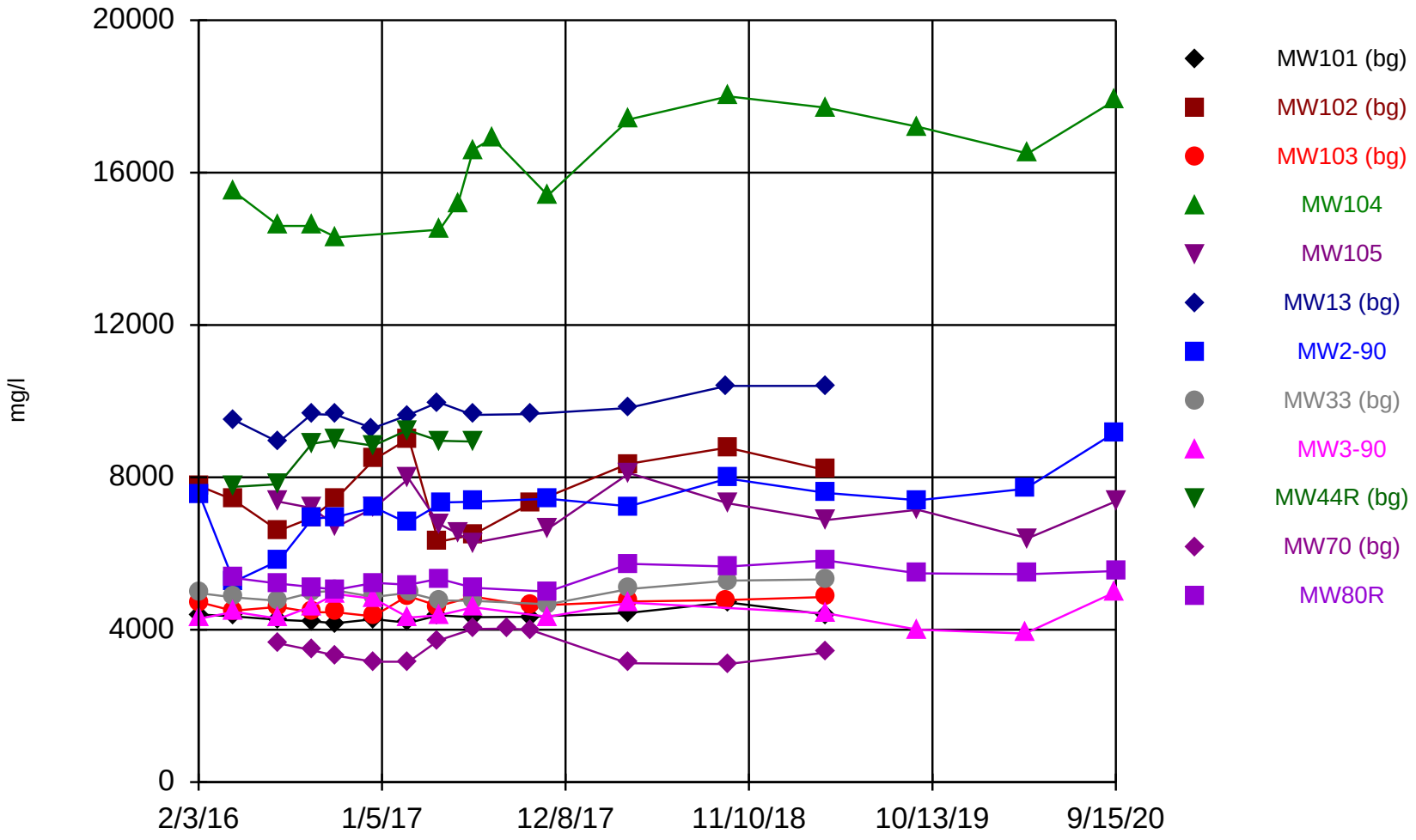
Time Series



Constituent: pH, Field Analysis Run 12/7/2020 3:00 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

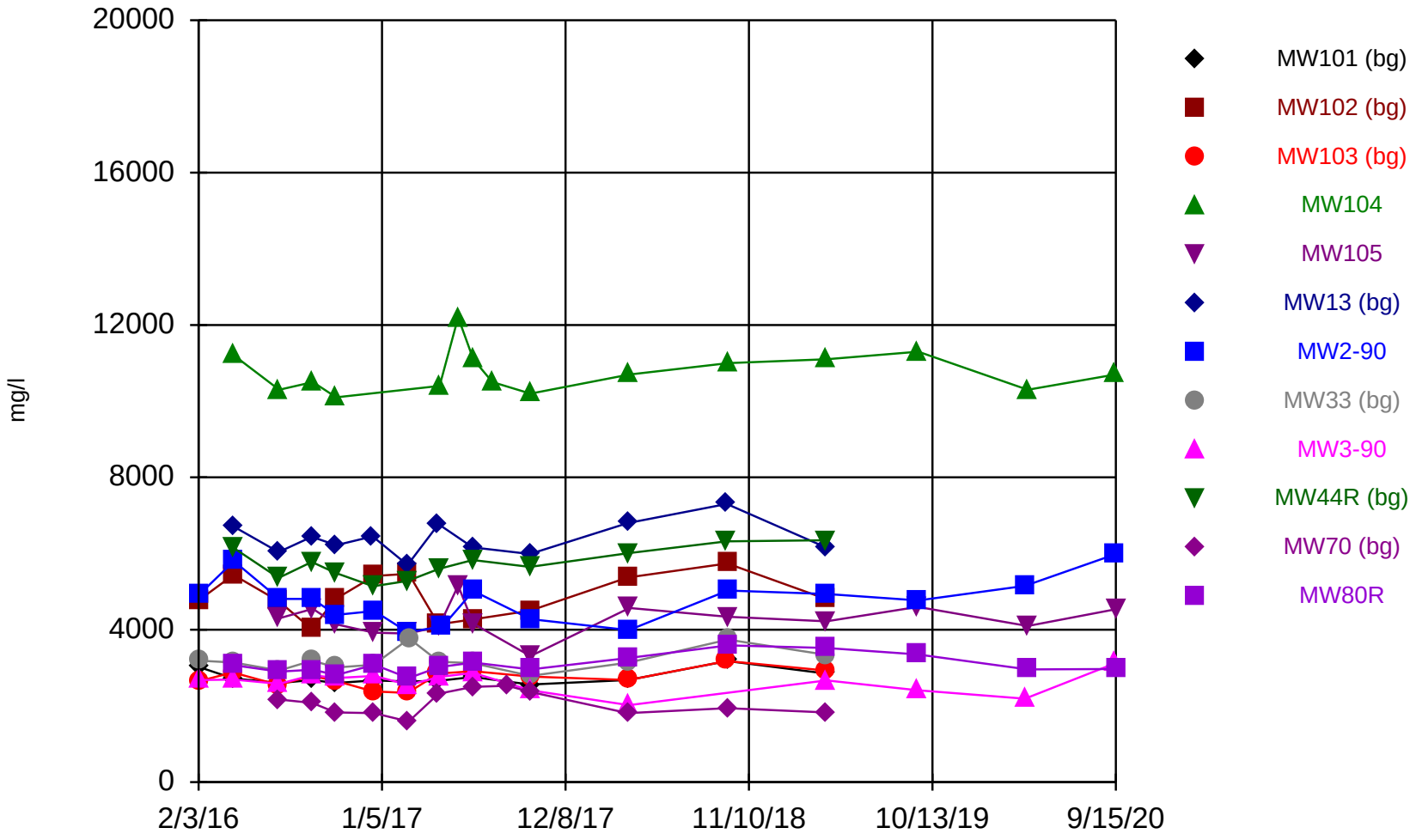
Time Series



Constituent: Solids, total dissolved Analysis Run 12/7/2020 3:00 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Time Series



Constituent: Sulfate, as SO4 Analysis Run 12/7/2020 3:00 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Appendix B

September 2020 Prediction Limit Plots

Prediction Limit

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII Printed 12/7/2020, 3:04 PM

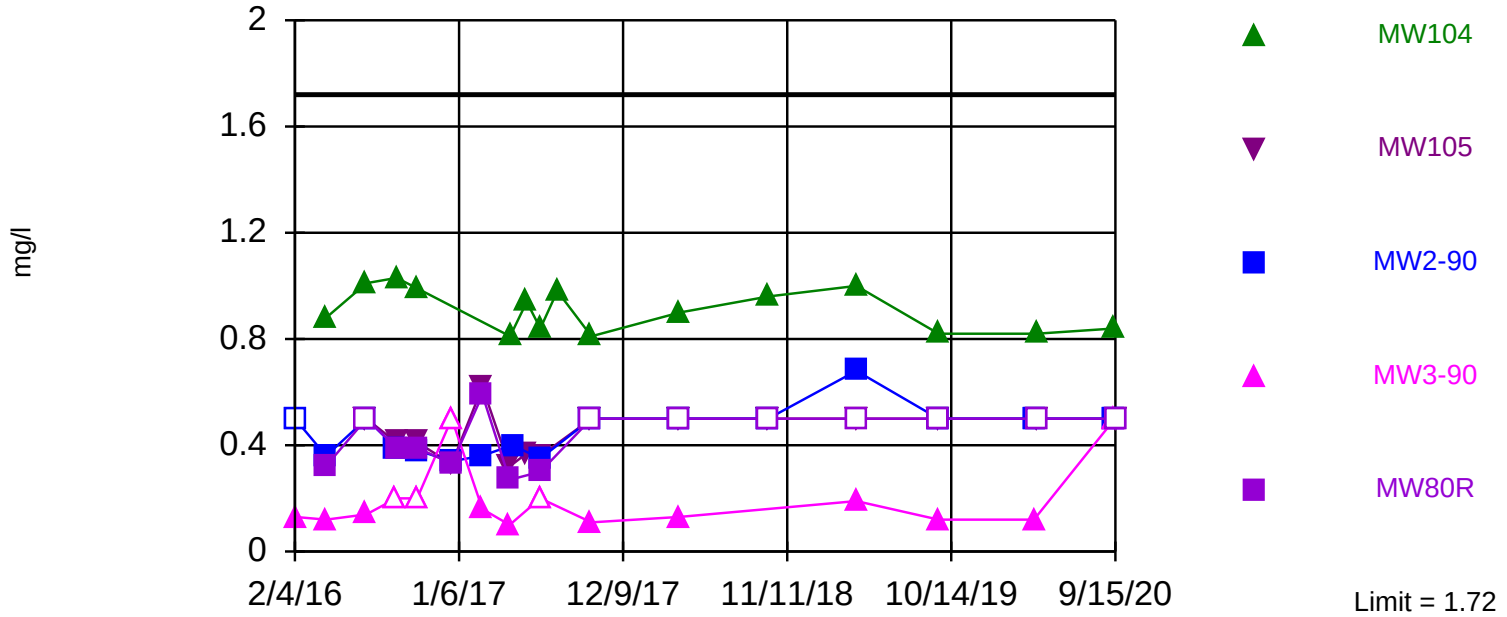
Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	%NDs	Transform	Alpha	Method
Boron, total (mg/l)	MW104	1.72	n/a	9/14/2020	0.84	No	88	17.05	n/a	0.00025	NP Inter (normality) ...
Boron, total (mg/l)	MW105	1.72	n/a	9/15/2020	0.5ND	No	88	17.05	n/a	0.00025	NP Inter (normality) ...
Boron, total (mg/l)	MW2-90	1.72	n/a	9/14/2020	0.5ND	No	88	17.05	n/a	0.00025	NP Inter (normality) ...
Boron, total (mg/l)	MW3-90	1.72	n/a	9/14/2020	0.5ND	No	88	17.05	n/a	0.00025	NP Inter (normality) ...
Boron, total (mg/l)	MW80R	1.72	n/a	9/15/2020	0.5ND	No	88	17.05	n/a	0.00025	NP Inter (normality) ...
Calcium, Total (mg/l)	MW104	548.5	n/a	9/14/2020	444	No	88	0	No	0.001504	Param Inter 1 of 2
Calcium, Total (mg/l)	MW105	548.5	n/a	9/15/2020	374	No	88	0	No	0.001504	Param Inter 1 of 2
Calcium, Total (mg/l)	MW2-90	548.5	n/a	9/14/2020	510	No	88	0	No	0.001504	Param Inter 1 of 2
Calcium, Total (mg/l)	MW3-90	548.5	n/a	9/14/2020	486	No	88	0	No	0.001504	Param Inter 1 of 2
Calcium, Total (mg/l)	MW80R	548.5	n/a	9/15/2020	322	No	88	0	No	0.001504	Param Inter 1 of 2
Chloride (mg/l)	MW104	271	n/a	9/14/2020	93.9	No	88	0	n/a	0.00025	NP Inter (normality) ...
Chloride (mg/l)	**MW105**	**271**	**n/a**	**9/15/2020**	**339**	**Yes**	**88**	**0**	**n/a**	**0.00025**	**NP Inter (normality) ...**
Chloride (mg/l)	MW2-90	271	n/a	9/14/2020	76.8	No	88	0	n/a	0.00025	NP Inter (normality) ...
Chloride (mg/l)	MW3-90	271	n/a	9/14/2020	36.5	No	88	0	n/a	0.00025	NP Inter (normality) ...
Chloride (mg/l)	MW80R	271	n/a	9/15/2020	147	No	88	0	n/a	0.00025	NP Inter (normality) ...
Fluoride (mg/l)	MW104	0.98	n/a	9/14/2020	0.55	No	88	11.36	n/a	0.00025	NP Inter (normality) ...
Fluoride (mg/l)	MW105	0.98	n/a	9/15/2020	0.27	No	88	11.36	n/a	0.00025	NP Inter (normality) ...
Fluoride (mg/l)	**MW2-90**	**0.98**	**n/a**	**9/14/2020**	**1.01**	**Yes**	**88**	**11.36**	**n/a**	**0.00025**	**NP Inter (normality) ...**
Fluoride (mg/l)	MW3-90	0.98	n/a	9/14/2020	0.13	No	88	11.36	n/a	0.00025	NP Inter (normality) ...
Fluoride (mg/l)	MW80R	0.98	n/a	9/15/2020	0.27	No	88	11.36	n/a	0.00025	NP Inter (normality) ...
pH, Field (pH units)	MW104	7.1	6.3	9/14/2020	6.9	No	88	0	n/a	0.000...	NP Inter (normality) ...
pH, Field (pH units)	MW105	7.1	6.3	9/15/2020	6.8	No	88	0	n/a	0.000...	NP Inter (normality) ...
pH, Field (pH units)	MW2-90	7.1	6.3	9/14/2020	6.9	No	88	0	n/a	0.000...	NP Inter (normality) ...
pH, Field (pH units)	MW3-90	7.1	6.3	9/14/2020	6.9	No	88	0	n/a	0.000...	NP Inter (normality) ...
pH, Field (pH units)	MW80R	7.1	6.3	9/15/2020	7.1	No	88	0	n/a	0.000...	NP Inter (normality) ...
Solids, total dissolved (mg/l)	**MW104**	**10400**	**n/a**	**9/14/2020**	**17900**	**Yes**	**84**	**0**	**n/a**	**0.000...**	**NP Inter (normality) ...**
Solids, total dissolved (mg/l)	MW105	10400	n/a	9/15/2020	7370	No	84	0	n/a	0.000...	NP Inter (normality) ...
Solids, total dissolved (mg/l)	MW2-90	10400	n/a	9/14/2020	9180	No	84	0	n/a	0.000...	NP Inter (normality) ...
Solids, total dissolved (mg/l)	MW3-90	10400	n/a	9/14/2020	4990	No	84	0	n/a	0.000...	NP Inter (normality) ...
Solids, total dissolved (mg/l)	MW80R	10400	n/a	9/15/2020	5540	No	84	0	n/a	0.000...	NP Inter (normality) ...
Sulfate, as SO4 (mg/l)	**MW104**	**7300**	**n/a**	**9/14/2020**	**10700**	**Yes**	**88**	**0**	**n/a**	**0.00025**	**NP Inter (normality) ...**
Sulfate, as SO4 (mg/l)	MW105	7300	n/a	9/15/2020	4540	No	88	0	n/a	0.00025	NP Inter (normality) ...
Sulfate, as SO4 (mg/l)	MW2-90	7300	n/a	9/14/2020	5980	No	88	0	n/a	0.00025	NP Inter (normality) ...
Sulfate, as SO4 (mg/l)	MW3-90	7300	n/a	9/14/2020	3120	No	88	0	n/a	0.00025	NP Inter (normality) ...
Sulfate, as SO4 (mg/l)	MW80R	7300	n/a	9/15/2020	2970	No	88	0	n/a	0.00025	NP Inter (normality) ...

Sanitas™ v.9.6.27 For the statistical analyses of ground water by Barr Engineering Company only. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 88 background values. 17.05% NDs. Annual per-constituent alpha = 0.002497. Individual comparison alpha = 0.00025 (1 of 2). Comparing 5 points to limit. Seasonality was not detected with 95% confidence.

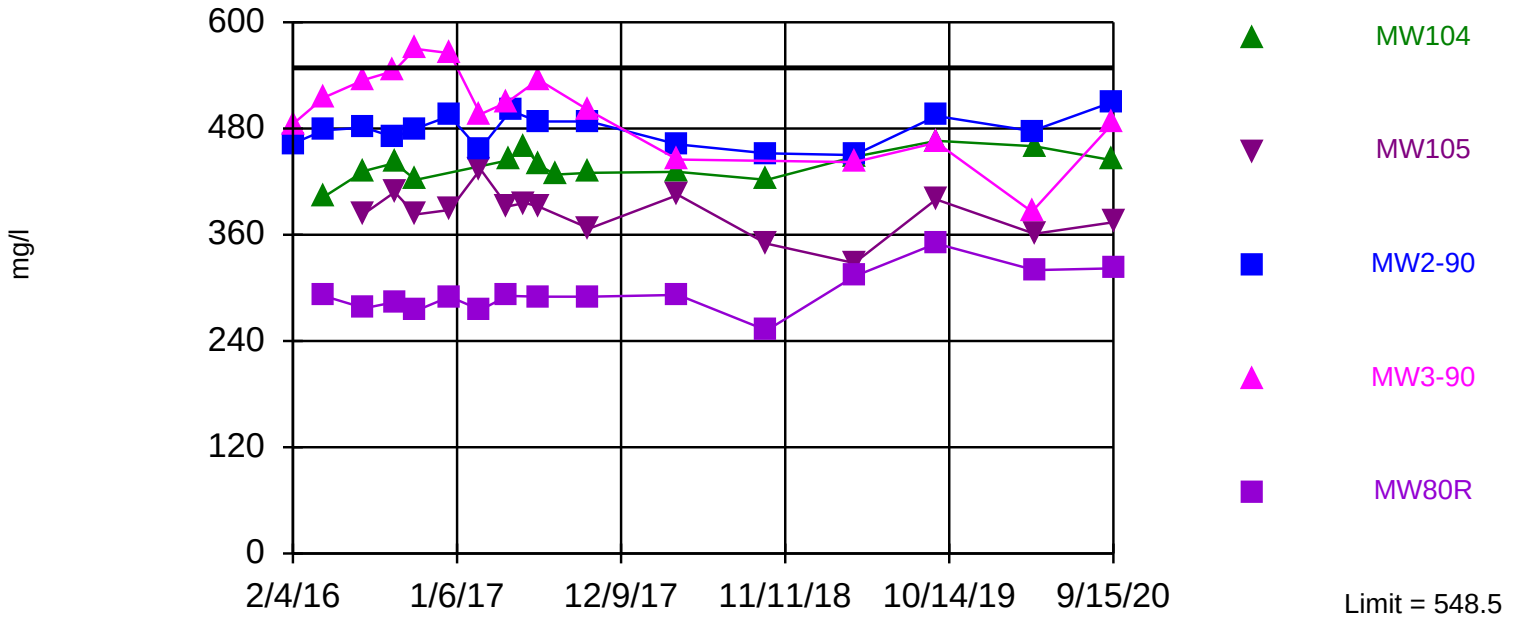
Constituent: Boron, total Analysis Run 12/7/2020 3:04 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Within Limit

Prediction Limit

Interwell Parametric



Background Data Summary: Mean=432.4, Std. Dev.=64.15, n=88. Seasonality was not detected with 95% confidence. Normality test: Shapiro Francia @alpha = 0.05, calculated = 0.9786, critical = 0.972. Kappa = 1.81 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.001504. Comparing 5 points to limit.

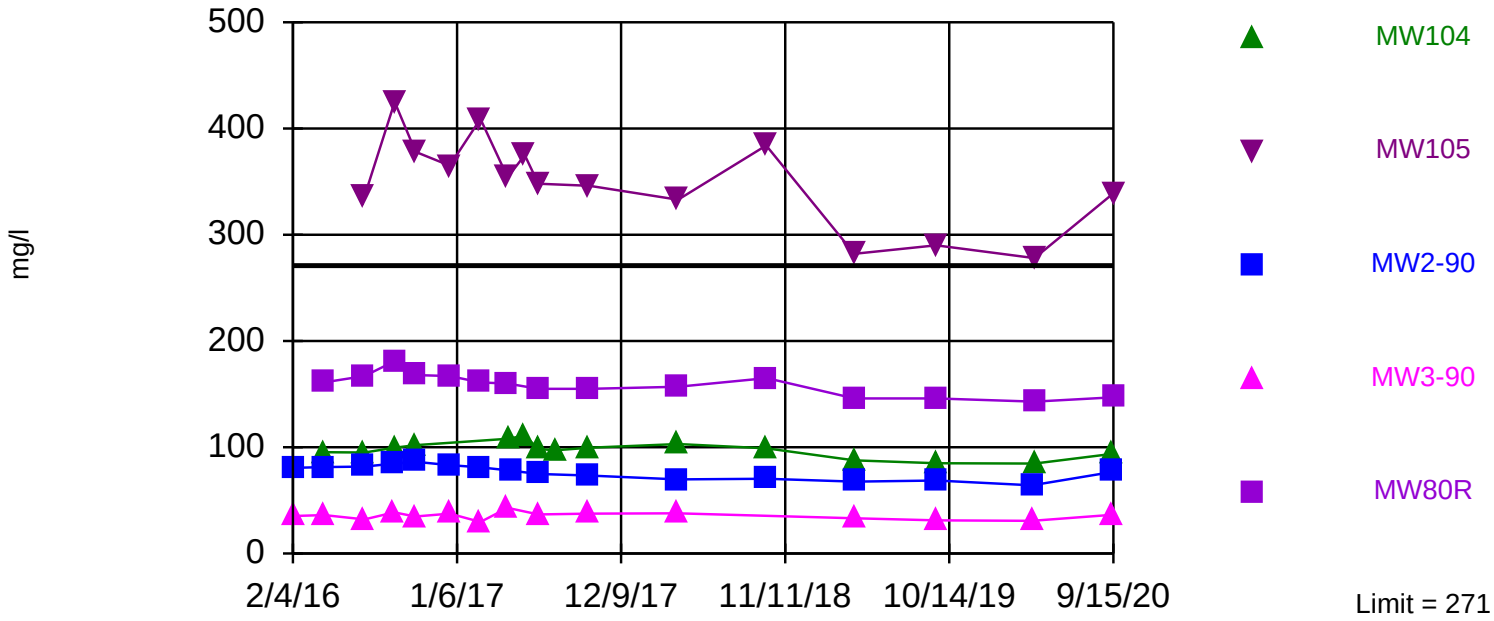
Constituent: Calcium, Total Analysis Run 12/7/2020 3:04 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Exceeds Limit: MW105

Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 88 background values. Annual per-constituent alpha = 0.002497. Individual comparison alpha = 0.00025 (1 of 2). Comparing 5 points to limit. Seasonality was not detected with 95% confidence.

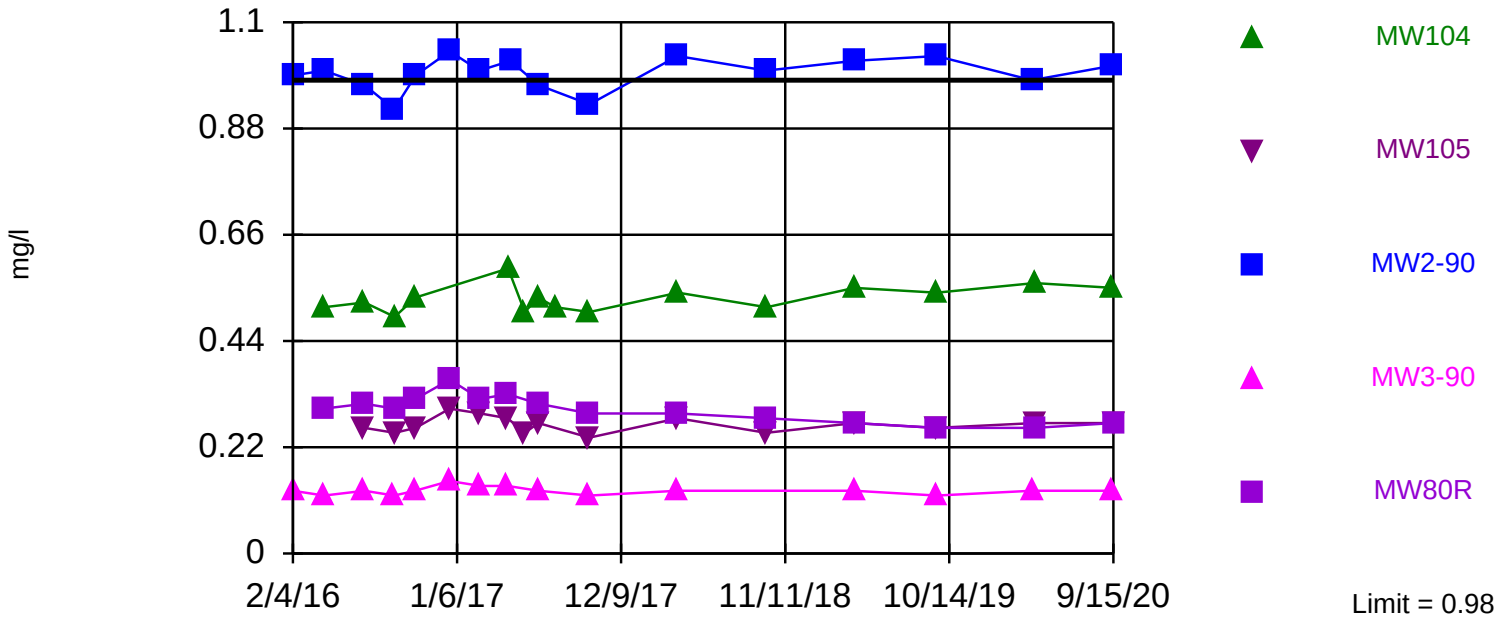
Constituent: Chloride Analysis Run 12/7/2020 3:04 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Exceeds Limit: MW2-90

Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 88 background values. 11.36% NDs. Annual per-constituent alpha = 0.002497. Individual comparison alpha = 0.00025 (1 of 2). Comparing 5 points to limit. Seasonality was not detected with 95% confidence.

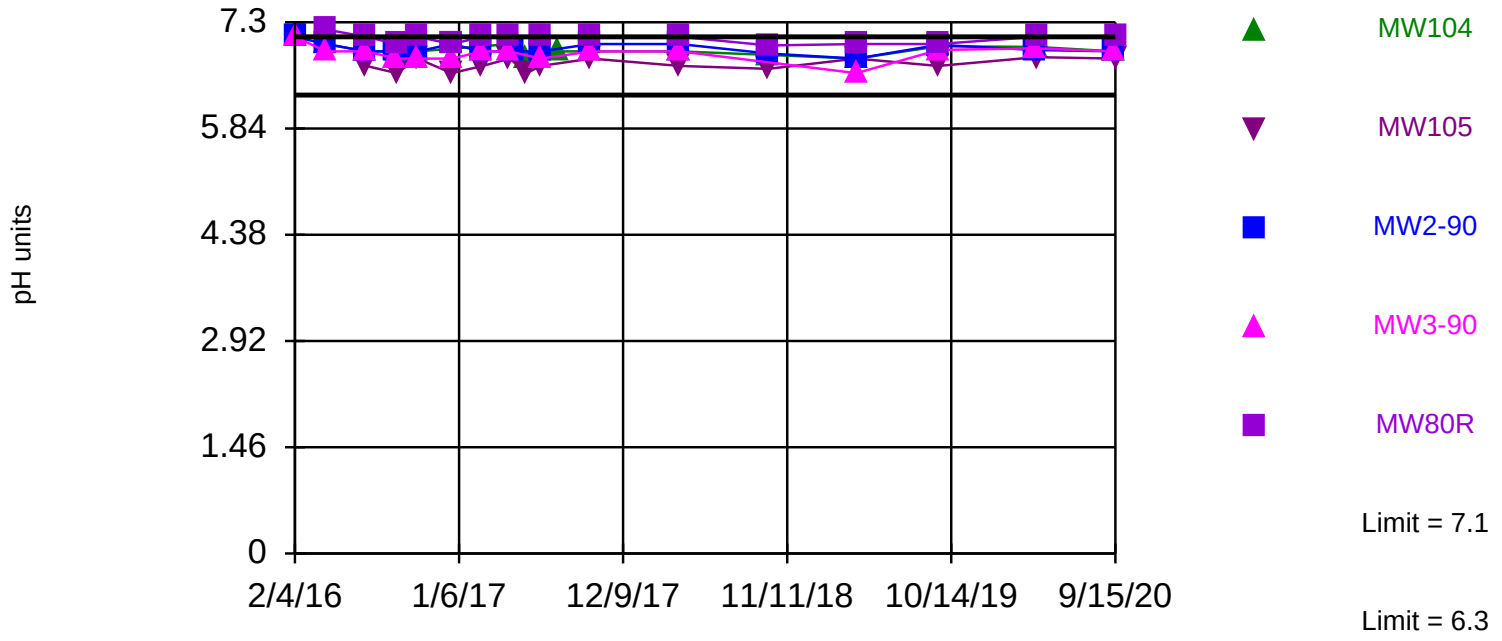
Constituent: Fluoride Analysis Run 12/7/2020 3:04 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Within Limits

Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limits are highest and lowest of 88 background values. Annual per-constituent alpha = 0.004994. Individual comparison alpha = 0.0004999 (1 of 2). Comparing 5 points to limit. Seasonality was not detected with 95% confidence.

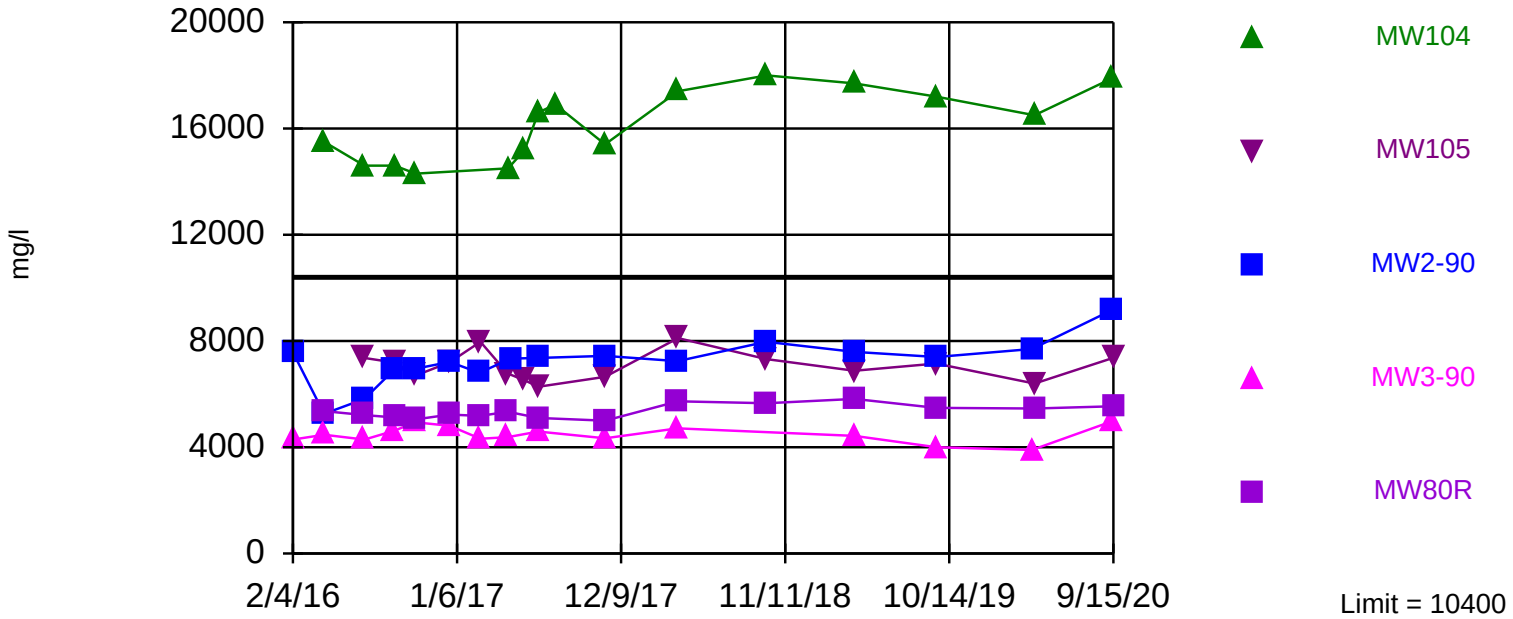
Constituent: pH, Field Analysis Run 12/7/2020 3:04 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Exceeds Limit: MW104

Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 84 background values. Annual per-constituent alpha = 0.002742. Individual comparison alpha = 0.0002746 (1 of 2). Comparing 5 points to limit. Seasonality was not detected with 95% confidence.

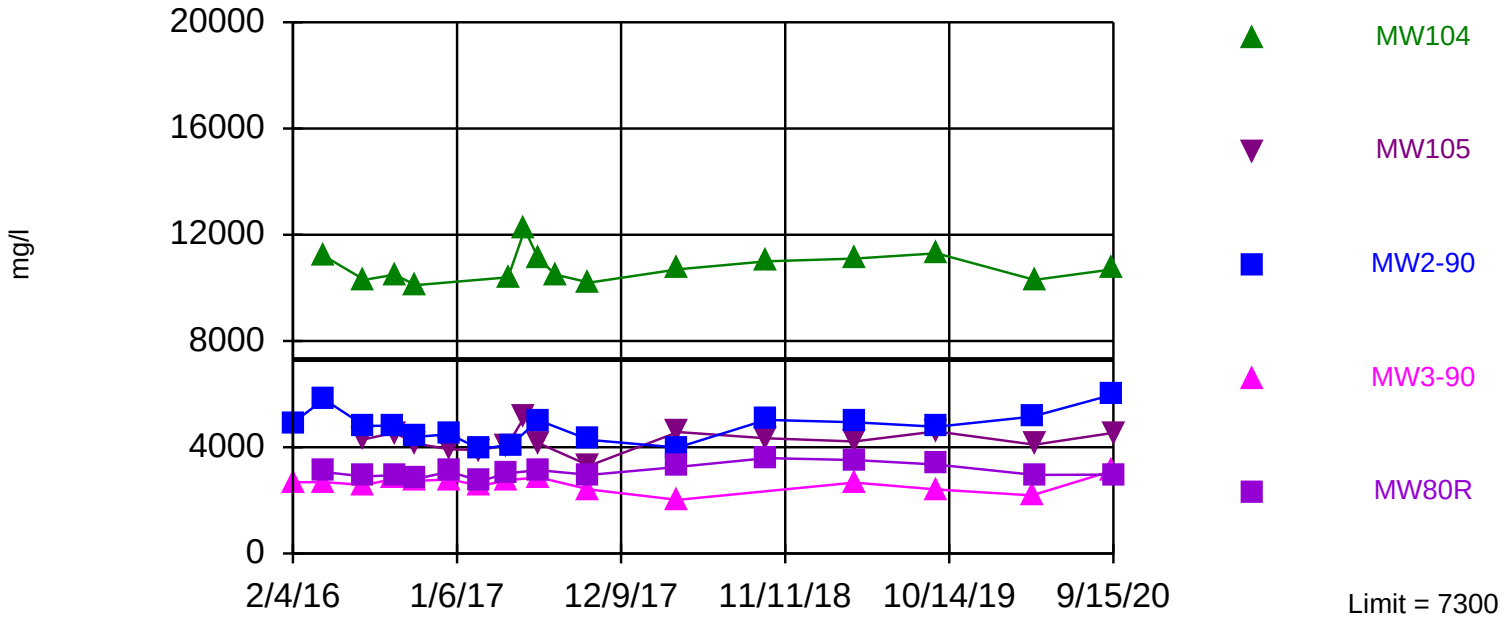
Constituent: Solids, total dissolved Analysis Run 12/7/2020 3:04 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Exceeds Limit: MW104

Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 88 background values. Annual per-constituent alpha = 0.002497. Individual comparison alpha = 0.00025 (1 of 2). Comparing 5 points to limit. Seasonality was not detected with 95% confidence.

Constituent: Sulfate, as SO4 Analysis Run 12/7/2020 3:04 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Appendix C

Ash SPLP Laboratory Report (2011)

MINNESOTA VALLEY TESTING LABORATORIES, INC.

1126 North Front St. ~ New Ulm, MN 56073 ~ 800-782-3557 ~ Fax 507-359-2890
2616 East Broadway Ave. ~ Bismarck, ND 58501 ~ 800-279-6885 ~ Fax 701-258-9724
51 West Lincoln Way ~ Nevada, IA 50201 ~ 800-362-0855 ~ Fax 515-382-3885
www.mvtl.com

MEMBER ACIL

Report Date: 8 Sep 11
Lab Number: 11-M2450
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit I Bottom Ash
Sample Site: MDU Heskett

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
SPLP Extraction				1312	22 Jul 11	SS
pH	12.2	units	N/A	SM4500 H+ B	22 Jul 11 17:00	Claudette
Specific Conductance	8778	umhos/cm	N/A	SM2510-B	22 Jul 11 17:00	Claudette
Total Suspended Solids	3	mg/l	1	SM2540-D	22 Jul 11 14:00	CLB
Total Alkalinity	1120	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Phenolphthalein Alk	1090	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Bicarbonate	< 4	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Carbonate	60	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Hydroxide	1060	mg/l CaCO3	0	SM2320-B	22 Jul 11 17:00	Claudette
Tot Dis Solids(Summation)	4860	mg/l	NA	SM1030-F	3 Aug 11 8:40	Calculated
Total Hardness as CaCO3	524	mg/l	NA	SM2340-B	3 Aug 11 8:40	Calculated
Hardness in grains/gallon	30.7	gr/gal	NA	SM2340-B	3 Aug 11 8:40	Calculated
Cation Summation	74.3	meq/L	NA	SM1030-F	3 Aug 11 8:40	Calculated
Anion Summation	74.6	meq/L	NA	SM1030-F	28 Jul 11 14:30	Calculated
Percent Error	-0.24	%	NA	SM1030-F	3 Aug 11 8:40	Calculated
Sodium Adsorption Ratio	27.1		NA	USDA 20b	3 Aug 11 8:40	Calculated
Gross Alpha Radiation	Attached	pCi/l			22 Aug 11 2:03	
Radon 222	Attached				28 Jul 11 4:37	
Radium 226	Attached	pCi/l			22 Aug 11 22:20	
Radium 228	Attached	pCi/l			16 Aug 11 16:50	
Total Organic Carbon	0.7	mg/l	0.5	SM5310-C	1 Aug 11 8:00	Eric
Fluoride	< 0.1	mg/l	0.10	SM4500-F-C	4 Aug 11 17:00	CLB
Sulfate	2440	mg/l	5.00	ASTM D516-02	27 Jul 11 9:00	KMP
Chloride	50.5	mg/l	1.0	SM4500-Cl-E	27 Jul 11 14:00	KMP
Nitrate-Nitrite as N	0.21	mg/l	0.10	EPA 353.2	28 Jul 11 14:30	KMP
Ammonia-Nitrogen as N	0.32	mg/l	0.10	EPA 350.1	28 Jul 11 10:45	KMP
Phosphorus as P - Total	< 0.1	mg/l	0.10	EPA 365.1	28 Jul 11 13:00	KMP
Mercury - Total	< 0.0002	mg/l	0.0002	EPA 245.1	28 Jul 11 8:00	Eric
Chemical Oxygen Demand	< 5	mg/l	5.0	HACH 8000	1 Aug 11 8:30	Wayne
Calcium - Total	210	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Magnesium - Total	< 2.5	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Sodium - Total	1440	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Potassium - Total	44.8	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Aluminum - Total	< 0.5	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Iron - Total	< 0.5	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Strontium - Total	28.2	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Titanium - Total	< 0.5	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Boron - Total	< 0.5	mg/l	0.10	6010	11 Aug 11 8:40	Stacy

RL = Method Reporting Limit

Elevated "Less Than Result" (<): @ = Due to sample matrix
! = Due to sample quantity
= Due to sample concentration
+ = Due to extract volume

CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

MINNESOTA VALLEY TESTING LABORATORIES, INC.
1126 North Front St. ~ New Ulm, MN 56073 ~ 800-782-3557 ~ Fax 507-359-2890
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MEMBER ACIL

Report Date: 8 Sep 11
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Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit I Bottom Ash
Sample Site: MDU Heskett

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
Antimony - Total	< 0.002	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Arsenic - Total	0.0044	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Barium - Total	0.1135	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Beryllium - Total	< 0.001	mg/l	0.0010	6020	25 Jul 11 16:18	Claudette
Cadmium - Total	0.00164	mg/l	0.00100	6020	25 Jul 11 16:18	Claudette
Chromium - Total	0.0065	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Cobalt - Total	< 0.002	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Copper - Total	0.0213	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Lead - Total	< 0.002	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Manganese - Total	0.0027	mg/l	0.0010	6020	25 Jul 11 16:18	Claudette
Molybdenum - Total	0.6860	mg/l	0.0020	6020	26 Jul 11 12:46	Claudette
Nickel - Total	0.0074	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Selenium - Total	0.0133	mg/l	0.0020	6020	26 Jul 11 9:46	Claudette
Silver - Total	< 0.001	mg/l	0.0010	6020	25 Jul 11 16:18	Claudette
Thallium - Total	< 0.002	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Tin - Total	< 0.05	mg/l	0.0500	6020	25 Jul 11 16:18	Claudette
Vanadium - Total	0.0189	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Zinc - Total	0.0151	mg/l	0.0100	6020	25 Jul 11 16:18	Claudette
Uranium	< 0.002	mg/l	0.002	6020	25 Jul 11 16:18	Claudette

All analyses were performed on the extract from Method 1312 (SPLP) with a modified solution to solids ratio of 4:1.

Approved by: D. Zander

RL = Method Reporting Limit

Elevated "Less Than Result" (<): @ = Due to sample matrix
! = Due to sample quantity
= Due to sample concentration
+ = Due to extract volume

CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

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MEMBER ACIL

Report Date: 8 Sep 11
Lab Number: 11-M2451
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit II Sand Ash
Sample Site: MDU Heskett

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
SPLP Extraction				1312	22 Jul 11	SS
pH	11.1	units	N/A	SM4500 H+ B	22 Jul 11 17:00	Claudette
Specific Conductance	20110	umhos/cm	N/A	SM2510-B	22 Jul 11 17:00	Claudette
Total Suspended Solids	21	mg/l	1	SM2540-D	22 Jul 11 14:00	CLB
Total Alkalinity	203	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Phenolphthalein Alk	171	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Bicarbonate	< 4	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Carbonate	64	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Hydroxide	139	mg/l CaCO3	0	SM2320-B	22 Jul 11 17:00	Claudette
Tot Dis Solids(Summation)	22500	mg/l	NA	SM1030-F	3 Aug 11 8:40	Calculated
Total Hardness as CaCO3	1200	mg/l	NA	SM2340-B	3 Aug 11 8:40	Calculated
Hardness in grains/gallon	70.2	gr/gal	NA	SM2340-B	3 Aug 11 8:40	Calculated
Cation Summation	318	meq/L	NA	SM1030-F	3 Aug 11 8:40	Calculated
Anion Summation	314	meq/L	NA	SM1030-F	28 Jul 11 14:30	Calculated
Percent Error	0.65	%	NA	SM1030-F	3 Aug 11 8:40	Calculated
Sodium Adsorption Ratio	80.9		NA	USDA 20b	3 Aug 11 8:40	Calculated
Gross Alpha Radiation	Attached	pCi/l			22 Aug 11 2:03	
Radon 222	See Attached				28 Jul 11 4:37	
Radium 226	Attached	pCi/l			22 Aug 11 22:20	
Radium 228	Attached	pCi/l			16 Aug 11 16:50	
Total Organic Carbon	< 0.5	mg/l	0.5	SM5310-C	1 Aug 11 8:00	Eric
Fluoride	< 0.1	mg/l	0.10	SM4500-F-C	4 Aug 11 17:00	CLB
Sulfate	14900	mg/l	5.00	ASTM D516-02	27 Jul 11 9:00	KMP
Chloride	2.0	mg/l	1.0	SM4500-Cl-E	27 Jul 11 14:00	KMP
Nitrate-Nitrite as N	< 0.1	mg/l	0.10	EPA 353.2	28 Jul 11 14:30	KMP
Ammonia-Nitrogen as N	0.10	mg/l	0.10	EPA 350.1	28 Jul 11 10:45	KMP
Phosphorus as P - Total	< 0.1	mg/l	0.10	EPA 365.1	28 Jul 11 13:00	KMP
Mercury - Total	< 0.0002	mg/l	0.0002	EPA 245.1	28 Jul 11 8:00	Eric
Chemical Oxygen Demand	< 5	mg/l	5.0	HACH 8000	1 Aug 11 8:30	Wayne
Calcium - Total	481	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Magnesium - Total	< 5	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Sodium - Total	6500	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Potassium - Total	459	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Aluminum - Total	1.09	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Iron - Total	< 1	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Strontium - Total	66.0	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Titanium - Total	< 1	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Boron - Total	5.96	mg/l	0.10	6010	11 Aug 11 8:40	Stacy

RL = Method Reporting Limit

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CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

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www.mvtl.com
MEMBER ACIL

Report Date: 8 Sep 11
Lab Number: 11-M2451
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit II Sand Ash
Sample Site: MDU Heskett

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
Antimony - Total	< 0.002	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Arsenic - Total	0.0822	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Barium - Total	0.0930	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Beryllium - Total	< 0.001	mg/l	0.0010	6020	25 Jul 11 16:18	Claudette
Cadmium - Total	0.00182	mg/l	0.00100	6020	25 Jul 11 16:18	Claudette
Chromium - Total	0.0244	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Cobalt - Total	< 0.002	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Copper - Total	0.1108	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Lead - Total	< 0.002	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Manganese - Total	0.0052	mg/l	0.0010	6020	25 Jul 11 16:18	Claudette
Molybdenum - Total	0.1000	mg/l	0.0020	6020	26 Jul 11 12:46	Claudette
Nickel - Total	0.0136	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Selenium - Total	0.0937	mg/l	0.0020	6020	26 Jul 11 9:46	Claudette
Silver - Total	< 0.001	mg/l	0.0010	6020	25 Jul 11 16:18	Claudette
Thallium - Total	< 0.002	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Tin - Total	< 0.05	mg/l	0.0500	6020	25 Jul 11 16:18	Claudette
Vanadium - Total	0.3026	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Zinc - Total	0.0327	mg/l	0.0100	6020	25 Jul 11 16:18	Claudette
Uranium	< 0.002	mg/l	0.002	6020	25 Jul 11 16:18	Claudette

All analyses were performed on the extract from Method 1312 (SPLP) with a modified solution to solids ratio of 4:1.

Approved by: D. Zander

RL = Method Reporting Limit

Elevated "Less Than Result" (<): @ = Due to sample matrix
! = Due to sample quantity
= Due to sample concentration
+ = Due to extract volume

CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

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MEMBER ACIL

Report Date: 8 Sep 11
Lab Number: 11-M2452
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit I Fly Ash
Sample Site: MDU Heskett

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
SPLP Extraction				1312	22 Jul 11	SS
pH	12.9	units	N/A	SM4500 H+ B	22 Jul 11 17:00	Claudette
Specific Conductance	50660	umhos/cm	N/A	SM2510-B	22 Jul 11 17:00	Claudette
Total Suspended Solids	30	mg/l	1	SM2540-D	22 Jul 11 14:00	CLB
Total Alkalinity	7020	mg/l CaCO3	4	SM2320-B	25 Jul 11 17:00	Claudette
Phenolphthalein Alk	6900	mg/l CaCO3	4	SM2320-B	25 Jul 11 17:00	Claudette
Bicarbonate	< 4	mg/l CaCO3	4	SM2320-B	25 Jul 11 17:00	Claudette
Carbonate	240	mg/l CaCO3	4	SM2320-B	25 Jul 11 17:00	Claudette
Hydroxide	6780	mg/l CaCO3	0	SM2320-B	25 Jul 11 17:00	Claudette
Tot Dis Solids(Summation)	42200	mg/l	NA	SM1030-F	3 Aug 11 8:40	Calculated
Total Hardness as CaCO3	1750	mg/l	NA	SM2340-B	3 Aug 11 8:40	Calculated
Hardness in grains/gallon	102	gr/gal	NA	SM2340-B	3 Aug 11 8:40	Calculated
Cation Summation	663	meq/L	NA	SM1030-F	3 Aug 11 8:40	Calculated
Anion Summation	613	meq/L	NA	SM1030-F	28 Jul 11 14:30	Calculated
Percent Error	3.99	%	NA	SM1030-F	3 Aug 11 8:40	Calculated
Sodium Adsorption Ratio	143		NA	USDA 20b	3 Aug 11 8:40	Calculated
Gross Alpha Radiation	Attached	pCi/l			22 Aug 11 2:03	
Radon 222	Attached				28 Jul 11 4:37	
Radium 226	Attached	pCi/l			22 Aug 11 22:20	
Radium 228	Attached	pCi/l			16 Aug 11 16:50	
Total Organic Carbon	1.5	mg/l	0.5	SM5310-C	1 Aug 11 8:00	Eric
Fluoride	5.60	mg/l	0.10	SM4500-F-C	10 Aug 11 17:00	CLB
Sulfate	22600	mg/l	5.00	ASTM D516-02	27 Jul 11 9:00	KMP
Chloride	53.8	mg/l	1.0	SM4500-Cl-E	27 Jul 11 14:00	KMP
Nitrate-Nitrite as N	0.68	mg/l	0.10	EPA 353.2	28 Jul 11 14:30	KMP
Ammonia-Nitrogen as N	7.22	mg/l	0.10	EPA 350.1	28 Jul 11 10:45	KMP
Phosphorus as P - Total	< 0.1	mg/l	0.10	EPA 365.1	28 Jul 11 13:00	KMP
Mercury - Total	< 0.0002	mg/l	0.0002	EPA 245.1	28 Jul 11 8:00	Eric
Chemical Oxygen Demand	22.4	mg/l	5.0	HACH 8000	1 Aug 11 8:30	Wayne
Calcium - Total	700	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Magnesium - Total	< 25	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Sodium - Total	14100	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Potassium - Total	580	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Aluminum - Total	< 5	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Iron - Total	< 5	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Strontium - Total	59.5	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Titanium - Total	< 5	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Boron - Total	1.89	mg/l	0.10	6010	11 Aug 11 8:40	Stacy

RL = Method Reporting Limit

Elevated "Less Than Result" (<): @ = Due to sample matrix
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= Due to sample concentration
+ = Due to extract volume

CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

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www.mvtl.com

Report Date: 8 Sep 11
Lab Number: 11-M2452
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit I Fly Ash
Sample Site: MDU Heskett

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
Antimony - Total	< 0.002	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Arsenic - Total	0.1128	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Barium - Total	0.0906	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Beryllium - Total	< 0.001	mg/l	0.0010	6020	25 Jul 11 16:18	Claudette
Cadmium - Total	0.00244	mg/l	0.00100	6020	25 Jul 11 16:18	Claudette
Chromium - Total	0.0270	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Cobalt - Total	< 0.002	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Copper - Total	0.2934	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Lead - Total	0.0161	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Manganese - Total	0.0102	mg/l	0.0010	6020	25 Jul 11 16:18	Claudette
Molybdenum - Total	0.9246	mg/l	0.0020	6020	26 Jul 11 12:46	Claudette
Nickel - Total	0.0175	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Selenium - Total	0.1959	mg/l	0.0020	6020	26 Jul 11 9:46	Claudette
Silver - Total	< 0.001	mg/l	0.0010	6020	25 Jul 11 16:18	Claudette
Thallium - Total	< 0.002	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Tin - Total	< 0.05	mg/l	0.0500	6020	25 Jul 11 16:18	Claudette
Vanadium - Total	0.0158	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Zinc - Total	0.3984	mg/l	0.0100	6020	25 Jul 11 16:18	Claudette
Uranium	< 0.002	mg/l	0.002	6020	25 Jul 11 16:18	Claudette

All analyses were performed on the extract from Method 1312 (SPLP) with a modified solution to solids ratio of 4:1.

Approved by: D. Zarda

RL = Method Reporting Limit

Elevated "Less Than Result" (<): @ = Due to sample matrix
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+ = Due to extract volume

CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

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Report Date: 8 Sep 11
Lab Number: 11-M2453
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit II Fly Ash
Sample Site: MDU Heskett

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
SPLP Extraction				1312	22 Jul 11	SS
pH	12.8	units	N/A	SM4500 H+ B	22 Jul 11 17:00	Claudette
Specific Conductance	27240	umhos/cm	N/A	SM2510-B	22 Jul 11 17:00	Claudette
Total Suspended Solids	13	mg/l	1	SM2540-D	22 Jul 11 14:00	CLB
Total Alkalinity	4570	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Phenolphthalein Alk	4520	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Bicarbonate	< 4	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Carbonate	100	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Hydroxide	4470	mg/l CaCO3	0	SM2320-B	22 Jul 11 17:00	Claudette
Tot Dis Solids(Summation)	16000	mg/l	NA	SM1030-F	3 Aug 11 8:40	Calculated
Total Hardness as CaCO3	1960	mg/l	NA	SM2340-B	3 Aug 11 8:40	Calculated
Hardness in grains/gallon	115	gr/gal	NA	SM2340-B	3 Aug 11 8:40	Calculated
Cation Summation	252	meq/L	NA	SM1030-F	9 Aug 11 9:09	Calculated
Anion Summation	247	meq/L	NA	SM1030-F	28 Jul 11 14:30	Calculated
Percent Error	1.00	%	NA	SM1030-F	9 Aug 11 9:09	Calculated
Sodium Adsorption Ratio	46.1		NA	USDA 20b	3 Aug 11 8:40	Calculated
Gross Alpha Radiation	Attached	pCi/l			22 Aug 11 2:03	
Radon 222	Attached				28 Jul 11 4:37	
Radium 226	Attached	pCi/l			22 Aug 11 22:20	
Radium 228	Attached	pCi/l			16 Aug 11 16:50	
Total Organic Carbon	1.6	mg/l	0.5	SM5310-C	1 Aug 11 8:00	Eric
Fluoride	3.60	mg/l	0.10	SM4500-F-C	4 Aug 11 17:00	CLB
Sulfate	7400	mg/l	5.00	ASTM D516-02	27 Jul 11 9:00	KMP
Chloride	66.0	mg/l	1.0	SM4500-Cl-E	27 Jul 11 14:00	KMP
Nitrate-Nitrite as N	0.38	mg/l	0.10	EPA 353.2	28 Jul 11 14:30	KMP
Ammonia-Nitrogen as N	15.0	mg/l	0.10	EPA 350.1	28 Jul 11 10:45	KMP
Phosphorus as P - Total	< 0.1	mg/l	0.10	EPA 365.1	28 Jul 11 13:00	KMP
Mercury - Total	< 0.0002	mg/l	0.0002	EPA 245.1	28 Jul 11 8:00	Eric
Chemical Oxygen Demand	9.4	mg/l	5.0	HACH 8000	1 Aug 11 8:30	Wayne
Calcium - Total	785	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Magnesium - Total	< 5	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Sodium - Total	4720	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Potassium - Total	275	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Aluminum - Total	< 1	mg/l	0.10	6010	9 Aug 11 9:09	Stacy
Iron - Total	< 1	mg/l	0.10	6010	9 Aug 11 9:09	Stacy
Strontium - Total	85.0	mg/l	0.10	6010	9 Aug 11 9:09	Stacy
Titanium - Total	< 1	mg/l	0.10	6010	9 Aug 11 9:09	Stacy
Boron - Total	< 1	mg/l	0.10	6010	11 Aug 11 8:40	Stacy

RL = Method Reporting Limit

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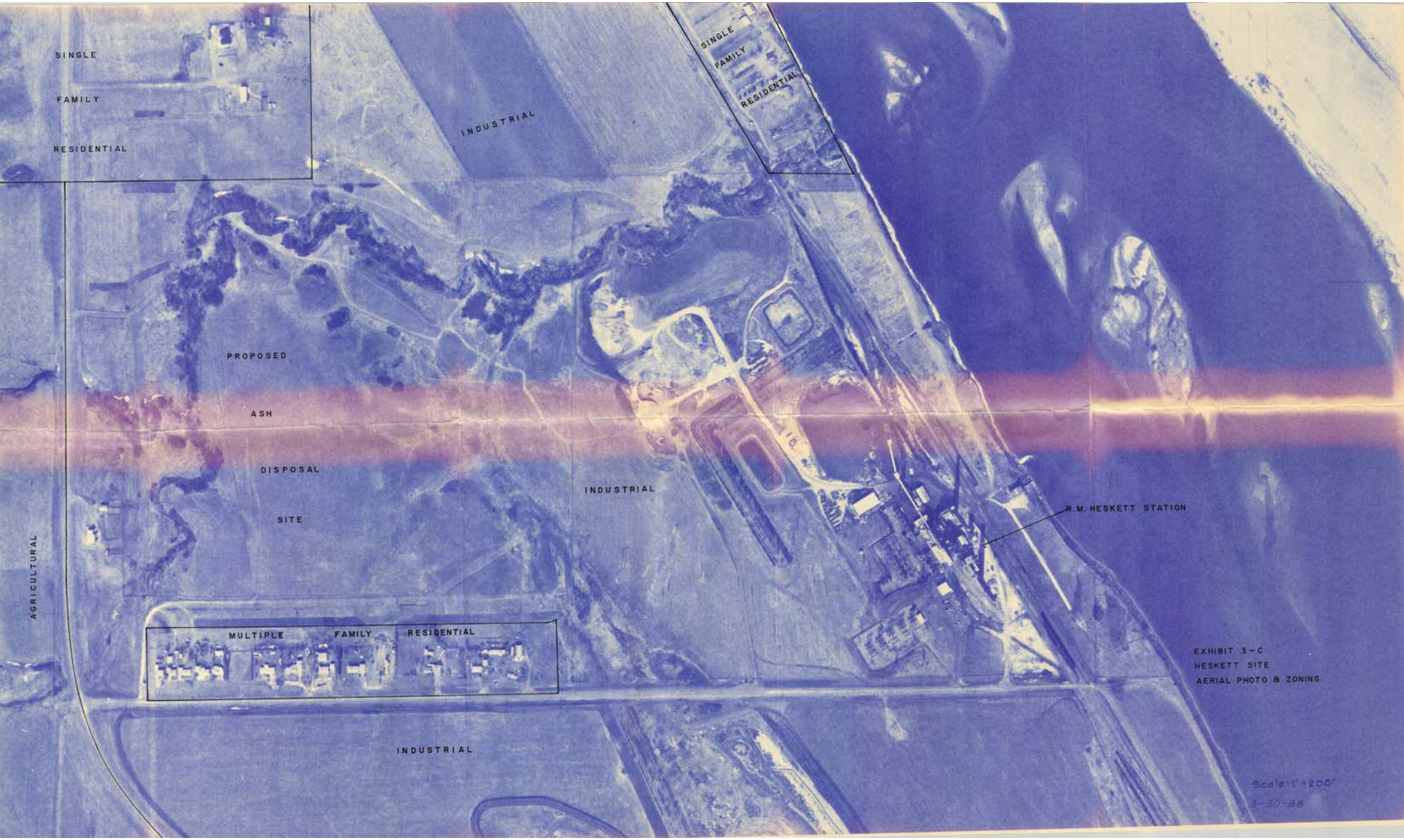
+ = Due to extract volume

CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

Appendix D

Aerial Photo (March 30, 1988)


SINGLE
FAMILY
RESIDENTIAL
INDUSTRIAL
SINGLE
FAMILY
RESIDENTIAL
PROPOSED
ASH
DISPOSAL
SITE
INDUSTRIAL
R.M. HESKETT STATION
AGRICULTURAL
MULTIPLE FAMILY RESIDENTIAL
INDUSTRIAL
EXHIBIT 3-C
HESKETT SITE
AERIAL PHOTO & ZONING
Scale 1"=200'
1-30-88

Appendix E

Boring Logs

EXHIBIT 5-E

LITHOLOGIC LOGS

Wells 10, 11, 12 and 13

0-1	Top soil, silty, clayey, sandy, brown, calcareous; with some limestone pebbles.
1-11	Silt, clayey, brownish-tan, slightly indurated, very dry, calcareous; with thin coarse-grained, clean silt lenses and a few small (less than .5 in.) iron oxide concretions. Abundant small gypsum crystals (less than .13 in. long). Some small, black flakes of organic plant material. Cannonball-Ludlow Formations.
11-14	Silt, as above, with some (less than 20%) very fine- to fine-grained sand interspersed.
14-30	Silt, as above, clayey, less sand than above interval, oxidized; with very fine-grained silty sand lenses and very few gypsum crystals.
30-41	Silt, very clayey, with some (less than 20%) very fine-grained sand interspersed, steel-gray (color change), moderately indurated; with fewer small gypsum crystals than above intervals.
41-59	Silt, as above, very clayey, with some (less than 20%) fine- to medium-grained sand interspersed in a silt and clay matrix.
59-65	Silt, as above, with abundant (more than 20%) fine- to medium-grained sand interspersed.
65-81	Silt, clayey, steel-gray to bluish, moderately indurated; with thin coarse-grained silt to very fine-grained sand lenses in an otherwise fine silt to clay matrix.
81-84	Clay, silty, steel-gray to bluish, moderately indurated, dense.
84-91	Siltstone, sandy, clayey, steel-gray to bluish, slightly indurated; with small fine-grained sand lenses and abundant (more than 20%) sand interspersed in the matrix.
91-110	Silt, clayey, bluish-gray, moderately indurated; with thin (less than 1 foot) mudstone lenses.
110-120	Silt, very clayey, steel-gray to bluish, moderately indurated, very dense. Cannonball-Ludlow Formations.

Wells 20 and 21

0-1	Top soil, silty, sandy, clayey, dark-brown, calcareous; with some limestone and granite pebbles.
1-21	Silt, clayey, with minor amounts (less than 10%) of very fine-grained sand interspersed, brownish-tan, slightly indurated, calcareous, oxidized; with small iron oxide concretions and abundant small gypsum crystals. Cannonball-Ludlow Formations.
21-26	Silt, as above, steel-gray (color change).
26-49	Silt, clayey, with some (less than 20%) very fine- to medium-grained sand interspersed, steel-gray to bluish, slightly indurated; with very few small gypsum crystals and some thin (less than 1 foot) siltstone lenses.
49-53	Silt, as above, with abundant (more than 20%) fine- to medium-grained sand interspersed.
53-63	Silt, as above, clayey, less sand, with thin (less than 1 foot) siltstone to mudstone lenses.
63-80	Silt, very clayey, steel-gray to bluish, moderately indurated, very dense. Cannonball-Ludlow Formations.

Wells 30, 31, 32 and 33

0-1	Top soil, silty, sandy, brownish, calcareous; with some granite and limestone pebbles.
1-2	Pebble-loam (glacial till), silty, sandy, clayey, yellowish-brown, dry, calcareous.
2-31	Silt, clayey, with minor amounts (less than 10%) of very fine-grained sand interspersed, brownish-tan, slightly indurated, calcareous, oxidized; with small iron oxide concretions. Some small, black flakes organic plant material. Cannonball-Ludlow Formations.
31-44	Silt, clayey, steel-gray (color change), slightly indurated, calcareous; with small iron oxide concretions, thin coarse silt lenses, small gypsum crystals and gray to reddish-brown mottling.

44-61	Silt, as above, with some (less than 20%) fine- to medium-grained sand interspersed.
61-65	Silt, as above, with abundant (more than 20%) fine- to medium-grained sand interspersed, dense.
65-76	Silt, as above, clayey, less sand, some thin (less than 1 foot) lenses of siltstone to mudstone.
76-80	Siltstone, sandy, clayey, steel-gray to bluish, slightly indurated; with small fine-grained sand lenses and abundant (more than 20%) fine-grained sand interspersed in the matrix.
80-92	Silt, clayey, steel-gray to bluish, moderately indurated, with some (less than 20%) very fine- to fine grained sand interspersed.
92-120	Silt, very clayey, steel-gray to bluish, moderately indurated, very dense. Cannonball-Ludlow Formations.

Well 40

0-1	Top soil, sandy, silty, brownish-tan, calcareous; with some granite and limestone pebbles.
1-5	Pebble-loam (glacial till), sandy, silty, with detrital lignite and organic matter, yellowish-brown, very dry, calcareous.
5-22	Sand, very fine- to medium-grained, unconsolidated, with thin lenses of clay and detrital lignite, brownish-yellow, calcareous.
22-40	Silt, clayey, with minor amounts (less than 10%) very fine-grained sand interspersed, brownish-tan, slightly indurated, calcareous, oxidized; with small iron oxide concretions and small gypsum crystals; Cannonball-Ludlow Formations.
40-51	Silt, clayey, with minor amounts (less than 10%) of very fine-grained sand interspersed, steel-gray (color change), moderately indurated; with some reddish-brown mottling and some very thin (less than 6 inches) mudstone lenses.
51-58	Silt, as above, with abundant (more than 20%) fine-grained sand and thin silty-clay lenses.

58-62	Siltstone, sandy, clayey, steel-gray to bluish, moderately indurated; with small fine-grained sand lenses and abundant (more than 20%) sand interspersed in the matrix.
62-70	Silt, clayey, with some (less than 20%) fine- to medium-grained sand interspersed, steel-gray to bluish, moderately indurated; with thin (less than 2 feet) sandy lenses.
70-80	Silt, as above, very clayey, some (less than 10%) fine-grained sand interspersed; less sand than above interval.
80-120	Silt, as above, dark-steel-gray. Cannonball-Ludlow Formations.

Wells 41, 42 and 43

0-1	Top soil, sandy, silty, dark-brown, calcareous; with some granite and limestone pebbles.
1-4	Pebble-loam (glacial till), sandy, silty, clayey, yellowish-brown, very dry, calcareous.
4-40	Silt, clayey, with some (less than 20%) very fine-grained sand interspersed, brownish-tan, unconsolidated, noncompacted, calcareous to 25 feet, oxidized; with small iron oxide concretions and abundant small gypsum crystals. Cannonball-Ludlow Formations.
40-51	Silt, clayey, with minor amounts (less than 10%) of very fine-grained sand interspersed, steel-gray (color change), moderately indurated; with some reddish-brown mottling and some very thin (less than 6 inches) mudstone lenses.
51-58	Silt, as above, with abundant (more than 20%) fine-grained sand and thin silty-clay lenses.
58-62	Siltstone, sandy, clayey, steel-gray to bluish, moderately indurated; with small fine-grained sand lenses and abundant (more than 20%) sand interspersed in the matrix.
62-70	Silt, clayey, with some (less than 20%) fine- to medium-grained sand interspersed, steel-gray to bluish, moderately indurated; with thin (less than 2 feet) sandy lenses.

70-80	Silt, as above, very clayey, some (less than 10%) fine-grained sand interspersed; less sand than above interval.

Wells 43 and 44

0-2	Top soil, clayey, silty, some sand, brownish-tan to light-gray, calcareous.
2-20	Silt, clayey, with some (less than 20%) fine-grained sand interspersed, brownish-tan, slightly indurated, very dry, calcareous; with small iron oxide concretions, abundant small gypsum crystals and occasional thin silt lenses. Cannonball-Ludlow Formations.
20-25	Silt, as above, very clayey, oxidized, with minor amounts (less than 10%) of fine-grained sand.
25-35	Silt, as above, dark-brownish-tan to bluish-gray (color change), with thin very fine-grained sand lenses.
35-60	Silt, clayey, with some (less than 20%) fine- to medium-grained sand interspersed, steel-gray to bluish, moderately indurated; with some indurated silty sand lenses. Cannonball-Ludlow Formations.

Wells 50, 51 and 52

0-4	Top soil, clayey, silty, very dark-brown.
4-10	Clay, silty, with some (less than 20%) fine-grained sand, dark-brownish-tan, soft, cohesive, wet, sticky; with some pebbles.
10-22	Silt, very clayey, with some (less than 20%) very fine-grained sand interspersed, brownish-tan, slightly indurated, calcareous, dense; with abundant small gypsum crystals and very thin silt and sand lenses; Cannonball-Ludlow Formations.
22-23	Sandstone, fine-grained, silty, indurated, oxidized, dark-brown.
23-30	Silt, very clayey, with some (less than 20%) very fine-grained sand interspersed, steel-gray (color change), moderately indurated; with thin medium grained sand lenses.

30-40	Silt, as above, very clayey, less sand than above interval, dark-steel-gray. Cannonball-Ludlow Formations.

Wells 53 and 54

0-4	Top soil, clayey, silty, very dark-brown, wet, sticky.
4-15	Clay, silty, with some (less than 20%) fine- to medium-grained sand interspersed, brownish-tan, slightly indurated, dry, calcareous; with small iron oxide concretions, small gypsum crystals and occasional reddish-brown mottling; Cannonball-Ludlow Formations.
15-20	Sand, very fine-grained to medium-grained, silty, clayey, unconsolidated, yellowish-brown, oxidized.
20-30	Silt, clayey, with some (less than 20%) fine-grained sand interspersed, steel-gray (color change), slightly indurated; with clay and sand lenses, some small concretions and some small gypsum crystals.
30-45	Silt, as above, very clayey.
45-60	Silt, as above, clayey, brownish-gray, moderately indurated, some reddish-brown mottling. Cannonball-Ludlow Formations.

Wells 55 and 56

0-5	Sandy-loam (glacial), with fine- to medium-grained sand, silty, calcareous; with small granite and limestone pebbles.
5-26	Clay, silty, with minor amounts (less than 10%) of very fine-grained sand, dark-brownish-tan, moderately indurated, brittle, very dry, calcareous; with small iron oxide concretions, small gypsum crystals and occasional thin sandstone laminae. Some small, black flakes of organic plant material. Cannonball-Ludlow Formations.
26-35	Clay, as above, very silty, sandy, brownish-tan, oxidized.

35-40 Silt, clayey, with some (less than 20%) very fine- to fine-grained sand interspersed, steel-gray (color change) moderately indurated; with small gypsum crystals and occasional clay lenses.

40-60 Silt, as above, with minor amounts (less than 10%) of fine-grained sand interspersed.

60-85 Silt, as above, clayey, less sand than above interval.

85-100 Silt, as above, very clayey, with minor amounts (less than 10%) of sand interspersed, light-gray. Cannonball-Ludlow Formations.

Wells 60, 61 and 62

0-2 Top soil, silty, clayey, dark-brown to tanish-brown, calcareous.

2-25 Silt, very clayey, with some minor amounts (less than 10%) of very fine- to fine-grained sand interspersed, brownish-tan, slightly indurated, dry, calcareous; with abundant small gypsum crystals and thin silt and sand lenses; Cannonball-Ludlow Formations.

25-29 Silt, as above, with abundant (more than 20%) fine- to medium-grained sand interspersed.

29-36 Silt, as above, clayey, less sand than above interval, dark-brownish-tan, oxidized.

36-60 Silt, very clayey, with some (less than 20%) very fine-grained sand interspersed, steel-gray (color change), moderately indurated; with thin (less than 1 foot) sandy-silt lenses. Cannonball-Ludlow Formations.

Well 70 0-2 Pebble-loam (glacial till), clayey, sandy, yellowish-brown, unconsolidated, damp, calcareous.

2-21 Silty, clayey, with some (less than 20%) fine-grained sand interspersed, brownish-tan, moderately indurated, very dry, calcareous, oxidized; with small iron oxide concretions and abundant small gypsum crystals. Cannonball-Ludlow Formations.

21-24	Shale, silty, steel- to dark-gray (color change), indurated, fissile, very dry; with occasional thin silt and sand lenses.
24-31	Silt, clayey, with abundant (more than 30%) sand, steel-gray, moderately indurated.
31-62	Silt, clayey, with some (less than 20%) very fine- to fine- grained sand interspersed, steel-gray, moderately indurated; with some small gypsum crystals and small iron oxide concretions.
62-76	Silt, as above, with some (less than 20%) fine-grained sand interspersed.
76-82	Silt, as above, with abundant (more than 20%) fine- to medium-grained sand.
82-100	Silt, as above, clayey, with some (less than 20%) fine-grained sand interspersed, dark-gray. Cannonball-Ludlow Formations.

The litnologic logs for wells 1-4 were described by personal from Water Supply Incorporated (WS), Bismarck, North Dakota. The wells were installed during a previous ground water investigation at Heskett Station.

Well WS 2

0-1	Top soil, silty, black.
1-4	Pebble-loam (glacial till), silty, clayey, some cobbles, yellowish-brown.
4-7	Gravel, sand and rocks.
7-21	Sand, fine- to coarse-grained, some pebbles.
21-39	Clay, silty, sandy, yellowish-brown to gray.
39-52	Clay, silty, sandy, gray.
52-67	Sand, fine-grained, bluish, with some clay layers.
67-89	Clay, silty, sandy, brown to gray.

Wells WS 1, 1A and 1B

0-1	Top soil, silty, black
1-4	Clay, (glacial), silty, with pebbles, yellowish-brown.
4-21	Sand, fine- to medium-grained, yellowish-brown; with clay and silt lenses.
21-25	Clay, silty, yellowish-brown.
25-30	Sand, fine-grained, yellowish-brown, some indurated layers.
30-35	Clay, silty, yellowish-brown.
35-45	Sand, fine-grained, yellowish-brown.
45-50	Clay, silty, sandy, gray, about 50 percent shale.
50-56	Sand, fine-grained, with clay layers.
56-73	Clay, silty, sandy, gray.

WEll WS 4, 4A and 4B

0-13	Pebble-loam (glacial till), silty, sandy, with some cobbles, yellowish-brown.
13-23	Sand, fine- to medium-grained, yellowish-brown.
23-25	Slay, silty, sandy, yellowish-brown.
25-27	Sandstone, indurated.
27-30	Clay, sandy, silty, gray.
30-36	Sand, fine-grained, gray.
36-52	Clay, silty, sandy, gray; with some sand layers.

Wells WS 3 and 3A

0-1	Top soil, silty, black.
1-12	Pebble-loam, clayey, silty, with some cobbles, yellowish-brown.
12-16	Clay, silty, gray; with some shale layers.
16-18	Limestone, indurated.
18-23	Clay, silty, yellowish-brown; with some sand layers.
23-44	Sand, fine- to medium-grained, gray; with some clay layers.
44-50	Clay, silty, medium-gray.

Barr Engineering Company
234 West Century Avenue
Bismarck, ND 58503
Telephone: 701-255-5460

LOG OF BORING MW-44 R

Project:Heskett Station
Project No.:34301012
Location:Mandan, ND
Coordinates:Lat: 46.86620° Long: -100.89313°
Datum:

Surface Elevation:
Drilling Method:HSA
Sampling Method:Split Spoon
Completion Depth:46.0 ft

Unique Well No.:MW-44 R

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION
0		1	3-3-5-8.	OL/OH		0-1': TOPSOIL (OL/OH): Very Dark Brown (2.5/2 7.5YR); low to medium plasticity; roots, fine to medium grained sand.
						1-46': SANDY CLAY (CL): Brown (5/4 7.5YR) to Dark Gray (4/1 7.5YR); medium to high plasticity; massive; fine to medium grained sand. Moist; 20% gravel, 30% sand, 50% fines. At 1-5': Gravel sized inclusions.
		2	9-9-7-7.			Moist; 10% gravel, 20% sand, 70% fines.
5		3	7-5-5-7.			Moist; 0% gravel, 30% sand, 70% fines.
		4	7-9-11-13.			Moist; 0% gravel, 20% sand, 80% fines.
		5	7-9-12-13.			At 8': Oxidized staining.
10		6	6-7-11-13.			
		7	7-10-12-14.	CL		
15		8	6-10-14-14.			
20		9	10-10-13-16.			At 20': Interbedded layer of sand.
25		10	10-10-12-16.	CL		(CL): At 24': Color change to dark brown (3/3 7.5YR). Moist; 0% gravel, 20% sand, 80% fines. At 25': Sand lens.

WELL OR PIEZOMETER CONSTRUCTION DETAIL

PRO. CASING
Diameter: 4" by 4"
Type: Steel
Interval: 3' up & 3' down

RISER CASING
Diameter: 2"
Type: Schd 40 PVC
Interval: Stick up to screen (23')

GROUT
Type: Cement
Interval: 0-0.5' BGS

SEAL
Type: Bentonite Chips
Interval: 0.5-21' BGS

SANDPACK
Type: Granusil
Interval: 21-46' BGS

SCREEN
Diameter: 2"
Type: No. 10 Slot
Interval: 23-43' BGS

Elevation, feet

Date Boring Started: 10/20/14
Date Boring Completed: 10/20/14
Logged By: JEG3
Drilling Contractor: Midwest Testing (Terracon)
Drill Rig:

Remarks: Water encountered at 28.7' BGS in MW-44R while drilling on 10/2014

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
234 West Century Avenue
Bismarck, ND 58503
Telephone: 701-255-5460

LOG OF BORING MW-44 R

Project:Heskett Station
Project No.:34301012
Location:Mandan, ND
Coordinates:Lat: 46.86620° Long: -100.89313°
Datum:

Surface Elevation:
Drilling Method:HSA
Sampling Method:Split Spoon
Completion Depth:46.0 ft

Unique Well No.:MW-44 R

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
30		11	8-12-14-18.	CL		(CL): At 24': Color change to dark brown (3/3 7.5YR). *(continued)* Wet; 0% gravel, 20% sand, 80% fines. At 30.5': Sand lens.		
35		12	8-13-16-27.			(CL): At 32': Color change to dark gray (4/1 7.5YR).		
40		13	11-19-25-27.	CL				
45		14	14-18-27-34.	SC		(SC): At 45.8': Clayey Sand (SC), fine to medium grained, low to medium plasticity, dark greenish gray (4/10G Gley 2).		
50								
55								

PRO. CASING
Diameter: **4" by 4"**
Type: **Steel**
Interval: **3' up & 3' down**

RISER CASING
Diameter: **2"**
Type: **Schd 40 PVC**
Interval: **Stick up to screen (23')**

GROUT
Type: **Cement**
Interval: **0-0.5' BGS**

SEAL
Type: **Bentonite**
Interval: **Chips 0.5-21' BGS**

SANDPACK
Type: **Granusil**
Interval: **21-46' BGS**

SCREEN
Diameter: **2"**
Type: **No. 10 Slot**
Interval: **23-43' BGS**

Date Boring Started: 10/20/14
Date Boring Completed: 10/20/14
Logged By: JEG3
Drilling Contractor: Midwest Testing (Terracon)
Drill Rig:

Remarks: Water encountered at 28.7' BGS in MW-44R while drilling on 10/2014

Additional data may have been collected in the field which is not included on this log.
Weather:

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State of North Dakota

BOARD OF WATER WELL CONTRACTORS

900 E. BOULEVARD • BISMARCK, NORTH DAKOTA 58505

MONITORING WELL REPORT

State law requires that this report be filed with the State Board of Water Well Contractors within 30 days after completion or abandonment of the well.

1. WELL OWNER

Name MDU-Heskett Station

Address 2025 38th Street

Mandan, North Dakota

2. WELL LOCATION **(MW-44R)**

Address (if in city) (see attached drawing)

County Morton

SE ¼ SE ¼ SW ¼ Sec. 10 Twp. 139 N. Rge. 81 W.

Lat. 46.86620 Long.: -100.89313

Altitude:

3. METHOD DRILLED

■ Auger Other

4. WELL CONSTRUCTION

Diameter of Hole 8 inches Depth 46 feet

Riser: ■ PVC □ Other

■ Threaded □ Solvent □ Other

Riser rating SDR Schedule 40

Diameter 2.0 inches

From +2 ft. to 23 ft.

Was a well screen installed? ■ Yes □ No

Material Schedule 40 PVC Diameter 2.0 inches

Slot Size #10 set from 23 feet to 43 feet

Sand packed from 21 ft to 46 ft

Depth grouted from 1 ft to 21 ft

Grouting Material

Bentonite x Other

If other explain:

One foot concrete collar at surface

Well head completion:

24" above grade Other x

If other, specify 4" x 4" x 5' steel cover

Was protective casing installed? ■ Yes □ No

Was well disinfected upon completion? □ Yes ■ No

5. WATER LEVEL

Static water level 28.5 feet below surface

If flowing: closed in pressure psi or ft. above land surface

6. WELL LOG

Formation	Depth (Ft.) From	To
Topsoil	0	0.5
Sandy lean clay	0.5	5
Sandy fat clay	5	46

(Use separate sheet if necessary)

7. WAS THE HOLE PLUGGED OR ABANDONED?

□ Yes ■ No

If so, how?

8. REMARKS

3 steel bumpers installed around well head

9. DATE COMPLETED 10-21-14

10. CONTRACTOR CERTIFICATION

This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

Midwest Testing Laboratory, Inc. 444

Monitoring Well Contractor Certificate No.

P.O. Box 2084, Bismarck, ND 58502-2084

Address

Signature 10-22-14

Date

Barr Engineering Company
234 West Century Avenue
Bismarck, ND 58503
Telephone: 701-255-5460

LOG OF BORING MW-80 R

SHEET 1 OF 1

Project:Heskett Station
Project No.:34301012
Location:Mandan, ND
Coordinates:Lat: 46.86789° Long: -100.89320°
Datum:

Surface Elevation:
Drilling Method:HSA
Sampling Method:Split Spoon
Completion Depth:27.0 ft

Unique Well No.:MW-80 R

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0				OL/OH		0-0.5': TOPSOIL (OL/OH): Black; organic roots.		
		1	4-4-4-5.			0.5-27': SANDY CLAY (CL): Brown (4/4 7.5 YR) to Black (2.5/1 7.5YR); medium to high plasticity; fine to medium grained sand. Moist; 0% gravel, 30% sand, 70% fines.	PRO. CASING Diameter: 4" by 4" Type: Steel Interval: 3' up & 3' down	
		2	4-5-7-9.			At 2': Gravel inclusions. Moist; 10% gravel, 30% sand, 60% fines.		
5		3	4-4-5-8.	CL		Moist; 0% gravel, 20% sand, 80% fines.	RISER CASING Diameter: 2" Type: Schd 40 PVC Interval: Stick up to screen (7')	
		4	4-4-6-6.					
		5	3-4-5-6.	CL		(CL): At 8': Color change to 2.5/1 7.5YR black, no odor.	GROUT Type: Cement Interval: 0-0.5' BGS	
10		6	1-3-3-4.	CL		(CL): At 9': Color change to 2.5/2 7.5YR very dark brown. Moist; 0% gravel, 20% sand, 80% fines.	SEAL Type: Bentonite Interval: Chips 0.5-5' BGS	
		7	1-1-2-1.	CL		(CL): At 11': Color change to 3/3 7.5YR dark brown. Moist; 0% gravel, 20% sand, 80% fines.	SANDPACK Type: Granusil Interval: 5-27' BGS	
15		8	1-2-2-1.			(CL): At 13': Color change to 4/4 7.5YR brown. Wet; 0% gravel, 20% sand, 80% fines.	SCREEN Diameter: 2" Type: No 10 Slot Interval: 7-27' BGS	
20		9	7-11-12-17.	CL		At 21': Thin sand lens less than 0.1" thick. Wet; 0% gravel, 20% sand, 80% fines. At 21.5': Thin sand lens less than 0.1" thick.		
25		10	7-11-17-17.			Wet; 0% gravel, 20% sand, 80% fines. At 26.5': Thin sand lens less than 0.1" thick.		

Date Boring Started: 10/20/14
Date Boring Completed: 10/20/14
Logged By: JEG3
Drilling Contractor: Midwest Testing (Terracon)
Drill Rig:

Remarks: Water encountered at 11.8' BGS in MW-80R while drilling on 10/20/14

Additional data may have been collected in the field which is not included on this log.
Weather:

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State of North Dakota

BOARD OF WATER WELL CONTRACTORS

900 E. BOULEVARD • BISMARCK, NORTH DAKOTA 58505

MONITORING WELL REPORT

State law requires that this report be filed with the State Board of Water Well Contractors within 30 days after completion or abandonment of the well.

1. WELL OWNER

Name MDU-Heskett Station

Address 2025 38th Street

Mandan, North Dakota

2. WELL LOCATION **(MW-80R)**

Address (if in city) (see attached drawing)

County Morton

NE ¼ SE ¼ SW ¼ Sec. 10 Twp. 139 N. Rge. 81 W.

Lat. 46.86789 Long.: -100.89320

Altitude:

3. METHOD DRILLED

■ Auger Other

4. WELL CONSTRUCTION

Diameter of Hole 8 inches Depth 27 feet

Riser: ■ PVC □ Other

■ Threaded □ Solvent □ Other

Riser rating SDR Schedule 40

Diameter 2.0 inches

From +2.5 ft. to 7 ft.

Was a well screen installed? ■ Yes □ No

Material Schedule 40 PVC Diameter 2.0 inches

Slot Size #10 set from 7 feet to 27 feet

Sand packed from 5 ft to 27 ft

Depth grouted from 1 ft to 5 ft

Grouting Material

Bentonite x Other

If other explain:

One foot concrete collar at surface

Well head completion:

24" above grade Other x

If other, specify 4" x 4" x 5' steel cover

Was protective casing installed? ■ Yes □ No

Was well disinfected upon completion? □ Yes ■ No

5. WATER LEVEL

Static water level 12 feet below surface

If flowing: closed in pressure psi or ft. above land surface

6. WELL LOG

Formation	Depth (Ft.) From	To
Topsoil	0	0.5
Sandy lean clay	0.5	27

(Use separate sheet if necessary)

7. WAS THE HOLE PLUGGED OR ABANDONED?

□ Yes ■ No

If so, how?

8. REMARKS

3 steel bumpers installed around well head

9. DATE COMPLETED 10-21-14

10. CONTRACTOR CERTIFICATION

This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

Midwest Testing Laboratory, Inc. 444

Monitoring Well Contractor Certificate No.

P.O. Box 2084, Bismarck, ND 58502-2084

Address

Signature 10-22-14

Date

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING MW-101
DRAFT

Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438844.919° Long: 1868647.777°
Datum:NAD 83

Surface Elevation:1716.6 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:58.0 ft

Unique Well No.:

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0						TOPSOIL: Brown (5/4 7.5YR).		
		1	4-4-4-6.			SANDY LEAN CLAY WITH GRAVEL (CL): fine to medium grained; Brown (5/3 7.5YR); moist; thinly laminated; some mottling; low plasticity; [Cannonball Formation].	PRO. CASING Diameter: **4"** Type: **Steel pipe** Interval: **3.5' ags - 1.5' bgs**	1715
		2	4-6-6-7.			At 2': Start to see gravel inclusions.		
5		3	7-9-14-16.			At 4': Oxidized staining. At 5': Oxidized staining.	RISER CASING Diameter: **2"** Type: **PVC SCH 80** Interval: **2.98' ags - 34' bgs**	1710
		4	8-9-12-15.			At 7': Oxidized staining and white staining.	GROUT Type: **Neat cement** Interval: **0 - 29' bgs**	
		5	10-15-21-26.				SEAL Type: **Bentonite chips** Interval: **29 - 32' bgs**	
10		6	7-18-24-27.	CL		At 11': Oxidized staining.	SANDPACK Type: **Silica 40-70** Interval: **32 - 56' bgs**	1705
		7	8-12-19-23.					
15		8	8-14-18-23.			At 15': Gypsum. 16-20': No recovery.	SCREEN Diameter: **2"; No.6 slot** Type: **PVC SCH 80** Interval: **34 - 54' bgs**	1700
20		9	7-10-13-15.			At 20.5': Gypsum. LEAN CLAY (CL): Dark Brown (3/2 7.5YR); oxidized staining, some mottling; medium to high plasticity; [Cannonball Formation].		1695
		10	7-9-13-15.	CL		At 22': Color change to Brown (4/2 7.5YR). At 24': Interbedded sand, fine grained.		
25								

Date Boring Started: 8/18/15
Date Boring Completed: 8/19/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: Hole caved in from 56 - 58' bgs.
DTW = 36.66' TOR on 9/23/2015 (elev. 1682.87)

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING MW-101
DRAFT

Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438844.919° Long: 1868647.777°
Datum:NAD 83

Surface Elevation:1716.6 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:58.0 ft

Unique Well No.:

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
25		11	7-11-13-15.	CL		LEAN CLAY (CL): Dark Brown (3/2 7.5YR); oxidized staining, some mottling; medium to high plasticity; [Cannonball Formation]. *(continued)* At 25' and 25.5': Gypsum.		
		12	8-11-15-19.			At 26.5': Gypsum.	PRO. CASING Diameter: **4"** Type: **Steel pipe** Interval: **3.5' ags - 1.5' bgs**	1690
		13	8-11-13-15.				RISER CASING Diameter: **2"** Type: **PVC SCH 80** Interval: **2.98' ags - 34' bgs**	
30		14	6-11-14-17.			At 29.5': Gypsum.		1685
		15	8-13-17-22.			At 33': Gypsum.	GROUT Type: **Neat cement** Interval: **0 - 29' bgs**	
35		16	8-14-19-21.			At 34.5': Gypsum. At 35.5-36': Color change to Black (2.5/1 7.5YR), turns back to brown.	SEAL Type: **Bentonite chips** Interval: **29 - 32' bgs**	1680
		17	11-16-20-27.	CH		FAT CLAY (CH): Black (2.5/1 7.5YR); very stiff; hight plasticity; wet at 43'; [Cannonball Formation].	SANDPACK Type: **Silica 40-70** Interval: **32 - 56' bgs**	
		18	9-13-20-25.			At 38': Oxidized staining.	SCREEN Diameter: **2"; No.6 slot** Type: **PVC SCH 80** Interval: **34 - 54' bgs**	
40		19	7-14-23-26.			At 41': Oxidized staining.		1675
		20	9-16-23-26.					
45								1670
50								

Date Boring Started: 8/18/15
Date Boring Completed: 8/19/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: Hole caved in from 56 - 58' bgs.
DTW = 36.66' TOR on 9/23/2015 (elev. 1682.87)

Additional data may have been collected in the field which is not included on this log.
Weather:

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Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING MW-101
DRAFT

Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438844.919° Long: 1868647.777°
Datum:NAD 83

Surface Elevation:1716.6 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:58.0 ft

Unique Well No.:

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
50				CH		FAT CLAY (CH): Black (2.5/1 7.5YR); very stiff; hight plasticity; wet at 43'; [Cannonball Formation]. *(continued)*	PRO. CASING Diameter: **4"** Type: **Steel pipe** Interval: **3.5' ags - 1.5' bgs** RISER CASING Diameter: **2"** Type: **PVC SCH 80** Interval: **2.98' ags - 34' bgs** GROUT Type: **Neat cement** Interval: **0 - 29' bgs** SEAL Type: **Bentonite chips** Interval: **29 - 32' bgs** SANDPACK Type: **Silica 40-70** Interval: **32 - 56' bgs** SCREEN Diameter: **2"; No.6 slot** Type: **PVC SCH 80** Interval: **34 - 54' bgs**	1665
55								1660
						End of boring 58.0 feet		
60								
65								
70								
75								

Date Boring Started: 8/18/15
Date Boring Completed: 8/19/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: Hole caved in from 56 - 58' bgs.
DTW = 36.66' TOR on 9/23/2015 (elev. 1682.87)

Additional data may have been collected in the field which is not included on this log.
Weather:

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LOG OF BORING MW-102
DRAFT

Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438161.145° Long: 1868782.871°
Datum:NAD 83

Surface Elevation:1703.8 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:46.0 ft

Unique Well No.:

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0						TOPSOIL: Brown (5/4 7.5YR).		
		1	3-3-3-2.			LEAN CLAY (CL): medium grained; Brown (4/3 7.5YR); moist; low to medium plasticity; with gravel to 4'; [Cannonball Formation].	PRO. CASING Diameter: **4"** Type: **Steel pipe** Interval: **3.5' ags - 1.5' bgs**	
		2	3-2-2-3.					1700
5		3	3-3-4-5.	CL			RISER CASING Diameter: **2"** Type: **PVC SCH 80** Interval: **2.85' ags - 10' bgs**	
		4	3-4-5-7.				GROUT Type: **None** Interval: **None**	
		5	4-8-7-4.					1695
				ML		SANDY SILT WITH GRAVEL (ML): Strong Brown (5/6 7.5YR); fine to coarse sand, fine to medium gravel, unconsolidated; [Cannonball Formation].		
10						LEAN CLAY WITH GRAVEL (CL): fine to medium grained; Brown (5/3 7.5YR); some mottling; medium plasticity; [Cannonball Formation].	SEAL Type: **Bentonite chips** Interval: **0 - 8' bgs**	
		6	4-3-5-9.	CL				
		7	3-5-7-9.			LEAN CLAY (CL): Dark Brown (3/2 7.5YR); medium to high plasticity; [Cannonball Formation].	SANDPACK Type: **Silica 40-70** Interval: **8 - 31' bgs**	
	▼							1690
15		8	6-8-12-14.				SCREEN Diameter: **2"; No.6 slot** Type: **PVC SCH 80** Interval: **20 - 30' bgs**	▼
		9	6-10-12-16.					
				CL				
		10	5-9-14-16.					1685
20								
		11	5-12-15-18.			At 21': Color changes to Black (2.5/1).		
		12	9-15-18-22.					
								1680
25								

Date Boring Started: 8/18/15
Date Boring Completed: 8/18/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: Lithological descriptions for a hole that was abandoned. Monitoring well blind drilled and installed next to abandoned hole.
DTW = 17.09' TOR on 8/21/2015 (elev. 1689.51

Additional data may have been collected in the field which is not included on this log.
Weather:

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Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING MW-102
DRAFT

Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438161.145° Long: 1868782.871°
Datum:NAD 83

Surface Elevation:1703.8 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:46.0 ft

Unique Well No.:

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
25		13	9-14-19-22.			LEAN CLAY (CL): Dark Brown (3/2 7.5YR); medium to high plasticity; [Cannonball Formation]. *(continued)*	PRO. CASING Diameter: **4"** Type: **Steel pipe** Interval: **3.5' ags - 1.5' bgs**	
		14	10-17-18-24.					
		15	6-15-18-26.			At 29': Gypsum.		1675
30		16	7-14-18-22.				RISER CASING Diameter: **2"** Type: **PVC SCH 80** Interval: **2.85' ags - 10' bgs**	
		17	11-16-20-27.			At 33.5' and 34': Gypsum.	GROUT Type: **None** Interval: **None**	1670
35		18	10-14-15-24.	CL			SEAL Type: **Bentonite chips** Interval: **0 - 8' bgs**	
		19	13-19-25-35.				SANDPACK Type: **Silica 40-70** Interval: **8 - 31' bgs**	
		20	8-17-26-31.					1665
40		21	10-20-27-38.				SCREEN Diameter: **2"; No.6 slot** Type: **PVC SCH 80** Interval: **20 - 30' bgs**	
		22	13-20-27-37.					1660
45		23	15-27-27-32.	SM		SILTY SAND (SM): fine to medium grained; Dark Gray (4/1 7.5YR); wet; [Cannonball Formation].		
						End of boring 46.0 feet		
50								

Date Boring Started: 8/18/15
Date Boring Completed: 8/18/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: Lithological descriptions for a hole that was abandoned. Monitoring well blind drilled and installed next to abandoned hole.
DTW = 17.09' TOR on 8/21/2015 (elev. 1689.51

Additional data may have been collected in the field which is not included on this log.
Weather:

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LOG OF BORING MW-103
DRAFT

Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 437578.205° Long: 1869355.992°
Datum:NAD 83

Surface Elevation:1714.7 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:44.0 ft

Unique Well No.:

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	Elevation, feet
0				OL/OH		TOPSOIL (OL/OH): Brown (5/4 7.5YR).	
		1	3-4-5-5.			LEAN CLAY (CL): Very Dark Gray (3/1 7.5YR); moist; stiff; medium to high plasticity; [Cannonball Formation].	
		2	5-5-8-8.	CL			
5		3	5-8-10-11.				1710
		4	6-9-15-15.			POORLY GRADED SAND WITH GRAVEL (SP): fine to coarse grained; Brown (5/4 7.5YR); some oxidized staining, some mottling; [Cannonball Formation].	
		5	5-6-5-4.	SP			
10		6	4-5-5-7.				1705
		7	2-2-2-3.			POORLY GRADED SAND WITH SILT (SP-SM): fine to medium grained; Brown (5/4 7.5YR); [Cannonball Formation].	
				SP-SM			
15		8	3-3-3-3.				1700
						NO RECOVERY (16 - 20').	
20		9	3-3-5-5.			SANDY LEAN CLAY (CL): fine to medium grained; Light Brown (6/4 7.5YR); wet; some mottling and oxidized staining, cohesive; low to medium plasticity; [Cannonball Formation].	1695
				CL			
25							1690

WELL OR PIEZOMETER CONSTRUCTION DETAIL

PRO. CASING
Diameter: **4"**
Type: **Steel pipe**
Interval: **3.5' ags - 1.5' bgs**

RISER CASING
Diameter: **2"**
Type: **PVC SCH 80**
Interval: **2.79' ags - 24' bgs**

GROUT
Type: **Neat cement**
Interval: **0 - 19' bgs**

SEAL
Type: **Bentonite chips**
Interval: **19 - 22' bgs**

SANDPACK
Type: **Silica 40-70**
Interval: **22 - 44' bgs**

SCREEN
Diameter: **2"; No.6 slot**
Type: **PVC SCH 80**
Interval: **24 - 44' bgs**

Date Boring Started: 8/19/15
Date Boring Completed: 8/20/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 33.24' TOR on 8/20/2015 (elev. 1684.29)

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
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Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING MW-103
DRAFT

Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 437578.205° Long: 1869355.992°
Datum:NAD 83

Surface Elevation:1714.7 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:44.0 ft

Unique Well No.:

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
25		10	2-2-4-4.	CL		SANDY LEAN CLAY (CL): fine to medium grained; Light Brown (6/4 7.5YR); wet; some mottling and oxidized staining, cohesive; low to medium plasticity; [Cannonball Formation]. *(continued)*	PRO. CASING Diameter: **4"** Type: **Steel pipe** Interval: **3.5' ags - 1.5' bgs**	
30				SM		SILTY SAND WITH GRAVEL (SM): wet; [Cannonball Formation].	RISER CASING Diameter: **2"** Type: **PVC SCH 80** Interval: **2.79' ags - 24' bgs**	1685
		11	10-10-7-9.			LEAN CLAY (CL): Brown (4/4 7.5YR); moist; oxidized staining; medium to high plasticity; [Cannonball Formation].	GROUT Type: **Neat cement** Interval: **0 - 19' bgs**	
		12	8-15-17-22.			At 32.5': Sand lens, color changes to Black (2.5/1 7.5YR).		
35		13	7-19-15-25.			At 33.5': Sand lens. At 34': Interbedded sand with oxidized staining.	SEAL Type: **Bentonite chips** Interval: **19 - 22' bgs**	1680
		14	11-16-21-50 for 5".	CL		At 36.5': Sand lens. At 37': Sand lens. At 37.5': Color change to Gray (5/1 7.5YR). At 38-38.5': 6" thick layer of hard material.	SANDPACK Type: **Silica 40-70** Interval: **22 - 44' bgs**	
		15	50 for 2"`-.				SCREEN Diameter: **2"; No.6 slot** Type: **PVC SCH 80** Interval: **24 - 44' bgs**	
40		16	12-17-22-30.			At 42-42.5': Silt layer.		1675
		17	9-18-24-50.			At 43.5-44': Silt layer.		
45						End of boring 44.0 feet		
50								

Date Boring Started: 8/19/15
Date Boring Completed: 8/20/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 33.24' TOR on 8/20/2015 (elev. 1684.29)

Additional data may have been collected in the field which is not included on this log.
Weather:

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Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING MW-104
DRAFT

Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438853.542° Long: 1869832.72°
Datum:NAD 83

Surface Elevation:1681.5 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:32.0 ft

Unique Well No.:

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0						TOPSOIL: Brown (5/4 7.5YR).		
		1	4-5-5-5.	CL		LEAN CLAY WITH SAND (CL): fine to medium grained; Brown (5/4 7.5YR); moist; gravel; medium plasticity; [Cannonball Formation].	PRO. CASING Diameter: **4"** Type: **Steel pipe** Interval: **3.5' ags - 1.5' bgs**	1680
		2	3-5-6-8.					
5		3	3-7-9-10.			LEAN CLAY (CL): Brown (4/4 7.5YR); oxidized staining and mottling; medium to high plasticity; with gypsum throughout; [Cannonball Formation].	RISER CASING Diameter: **2"** Type: **PVC SCH 80** Interval: **3.06' ags - 9' bgs**	1675
		4	5-7-9-10.				GROUT Type: **None** Interval: **None**	
		5	5-9-9-10.				SEAL Type: **Bentonite chips** Interval: **0 - 7' bgs**	
10		6	5-7-9-10.	CL		At 12': Heavily oxidized.	SANDPACK Type: **Silica 40-70** Interval: **7 - 32' bgs**	1670
		7	5-8-8-12.					
15		8	5-9-11-15.			At 15': Start seeing black staining.	SCREEN Diameter: **2"; No.6 slot** Type: **PVC SCH 80** Interval: **9 - 29' bgs**	
		9	6-9-11-13.			At 17': Heavily oxidized.		1665
		10	4-7-16-19.	SM		SILTY SAND (SM): Strong Brown (5/6 7.5YR); wet; [Cannonball Formation].		
20						At 19.5': Color change to Brown (5/4 7.5YR).		
		11	5-16-22-26.			At 21': Oxidized layer.		1660
		12	7-11-14-16.	CH		FAT CLAY (CH): Dark Gray (4/1 7.5YR); moist; stiff; high plasticity; with interbedded sand layers below 27'; [Cannonball Formation].		
25								

Date Boring Started: 8/20/15
Date Boring Completed: 8/20/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 13.25' TOR on 8/21/2015 (elev. 1671.26)

Additional data may have been collected in the field which is not included on this log.
Weather:

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4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING MW-104
DRAFT

Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438853.542° Long: 1869832.72°
Datum:NAD 83

Surface Elevation:1681.5 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:32.0 ft

Unique Well No.:

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
25		13	6-12-16-17.			FAT CLAY (CH): Dark Gray (4/1 7.5YR); moist; stiff; high plasticity; with interbedded sand layers below 27'; [Cannonball Formation]. *(continued)*		1655
		14	8-12-16-21.	CH				
		15	8-12-16-20.					
30		16				Driller notes: sluff.		1650
						End of boring 32.0 feet		
35								
40								
45								
50								

PRO. CASING
Diameter: **4"**
Type: **Steel pipe**
Interval: **3.5' ags - 1.5' bgs**

RISER CASING
Diameter: **2"**
Type: **PVC SCH 80**
Interval: **3.06' ags - 9' bgs**

GROUT
Type: **None**
Interval: **None**

SEAL
Type: **Bentonite chips**
Interval: **0 - 7' bgs**

SANDPACK
Type: **Silica 40-70**
Interval: **7 - 32' bgs**

SCREEN
Diameter: **2"; No.6 slot**
Type: **PVC SCH 80**
Interval: **9 - 29' bgs**

Date Boring Started: 8/20/15
Date Boring Completed: 8/20/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 13.25' TOR on 8/21/2015 (elev. 1671.26)

Additional data may have been collected in the field which is not included on this log.
Weather:

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4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING MW-105
DRAFT

Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438042.079° Long: 1870325.657°
Datum:NAD 83

Surface Elevation:1686.0 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:30.0 ft

Unique Well No.:

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0						TOPSOIL: Brown (5/4 7.5YR).		
		1	6-7-6-5.			SANDY LEAN CLAY (CL): fine to medium grained; Brown (4/2 7.5YR); moist; gravel; medium plasticity; [Cannonball Formation].	PRO. CASING Diameter: **4"** Type: **Steel pipe** Interval: **3.5' ags - 1.5' bgs**	1685
		2	5-5-5-6.				RISER CASING Diameter: **2"** Type: **PVC SCH 80** Interval: **3.16' ags - 10' bgs**	
5		3	3-2-4-5.	CL				1680
		4	2-2-2-3.				GROUT Type: **None** Interval: **None**	
		5	2-1-2-2.			LEAN CLAY (CL): Brown (4/2 7.5YR); soft; high plasticity; wet at 16'; [Cannonball Formation].	SEAL Type: **Bentonite chips** Interval: **0 - 7' bgs**	
10		6	2-1-2-1.			At 10.5': Color change to Reddish-Yellow (6/6 7.5YR).		1675
		7	2-1-1-3.				SANDPACK Type: **Silica 40-70** Interval: **7 - 30' bgs**	
15		8	4-3-5-5.	CL		At 14.5-15.5': Gravel inclusions. At 15.5': Color change to Brown (4/3 7.5YR).	SCREEN Diameter: **2"; No.6 slot** Type: **PVC SCH 80** Interval: **10 - 30' bgs**	1670
		9	7-9-11-13.					
						At 18': Color change to Brown (5/3 7.5YR).		
20		10	7-9-11-13.					
		11	7-9-13-15.					1665
		12	19-26-28-30.	SP-SM		POORLY GRADED SAND WITH SILT (SP-SM): medium to coarse grained; Brown (5/4 7.5YR); [Cannonball Formation].		
25								

Date Boring Started: 8/17/15
Date Boring Completed: 8/17/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 13.22' TOR on 8/21/2015 (elev. 1675.92)

Additional data may have been collected in the field which is not included on this log.
Weather:

M:\GINT\PROJECTS\34300014.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING MW-105
DRAFT

Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438042.079° Long: 1870325.657°
Datum:NAD 83

Surface Elevation:1686.0 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:30.0 ft

Unique Well No.:

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
25		13	15-25-31-40.					
		14	10-15-18-30.	CL		FAT CLAY (CL): Dark Brown (3/4 7.5YR); high plasticity; sand lens at 26.5'; [Cannonball Formation]. At 26': Color change to Gray (5/1 7.5YR).		1660
		15	11-16-22-32.					
30						End of boring 30.0 feet		
35								
40								
45								
50								

PRO. CASING
Diameter: **4"**
Type: **Steel pipe**
Interval: **3.5' ags - 1.5' bgs**

RISER CASING
Diameter: **2"**
Type: **PVC SCH 80**
Interval: **3.16' ags - 10' bgs**

GROUT
Type: **None**
Interval: **None**

SEAL
Type: **Bentonite chips**
Interval: **0 - 7' bgs**

SANDPACK
Type: **Silica 40-70**
Interval: **7 - 30' bgs**

SCREEN
Diameter: **2"; No.6 slot**
Type: **PVC SCH 80**
Interval: **10 - 30' bgs**

Date Boring Started: 8/17/15
Date Boring Completed: 8/17/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 13.22' TOR on 8/21/2015 (elev. 1675.92)

Additional data may have been collected in the field which is not included on this log.
Weather:

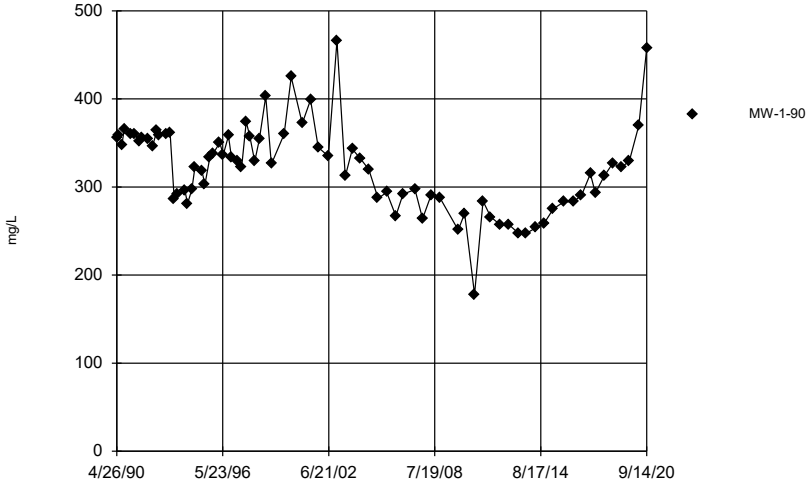
M:\GINT\PROJECTS\34300014.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Appendix F

MW1-90 Time Series Plots

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series



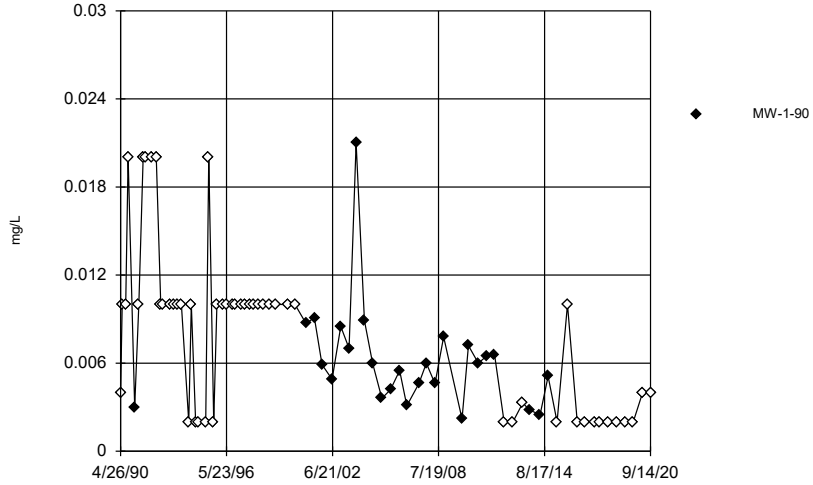
Constituent: Alkalinity, bicarbonate Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Hollow symbols indicate censored values.

Time Series



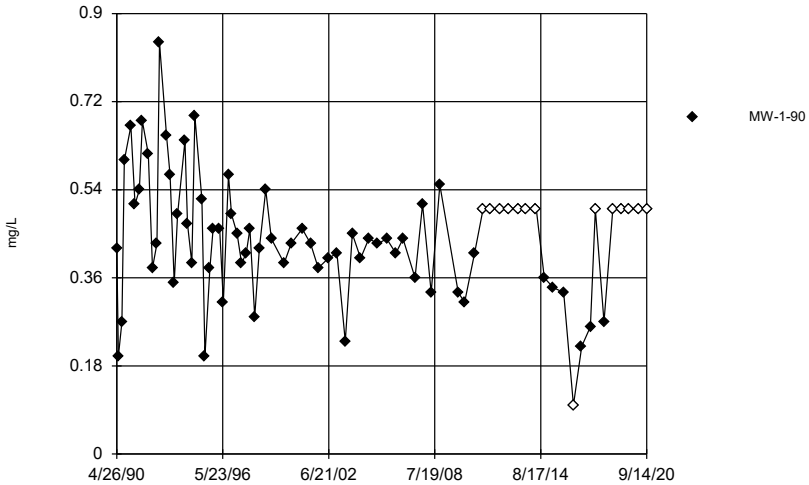
Constituent: Arsenic Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Hollow symbols indicate censored values.

Time Series

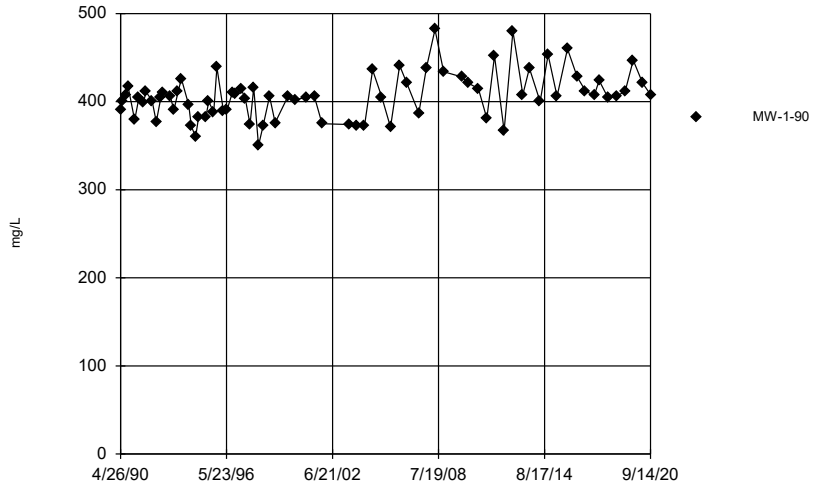


Constituent: Boron Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

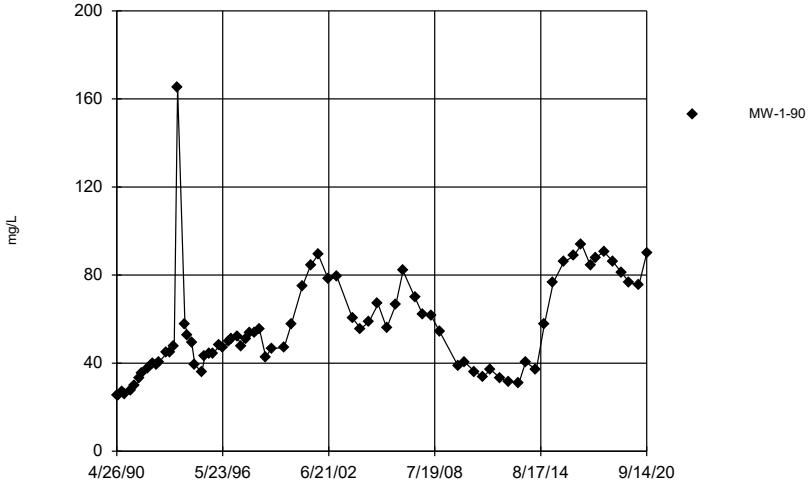


Constituent: Calcium Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

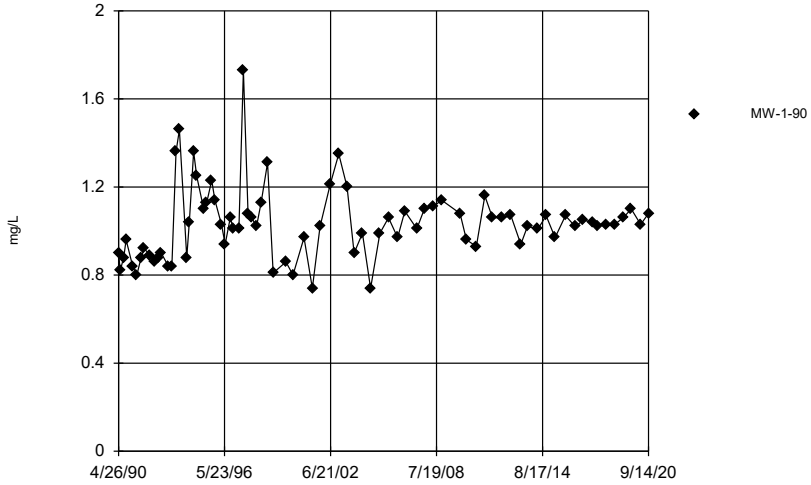


Constituent: Chloride Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

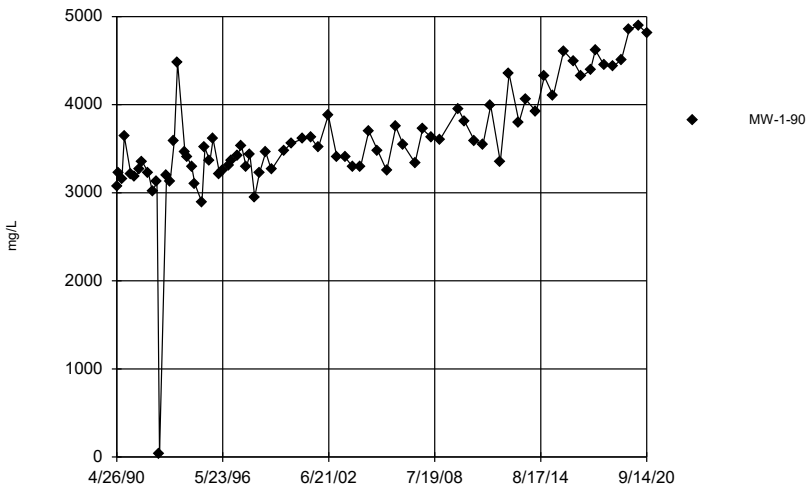


Constituent: Fluoride Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

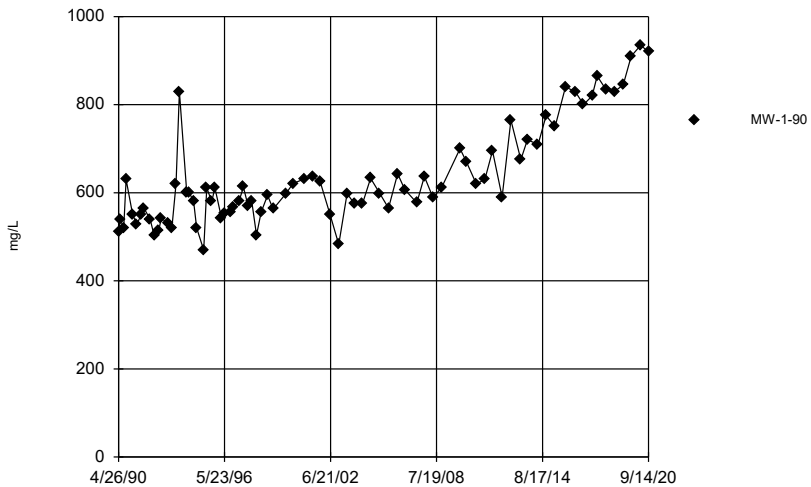


Constituent: Hardness Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

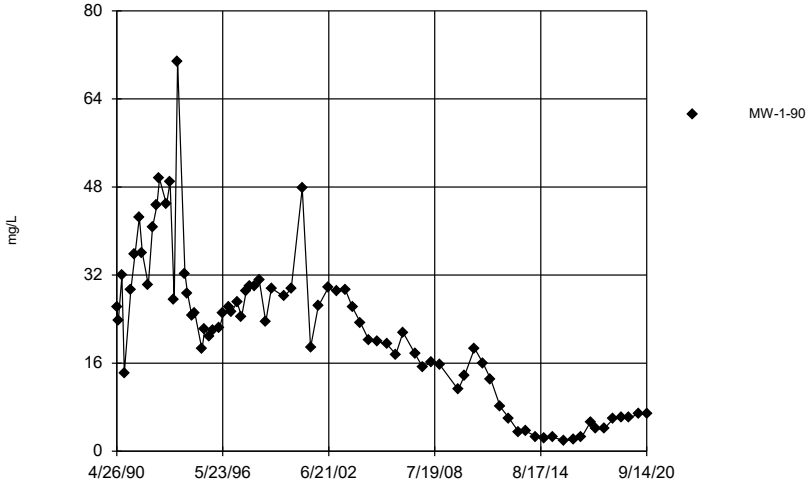


Constituent: Magnesium Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

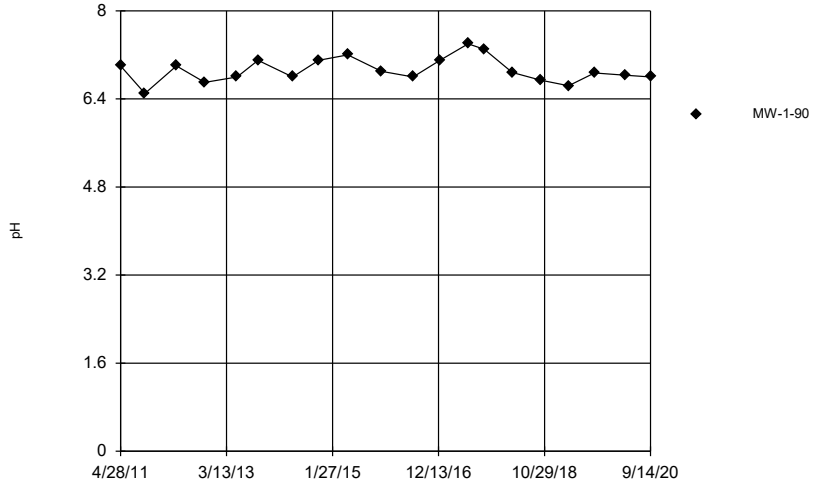


Constituent: Nitrogen Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

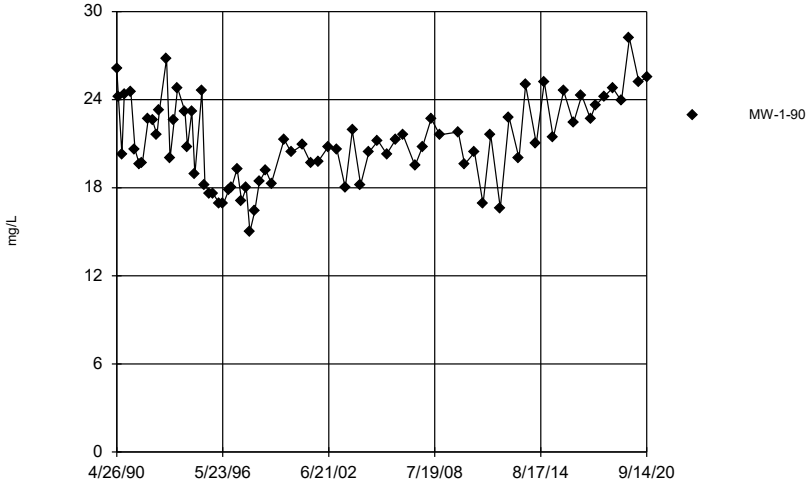


Constituent: pH Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

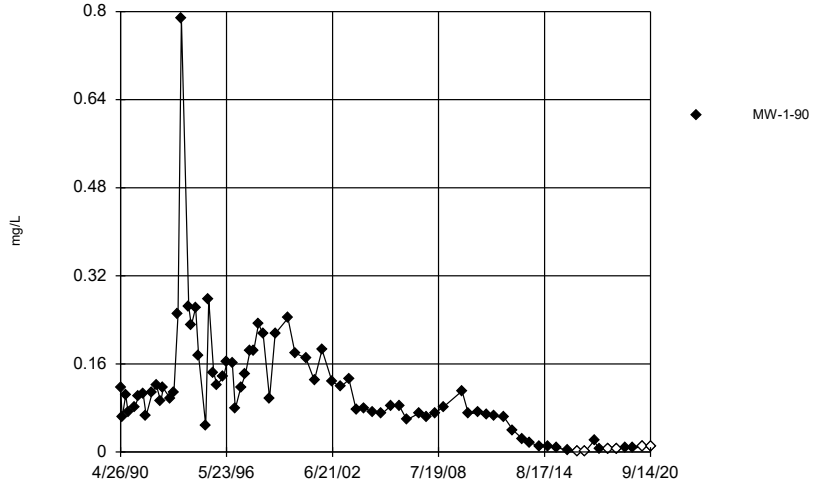


Constituent: Potassium Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG
Hollow symbols indicate censored values.

Time Series

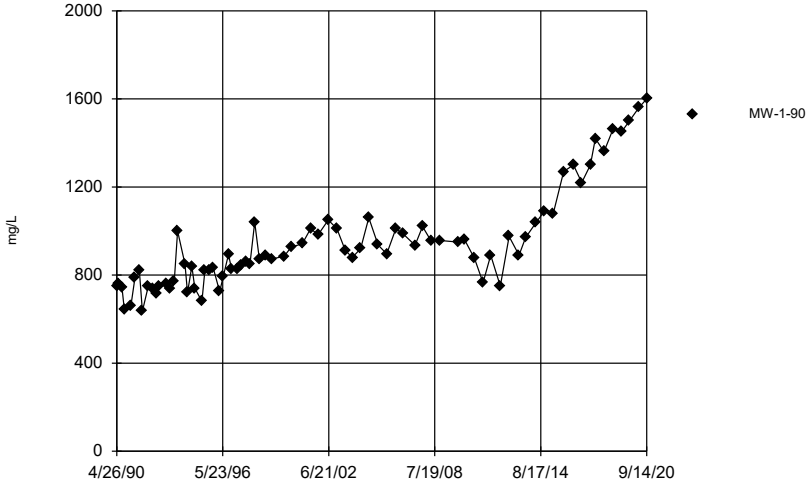


Constituent: Selenium Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

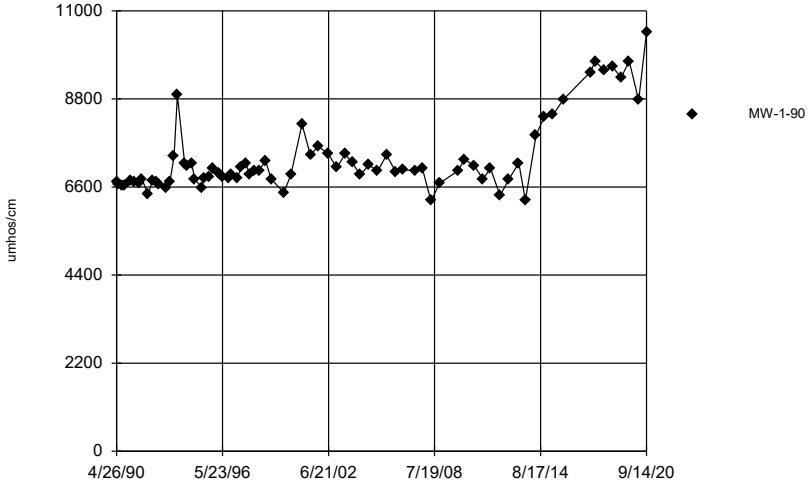


Constituent: Sodium Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

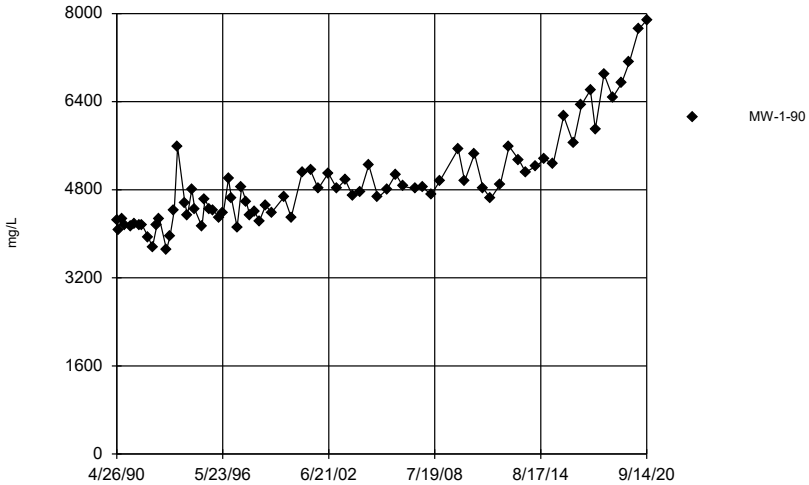


Constituent: Specific conductance Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

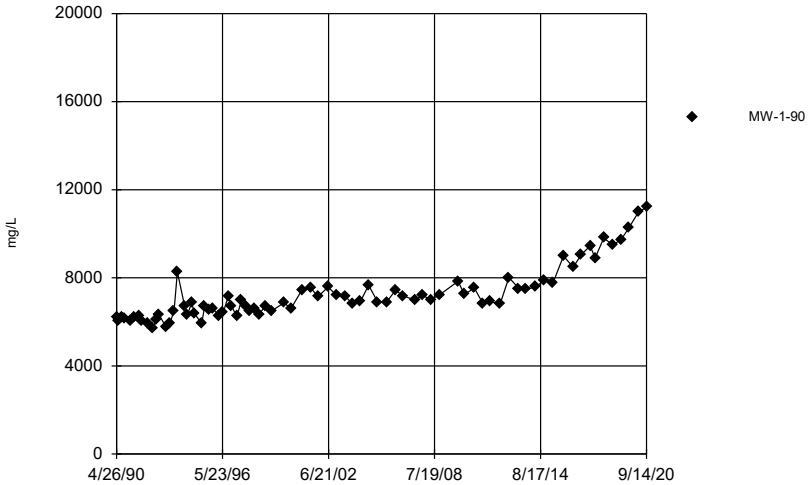


Constituent: Sulfate Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

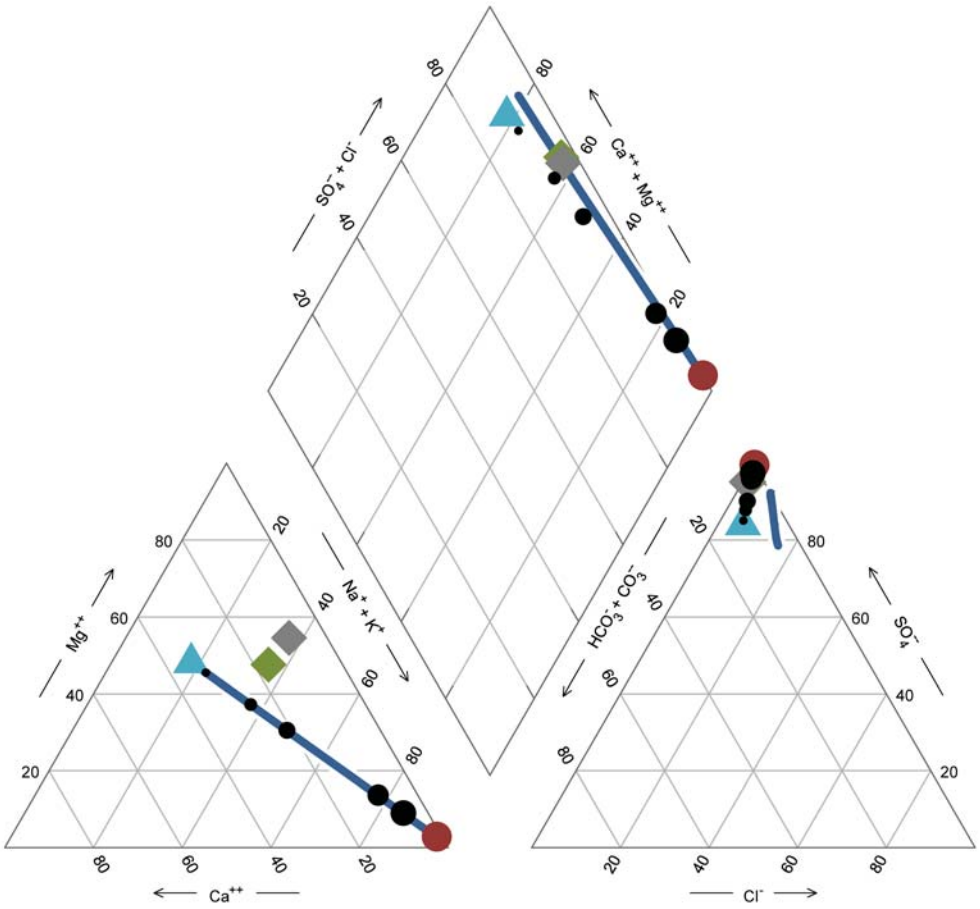


Constituent: TDS Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

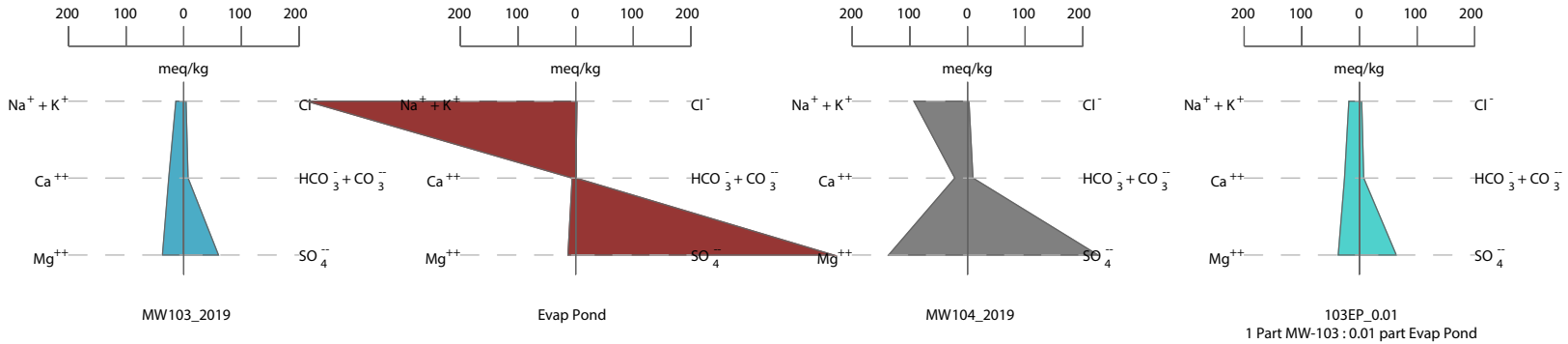
Appendix G

Geochemist's Workbench Results



- MW103_2019
- Evap Pond
- 1 part MW-103 : 1 part Evap Pond
- 1 part MW-103 : 0.50 part Evap Pond
- 1 part MW-103 : 0.10 part Evap Pond
- 1 part MW-103 : 0.05 part Evap Pond
- 1 part MW-103 : 0.01 part Evap Pond
- MW1-90
- MW104_2019

Figure G.1
Piper Plot for Mixing
Evaporation Pond into MW-103
R.M. Heskett Station
Alternative Source Demonstration
April 2020 Event
Montana Dakota Utilities
Mandan, North Dakota



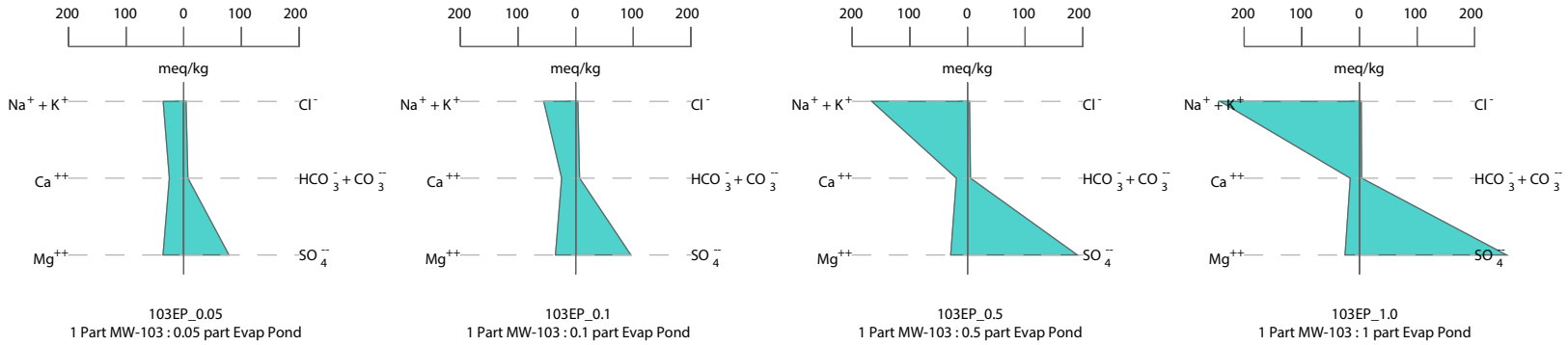


Figure G.2
Stiff Plot for Mixing
Evaporation Pond into MW-103
R.M. Heskett Station
Alternative Source Demonstration
April 2020 Event
Montana Dakota Utilities
Mandan, North Dakota

Table G.1

Geochemist's Workbench Mixing Model Results

Description		Upgradient	Evap Pond	Mixing Evap Pond into MW-103					Downgradient	
Sample ID		MW103	Evap Pond	1 : 0.01	1 : 0.05	1 : 0.1	1 : 0.5	1 : 1	MW1-90	MW-104
HCO3-	mg/l	457	20	452.7	436.2	417.3	311.3	238.5	259	591
Ca++	mg/l	530	125	526	510.7	493.2	395	327.5	453	448
Cl-	mg/l	142	79.8	141.4	139	136.3	121.3	110.9	57.4	87.6
F-	mg/l	0.15	0.1	0.1495	0.1476	0.1455	0.1334	0.125	1.07	0.55
Mg++	mg/l	458	165	455.1	444.1	431.4	360.4	311.5	775	1700
pH	SU	6.5	10.7	6.502	6.511	6.523	6.643	6.854	7.1	6.8
K+	mg/l	18.8	734	25.88	52.87	83.85	257.3	376.6	25.2	37
Na+	mg/l	311	10600	412.9	801.2	1247	3742	5458	1090	2160
SO4--	mg/l	2930	22100	3120	3843	4674	9323	12520	5350	11100
TDS	mg/kg	4860	34000	5152	6265	7541	14660.2	19527.5	7910	17700

Alternative Source Demonstration: March 2021 Event

R.M. Heskett Station

Prepared for
Montana-Dakota Utilities Co.

October 2021

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Minneapolis, MN 55435
952.832.2600
www.barr.com

Alternative Source Demonstration
March 2021 Event

October 2021

Contents

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List of Figures

List of Appendices

Certifications

I hereby certify that I, or my agent, have examined this written demonstration and attest that this Coal Combustion Residuals Facility Alternative Source Demonstration (ASD) is accurate and has been prepared in accordance with good engineering practice, including consideration of applicable industry standards and the requirements of 40 CFR §257.94. I further certify that this report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the state of North Dakota.

Revision	Date	Summary of Revisions
0	October 5, 2021	March 2021 Event Alternative Source Demonstration

1.0 Introduction

Montana-Dakota Utilities Co. (MDU) owns and operates R.M. Heskett Station (Site), a coal-fired generating station and a gas-fired turbine located in Mandan, Morton County, North Dakota (Figure 1). One CCR (coal combustion residual) unit, as defined by 40 CFR 257.53, is located on the property. The CCR unit contains coal combustion by-products, asbestos wastes generated from construction activity associated with MDU-owned facilities, and ash derived from burning tire-derived fuel (TDF) at the facility.

The CCR Rule (US EPA, 2015) §257.94(e)(2) allows for an alternative source demonstration (ASD) in the event of an identified statistically significant increase (SSI) in a water quality parameter in a downgradient monitoring well over background levels:

The owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The owner or operator must complete the written demonstration within 90 days of detecting a statistically significant increase over background levels to include obtaining a certification from a qualified professional engineer verifying the accuracy of the information in the report.

The purpose of this work is to evaluate the data collected as part of the March 2021 monitoring event, along with historical data, to demonstrate if the potential SSIs are the results of a "source other than the CCR unit" or due to natural variation in groundwater quality, an error in sampling, analysis, or statistical evaluation.

2.0 March 2021 SSIs

Sampling for the first detection monitoring event in 2021 was conducted March 22-23, 2021. Three potential SSIs over background were identified: sulfate and total dissolved solids (TDS) at MW-104 and fluoride at MW2-90 (see time series plots in Appendix A and prediction limit plots in Appendix B).

Evaluations were undertaken to review potential alternative sources for the SSIs. These evaluations included comparing leaching tests of on-site CCR materials, leachate collected in the Evaporation Pond (non-CCR unit), regional (background) groundwater quality data, and groundwater quality data collected at the site prior to construction of the CCR unit.

Several characteristics of the CCR unit site geology, groundwater monitoring well locations, and historic groundwater quality data prompted consideration of potential alternative sources for the potential SSIs, including elevated water quality parameters in pre-landfill groundwater monitoring data, site-specific geologic conditions, and/or leakage from the Evaporation Pond (non-CCR unit).

A successful demonstration of alternative source(s) for the potential SSIs are discussed in Section 3.0.

2.1 March Sampling Event

Methods used to evaluate potential alternative sources as the basis for water quality parameter concentrations over background from the March 2021 detection monitoring event are discussed below. Concentrations for potential SSIs observed in March 2021 are consistent with those observed during the prior six detection monitoring events (Table 1).

Table 1. Detection Monitoring Results for Potential SSI Well-Parameter Pairs

Well	Parameter	Interwell Prediction Limit (mg/L)	Detection Monitoring Results (mg/L)						
			April 2018	Oct. 2018	April 2019	Sept. 2019	April 2020	Sept. 2020	March 2021
MW-104	Sulfate	7,300	**10,700**	**11,000**	**11,100**	**11,300**	**10,300**	**10,700**	**11,000**
MW-104	TDS	10,400	**17,400**	**18,000**	**17,700**	**17,200**	**16,500**	**17,900**	**18,000**
MW2-90	Fluoride	0.98	**1.03**	**1.00**	**1.02**	**1.03**	0.98	**1.01**	**1.04**

Bolded values indicate concentrations exceed the associated interwell predication limits.

Trend analysis results indicate TDS at MW-104 has a statistically significant increasing trend (95% confidence level).

2.2 Verification Sampling

No verification sampling was conducted on the potential SSIs.

3.0 Alternative Source Demonstration

Successful demonstrations of alternative sources have previously been documented for the three potential SSIs. The associated ASD Reports (Barr, 2018a; Barr, 2018b; Barr, 2019a; Barr, 2019b; Barr, 2020a; Barr, 2020b; Barr, 2021) documented that each of the SSIs could be explained by natural groundwater quality variability based on concentrations that were either present at the Site before the landfill was constructed, consistent with regional groundwater quality data, and/or associated with a release from the Evaporation Pond (non-CCR unit).

The purpose of this ASD Report is to validate the results of prior findings with the March 2021 data. For each potential SSI, three hypotheses regarding the potential source of the SSI are assessed: 1) a release of leachate from the CCR unit is the source of one or more of the potential SSIs; 2) natural variations of pre-landfill or regional groundwater quality is the source of one or more of the potential SSIs; or 3) a release of leachate from the Evaporation Pond (non-CCR unit) is the source of one or more of the potential SSIs.

3.1 Source Hypothesis #1: CCR Unit Release

To accept the hypothesis that a release of leachate from the CCR unit is the source of one or more of the potential SSIs, it would be assumed that groundwater chemistry at one or both potentially impacted wells (MW2-90 and/or MW-104) would be geochemically similar to impacted water from the CCR unit represented by leach tests results. However, if they are geochemically dissimilar, this indicates that a source "other than the CCR unit" may be responsible for the potential SSI. Therefore, major ion chemistry from the CCR monitoring locations (upgradient and downgradient) was compared to CCR Synthetic Precipitation Leaching Procedure (SPLP; EPA Method 1312) data collected July 2011 (Appendix C).

To test this hypothesis, Piper diagrams were used to visually compare the CCR SPLP results (Appendix C) and the measured groundwater quality at the Site (Figure 2). Piper diagrams are plots of major ion chemistry of water samples (calcium, magnesium, potassium, sodium, chloride, sulfate, and alkalinity) that are used to differentiate between water types and to identify potential mixing of water types. This method is a means to identify or "fingerprint" water samples by their common characteristics (major ions) to assess which types of water are similar or dissimilar to potential source water types (Helsel and Hirsch, 2002). On the Piper diagram depicted in Figure 2, downgradient well compositions are shown as circular points, CCR SPLP compositions as red triangles, and the range of upgradient compositions as a blue polygon.

Downgradient water quality (including the potential SSI parameter-well pairs) is characterized as a Mg-SO_4 type water, whereas the ash SPLP results are Na-SO_4 type water. The major difference observed between the downgradient water quality and the SPLP results is the dominant cation concentration (magnesium vs. sodium). Because water quality data from SSI well-parameter pairs are clustered with data from that of the upgradient wells, which are Na-Mg-SO_4 to Mg-SO_4 type water, rather than near the SPLP results, it indicates that the water chemistry at those locations are more like upgradient groundwater than a potential release from the CCR unit. **Therefore, we reject the hypothesis that the CCR unit is the source of the sulfate and TDS observed at MW-104 and the fluoride at MW2-90.**

3.2 Source Hypothesis #2: Natural Variations of Pre-Landfill or Regional Groundwater Quality

As Source Hypothesis #1 (CCR Unit Release) was rejected as a potential source of the SSIs, natural variations of pre-landfill conditions and/or regional groundwater quality were evaluated for each of the potential SSIs. The second hypothesis evaluated is that concentrations of sulfate and TDS at MW-104 are consistent with historical (pre-landfill) or regional (background) groundwater data. To test this hypothesis, results of the March 2021 detection monitoring event were compared to pre-landfill data and/or regional groundwater quality data from the Cannonball Formation and associated units to determine if natural variation is a potential alternative source for the SSIs.

3.2.1 Fluoride at MW2-90

Source Hypothesis #2 was tested by comparing fluoride concentrations collected as part of several regional groundwater quality studies on the Cannonball Formation and associated units. A summary of the range of fluoride concentrations in the Cannonball Formation and associated units are included in the table below.

Table 2. Fluoride Concentrations in Morton County, North Dakota

Reference	Fluoride Conc. Range	Formation/Units	Data Source Location
Ackerman, D.J., 1980. Ground-Water Resources of Morton County, North Dakota. North Dakota Geological Survey Bulletin 72, Part III. 51 p.	0.0 to 4.0 mg/L	Cannonball and Ludlow formations, undifferentiated	Morton County
Crosby, O.A. and Klausing, R.L., 1984. Hydrology of Area 47, Northern Great Plains and Rocky Mountain Coal Provinces, North Dakota, South Dakota, and Montana. USGS Water-Resources Investigations Open-File Report 83-221, 93 p.	0.1 to 6.3 mg/L	Entire Fort Union Formation (includes Cannonball Formation)	Morton County

The Ackerman study provides summary statistics for the fluoride concentrations observed in Morton County. Forty-six samples were analyzed for fluoride; of those, 20 (or 43%) had concentrations greater than 1.3 mg/L (Ackerman, 1980). The fluoride concentration observed at MW-2-90 in March 2021 (1.04 mg/L) is within the range of values consistent with naturally occurring concentrations of fluoride associated with the Cannonball Formation in Morton County. **Therefore, we accept the hypothesis that fluoride concentrations observed at MW-2-90 are consistent with regional (background) groundwater data.**

3.2.2 Sulfate and TDS at MW-104

Analyses of groundwater samples collected prior to construction of the CCR unit included in the Permit Application notes that high sulfate and TDS was observed at the Site. Maximum sulfate and TDS concentrations reported in 1986 (pre-landfill) were 11,632 mg/L and 14,917 mg/L, respectively, in Well 60 (approximately 700 feet southwest of MW-104), with similar concentrations observed two years later.

Sulfate concentrations reported in March 2021 at MW-104 (11,000 mg/L) are within range of historically observed concentrations (Figure 3), but TDS concentrations (18,000 mg/L) are at the upper end of concentrations historically observed (Figure 4). Figures 3 and 4 show the range of sulfate and TDS concentrations, respectively, across the Site, including recent and historical monitoring well data.

The mineralogy of the underlying Fort Union Formation may yield an explanation for the elevated sulfate concentrations (which leads to elevated TDS concentrations). The dominant lithology observed at the Site is unconsolidated silt in a clay matrix with interspersed fine to medium-grained sand (10% to 30%). Small gypsum crystals are documented discontinuously throughout the upper 30 feet of the surface materials, which have been presumed to be the result of diagenetic processes which occur above the water table during alternating wetting and drying cycles (Groenewold et al., 1983). Gypsum is a hydrated calcium sulfate mineral that can be a source of high sulfate concentrations in groundwater.

The boring log for MW-104 (Appendix E) notes gypsum present throughout the upper layer of the screened interval. Boring logs for other CCR wells and pre-landfill wells note gypsum occurrences across the Site (Appendix E). The water level and screened interval in MW-104 are within the gypsum-bearing unit. In other wells with lower sulfate and TDS concentrations, the water levels and/or screened units are below the documented gypsum occurrences. As groundwater fluctuates and surface water infiltration occurs, periodic dissolution of gypsum into the water column may occur, resulting in elevated sulfate concentrations (and therefore elevated TDS, too).

Based on presence of gypsum in native subsurface deposits and documentation of elevated sulfate and TDS in pre-landfill groundwater, the hypothesis that the SSI for sulfate and TDS at MW-104 may be due to natural conditions (a "source other than the CCR unit") is possible. However, a statistically significant increasing trend for TDS at MW-104 was observed. Natural/background groundwater can be affected by seasonality and/or site-wide aquifer changes, resulting in trending data; two other monitoring wells at the site have statistically significant increasing trends at the site: upgradient well MW-13 and downgradient well MW2-90 (conversely, MW-13 has a long-term (late 1980s to present) statistically significant decreasing trend). Seasonality was not detected in TDS or sulfate at MW-104. **Sulfate and TDS concentrations at MW-104 may be due to natural conditions, however additional source considerations were evaluated.**

3.3 Source Hypothesis #3: Evaporation Pond Release

Two conditions are necessary to accept the hypothesis that a release of Evaporation Pond water is the source of one or more of the potential SSIs: (1) mechanism of release (such as an issue with Evaporation Pond liner integrity) and (2) geochemically similar groundwater chemistry at one or more of the potentially impacted wells with water from the Evaporation Pond. Based on proximity, only the SSIs observed at MW-104 (TDS and sulfate) are being evaluated for this potential source.

3.3.1 TDS and Sulfate at MW-104

A statistically significant increasing trend in TDS was observed at MW-104 following the March 2021 detection monitoring event. The only statistically significant trend observed for other Appendix III

parameters at this location was for fluoride. Past ASD Reports (Barr, 2019b; Barr, 2020a; Barr, 2020b; Barr, 2021) attributed elevated sulfate and TDS concentrations at MW-104 to either natural conditions or a release from the Evaporation Pond. MW-104 is located between the CCR unit and the Evaporation Pond (a non-CCR unit). The Evaporation Pond was constructed to collect surface water run-off from the Site as well as leachate from the CCR Unit. Due to the relative proximity of MW-104 to the Evaporation Pond, an evaluation was conducted to assess the Evaporation Pond liner integrity, potential impacts to downgradient wells, and determine the geochemical feasibility of Evaporation Pond water contributing to the conditions observed at MW-104.

Liner Integrity Evaluation

In the 2010 Annual Report for the Special Waste Disposal Permit (SP-087), it was noted that erosion was encountered at the Evaporation Pond. More specifically, "cuts in the banks of the pond ranged from 8 to 24-inches. Erosion was caused from storm water running into the evaporation pond from closed Slots and the haul road" (MDU, 2011). No repairs were made at that time due to standing water in the pond. Similar erosional features were noted in the 2011 and 2012 Annual Reports, citing erosion cuts of 8 to 48-inches (MDU, 2012 and MDU, 2013). These erosion cuts were repaired in 2013 during the construction of Slot 10. Additionally, the 2013 Annual Report stated that "the west wall of the evaporation pond was raised and graded to reroute storm water that accumulates outside of the ash disposal area from the cover of Phase I ash disposal site away from the pond during rain events" (MDU, 2014).

These reports did not specify if the erosional cuts were 8 to 48-inches wide or 8 to 48-inches deep. Based on the Phase I Development "as-constructed" Plan Sheets (January and November 1990), the Evaporation Pond was built with a 3-foot-thick compacted clay liner (MDU, 1989 Exhibit 6-B). If the erosional cuts were up to 48-inches deep, then the cuts would extend through the entirety of the liner thickness, creating a conduit for Evaporation Pond water to enter the groundwater. Additionally, no details were provided on the materials used for repairing the Evaporation Pond (i.e., if the liner was impacted, were the erosion cuts filled in with a comparable clay liner material).

Additionally, the integrity of the Evaporation Pond liner may have been compromised due to cation exchange. Time series plots of groundwater quality at nearby well MW1-90 (Appendix F) show an increase in sodium; this increase is most apparent at MW1-90 between 2012 and 2019. The Evaporation Pond liner may be composed of a clay with sodium as its main interlayer cation (e.g., sodium-montmorillonite and/or sodium-bentonite, which are common in the area (Groenewold et al., 1983)), and cation exchange processes can occur between the sodium in the clay and positively charged cations concentrated in the evaporation pond water (calcium, magnesium, potassium, and aluminum), increasing the concentration of dissolved sodium as it is released from the clay structure. Over time this exchange may decrease swelling potential and increase hydraulic conductivity of the clay constituting the pond liner, resulting in increased leakage of Evaporation Pond water.

Downgradient Impacts

The base of the Evaporation Pond sits at approximately 1675 feet above MSL whereas historical groundwater elevations in MW-104 and MW1-90 remain below 1675 feet MSL. Therefore, any water

leaking from the Evaporation Pond would report radially downward into the groundwater, toward both MW-104 and MW1-90, reaching both wells downgradient of the Pond.

As MW-104 was installed on August 20, 2015, it is not possible to determine if the erosional cuts observed in the early 2010s impacted the water quality at this location. However, data has consistently been collected from nearby well MW1-90, also downgradient of the Evaporation Pond. As seen in the time series plots (Appendix F; 1990-2020), in approximately 2010 concentrations of chloride, sulfate, TDS, magnesium, sodium, and specific conductance at MW1-90 began increasing more rapidly. To a lesser extent, changes in concentrations were observed around this same time for potassium, nitrogen, and total alkalinity. This timing corresponds to when the erosional cuts at the Evaporation Pond were first observed in the Annual Monitoring Reports. The increasing trends have since continued, despite reports of the erosional cuts being repaired in 2013, except for chloride, which has since leveled off and is now decreasing.

Geochemical Feasibility

A simple mixing model was developed in April 2019 (Barr, 2019b) to determine the potential of producing a similar water quality observed at MW-104 (and MW1-90, as a historical analogue) when mixing Evaporation Pond water with unimpacted upgradient water. This mixing model was conducted in Geochemist's Workbench® v.12.0, using a water sample collected from the Evaporation Pond in September 2014 and a water sample from upgradient monitoring well MW-103 in April 2019. The mixing model assumes a starting concentration equal to the upgradient groundwater concentrations and then iteratively mixes it with incremental amounts of Evaporation Pond water.

The results of the April 2019 model are provided in Appendix G. Figure G.1 shows the results of the mixing model on a stiff diagram for MW-103. Downgradient wells MW-104 and MW1-90 are shown as gray and green diamonds, respectively. The blue line represents the various possible outcomes when mixing the upgradient water quality with the Evaporation Pond. The black circles represent specific proportions (1-part upgradient water to 0.01-, 0.05-, 0.1-, 0.5-, and 1-part Evaporation Pond water). Figure G.2 shows the results as Stiff plots. Table G.1 provides the numerical inputs and results of the various mixing proportions.

As shown on Figure G.1, the downgradient well compositions are similar to the chemistry anticipated if the Evaporation Pond is mixing with upgradient groundwater emanating from the proximity of monitoring well MW-103. The path of the mixing reaction from MW-103 to the Evaporation Pond transects MW-104 when 1-part upgradient (MW-103) water is mixed with as little as 0.05-part Evaporation Pond water. Therefore, it appears plausible that a relatively small portion of Evaporation Pond water would be needed to "impact" upgradient groundwater to get a similar chemistry as observed in MW-104. The geometry of the Stiff plots in Figure G.2 shows the similarity in anionic concentrations and calcium in the mixing models.

Based on the description of erosional features extending upwards of 48 inches into the liner of the Evaporation Pond in 2010-2013 corresponding with the increased concentrations of several parameters observed in downgradient monitoring well MW1-90, it is possible that a release from the Evaporation Pond occurred starting in approximately 2011. Furthermore, the results of the geochemical model along

with the general proximity and hydraulic position of MW-104 relative to the Evaporation Pond supports the hypothesis that the SSI for TDS and sulfate at MW-104 is due to a "source other than the CCR unit." **Therefore, we accept the hypothesis that TDS and sulfate concentrations observed at MW-104 are consistent with a potential release from the Evaporation Pond, a non CCR unit.**

4.0 Conclusions

Three SSIs were identified from the March 2021 detection monitoring event. This report demonstrates that a "source other than the CCR unit" caused the potential SSIs (natural variation in regional and/or pre-landfill groundwater quality and the Evaporation Pond), as allowed by §257.94(e)(2). The results of this alternative source demonstration are summarized in the table below.

Table 3. Summary of SSIs and Alternative Sources

Well	Parameter	Report Section	Evidence for Alternative Source
MW-104	Sulfate	3.2.2, 3.3.1	Natural variability and/or Other (Evaporation Pond, a non CCR unit)
MW-104	Total Dissolved Solids	3.2.2, 3.3.1	Natural Variability and/or Other (Evaporation Pond, a non CCR unit)
MW-2-90	Fluoride	3.2.1	Natural variability (pre-landfill values and geologic background)

Based on the foregoing, the alternative source demonstration presented herein meets the requirements of CCR Rule §257.94(e)(2). As coal unit operations will cease around March 2022, MDU will work with the North Dakota Department of Environmental Quality (NDDEQ) on closure options for the Evaporation Pond as it is regulated under a permit through the NDDEQ.

5.0 References

Ackerman, D.J., 1980. Ground-Water Resources of Morton County, North Dakota. North Dakota Geological Survey Bulletin 72, Part III. 51 p.

Barr Engineering Co., 2019a. Alternative Source Demonstration: October 2018 Event. R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. April 2019.

Barr Engineering Co., 2019b. Alternative Source Demonstration: April 2019 Event. R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. November 2019.

Barr Engineering Co., 2020a. Alternative Source Demonstration: September 2019 Event. R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. April 2020.

Barr Engineering Co., 2020b. Alternative Source Demonstration: April 2020 Event. R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. July 2020.

Barr Engineering Co., 2021. Alternative Source Demonstration: September 2020 Event. R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. March 2021.

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Helsel, D.R. and R. M. Hirsch, 2002. Statistical Methods in Water Resources Techniques of Water Resources Investigations, Book 4, chapter A3. U.S. Geological Survey. 522 pages.

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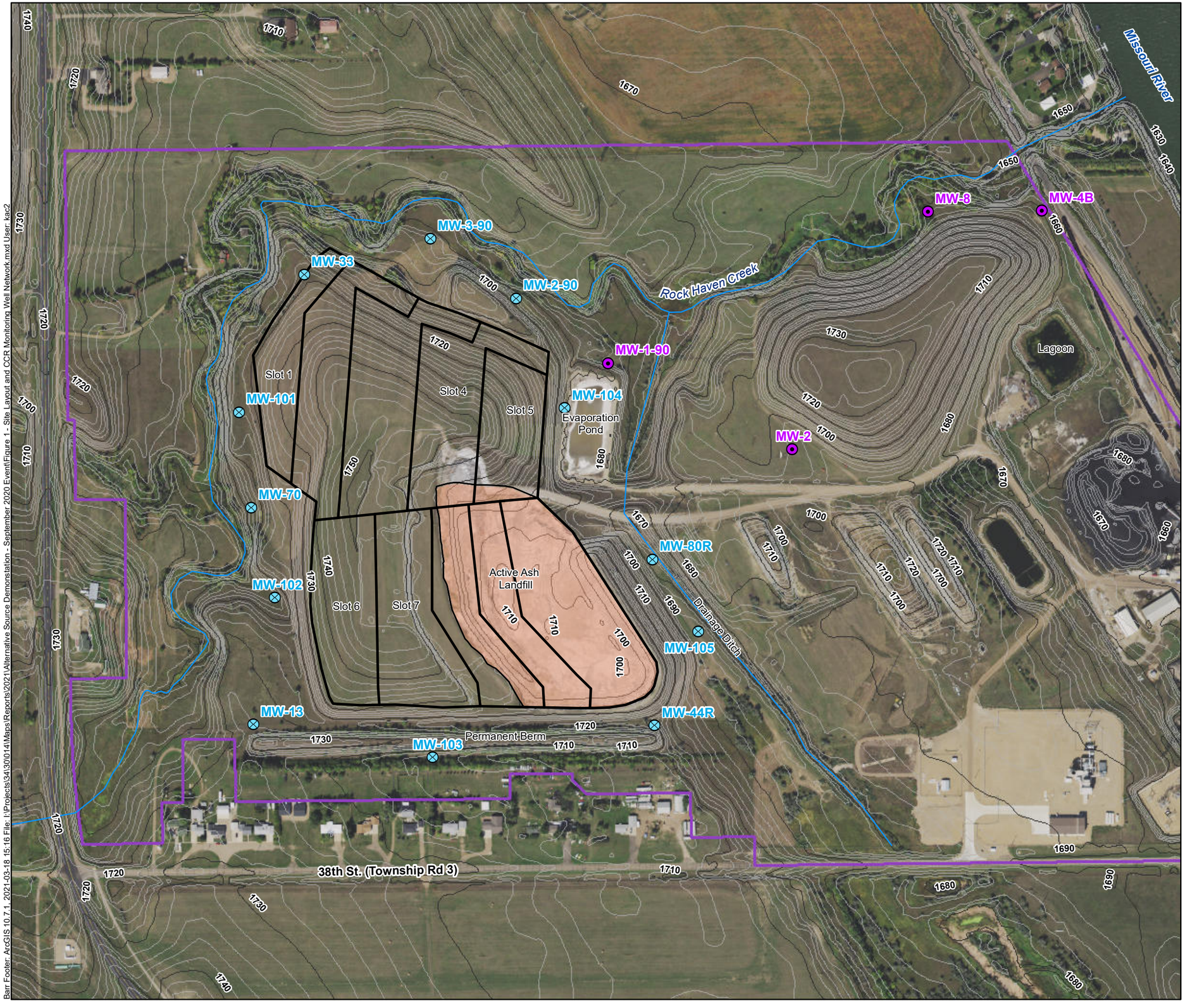
MDU, 2013, R.M. Heskett Station Special Waste Disposal Permit SP-087 2012 Annual Report. February 2013.

MDU, 2014, R.M. Heskett Station Special Waste Disposal Permit SP-087 2013 Annual Report. February 2014.

US EPA, 2015, Hazardous and Solid Waste Management Systems; Management of Coal Combustion Residuals from Electric Utility, CFR Parts 257 and 261, Federal Register, Vol. 80, No. 74, April 17, 2015

Figures



Monitoring Well Location

Monitoring Well Location - Water Level Only

Existing Slot Boundaries

Streams

Property Line

10ft Contours

2ft Contours

Active Portion of Landfill

Image Source: 2019 Statewide Imagery (ND GIS Hub)

CAD Data Source: Slot Linework.dwg

Feet

350 0 350

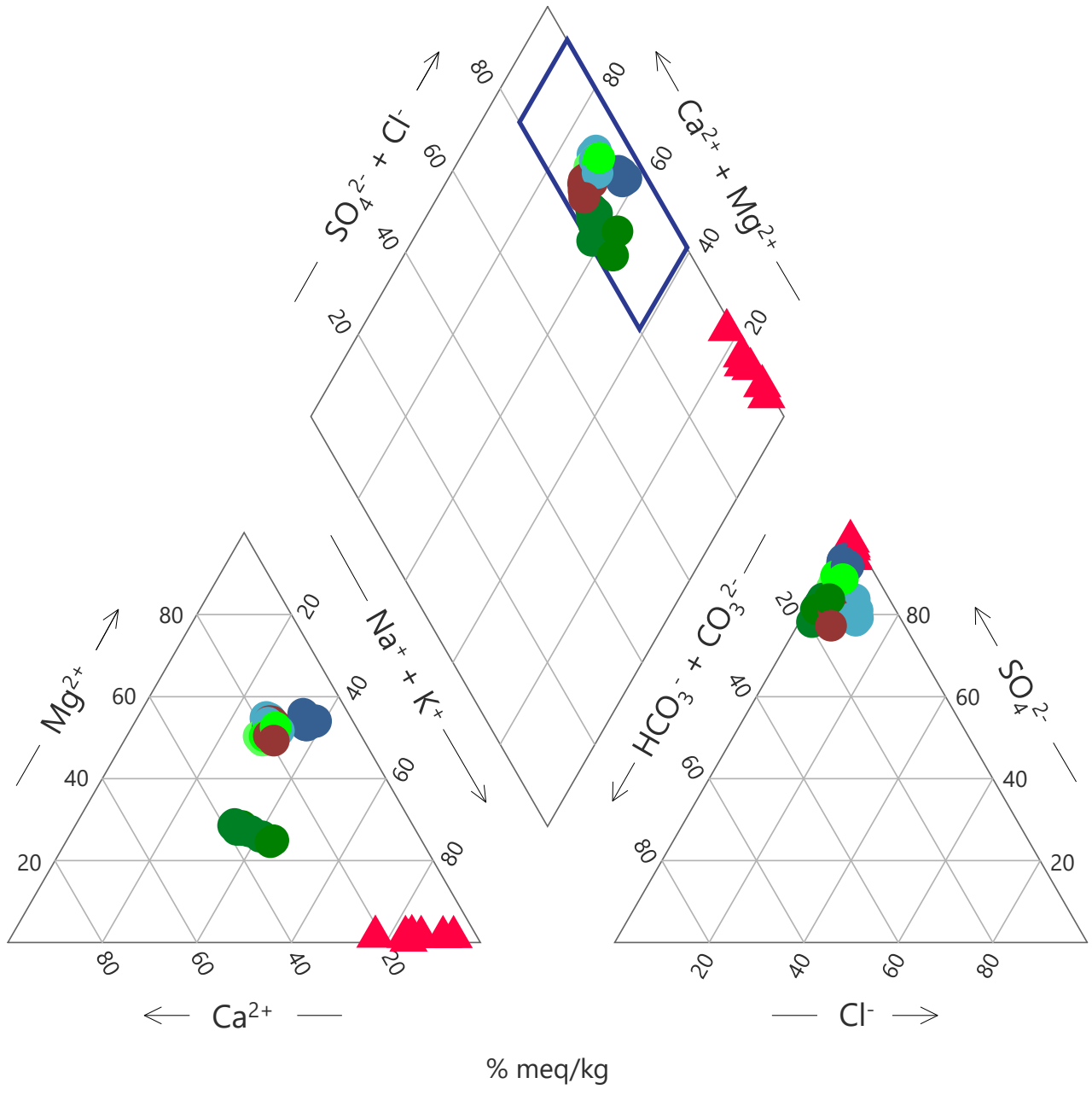
BARR

Figure 1

SITE LAYOUT AND CCR MONITORING WELL NETWORK
R. M. Heskett Station
Alternative Source Demonstration:
March 2021 Event
Montana Dakota Utilities
Mandan, North Dakota

Barr Footer: ArcGIS 10.7.1, 2021-03-18 15:16 File: j:\Projects\34\30\0141\Maps\Reports\2021\Alternative Source Demonstation - September 2020 Event\Figure 1 - Site Layout and CCR Monitoring Well Network.mxd User: kac2

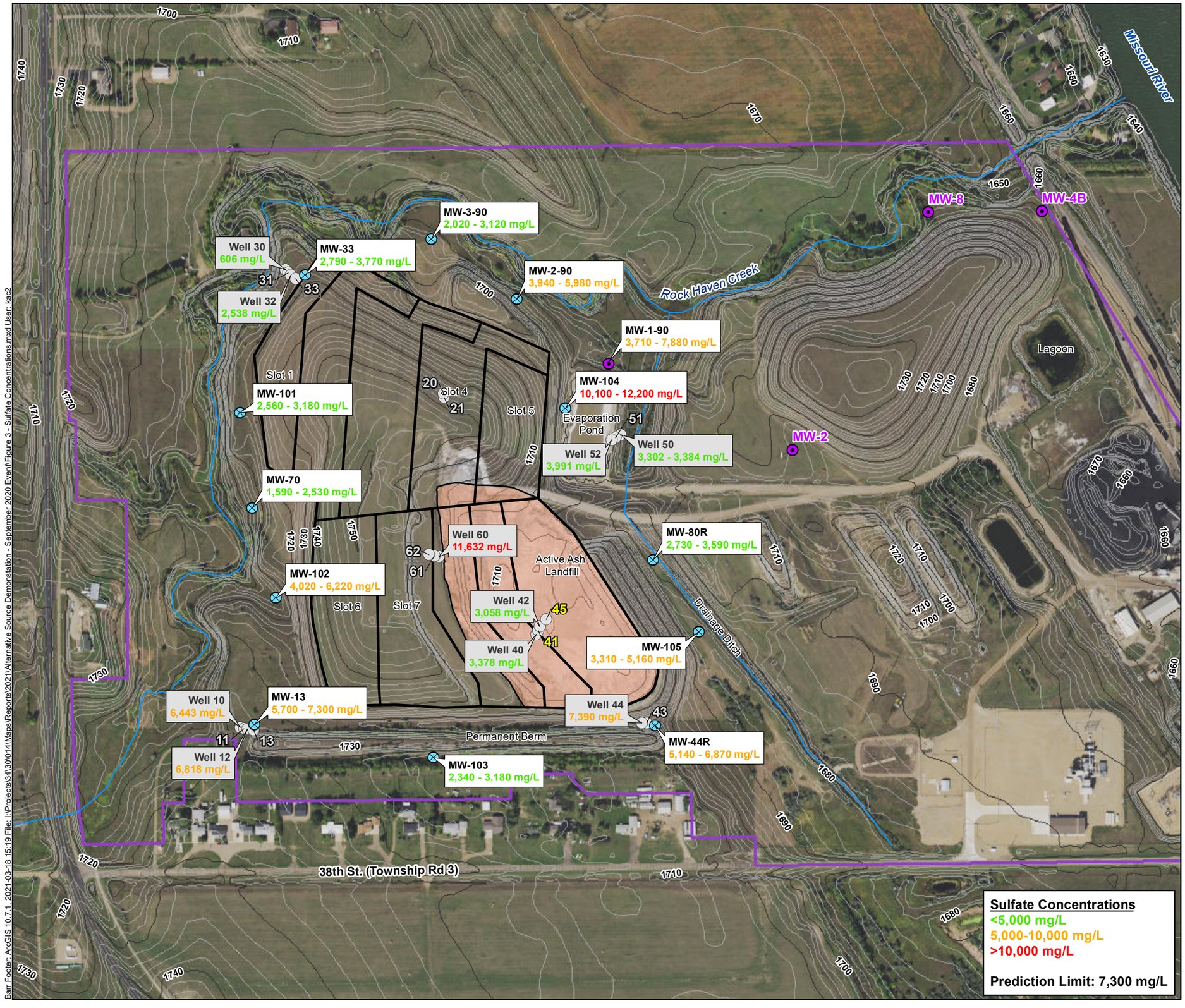
Piper Diagram



- MW104
- MW105
- MW2-90
- MW3-90
- MW-80R
- Upgradient
- Ash SPLP

Figure 2

PIPER PLOT
R.M. Heskett Station
Alternative Source Demonstration
March 2021 Event
Montana Dakota Utilities
Mandan, North Dakota



Monitoring Well Location

Monitoring Well Location - Water Level Only

Pre-Landfill Wells (Approximate)

Existing Slot Boundaries

Streams

Property Line

10ft Contours

2ft Contours

Active Portion of Landfill

Image Source: 2018 Statewide Imagery (ND GIS Hub)

CAD Data Source: Slot Linework.dwg
Pre-Landfill well concentrations are from 9/11/1986, 11/21/1986 (MDU, 1989), and CCR Rule monitoring well concentrations are from 2016-2019.

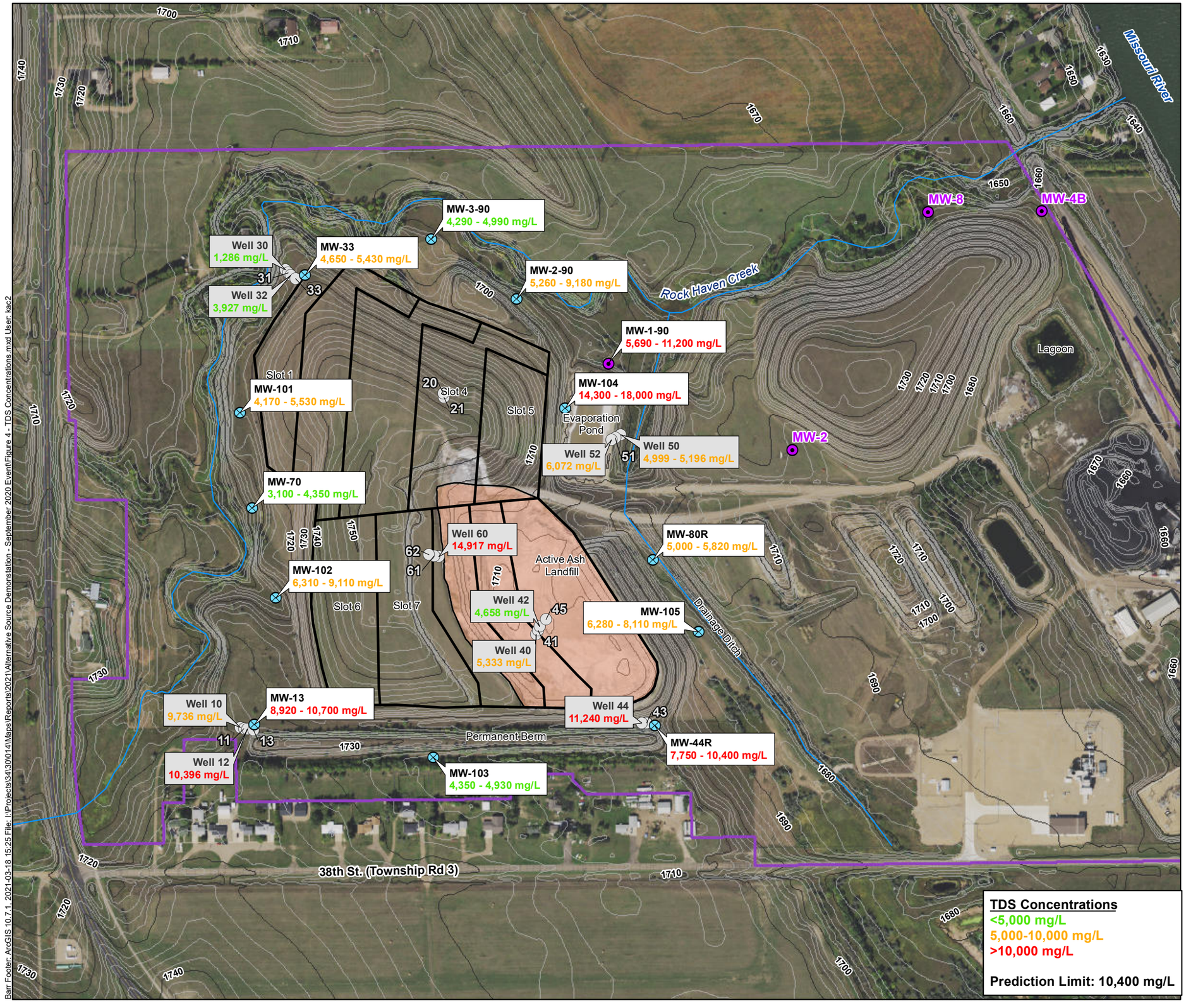
Feet
350 0 350

BARR

Figure 3

SULFATE CONCENTRATIONS
R. M. Heskett Station
Alternative Source Demonstration:
March 2021 Event
Montana Dakota Utilities
Mandan, North Dakota

Barr Footer: ArcGIS 10.7.1, 2021-03-18 15:19 File: I:\Projects\34\30014\Maps\Reports\2021\Alternative Source Demonstation - September 2020 Event\Figure 3 - Sulfate Concentrations.mxd User: kac2



Monitoring Well Location

Monitoring Well Location - Water Level Only

Pre-Landfill Wells (Approximate)

Existing Slot Boundaries

Streams

Property Line

10ft Contours

2ft Contours

Active Portion of Landfill

Image Source: 2018 Statewide Imagery (ND GIS Hub)

CAD Data Source: Slot Linework.dwg
Pre-Landfill well concentrations are from 9/11/1986, 11/21/1986 (MDU, 1989), and CCR Rule monitoring well concentrations are from 2016-2019.

N

Feet

350 0 350

BARR

Figure 4

TDS CONCENTRATIONS
R. M. Heskett Station
Alternative Source Demonstration:
March 2021 Event
Montana Dakota Utilities
Mandan, North Dakota

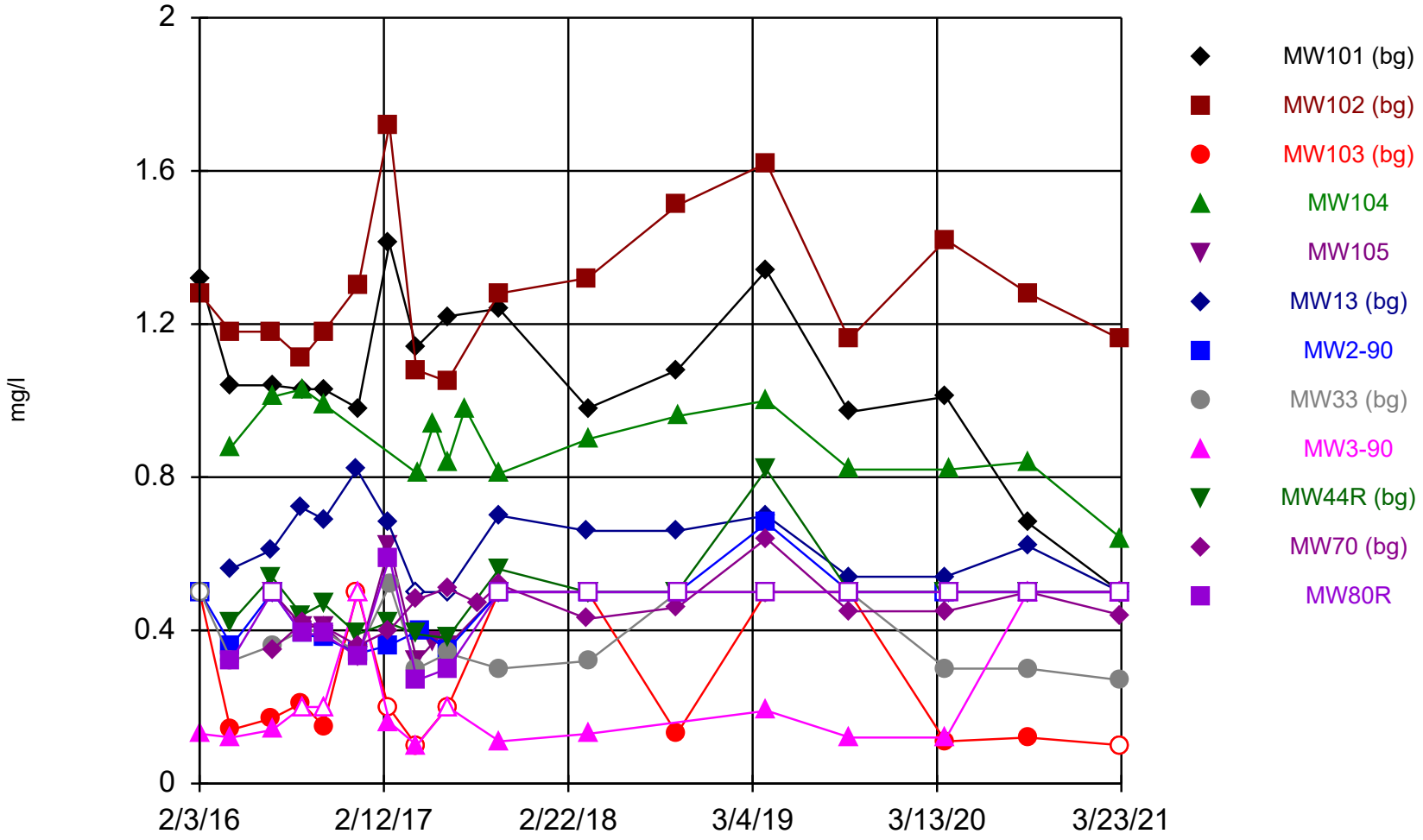
Barr Footer: ArcGIS 10.7.1, 2021-03-18 15:25 File: \\Projects\34\30\0141\Maps\Reports\2021\Alternative Source Demonstration - September 2020 Event\Figure 4 - TDS Concentrations.mxd User: kac2

Appendix A

Appendix III Time Series Plots

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG
Hollow symbols indicate censored values.

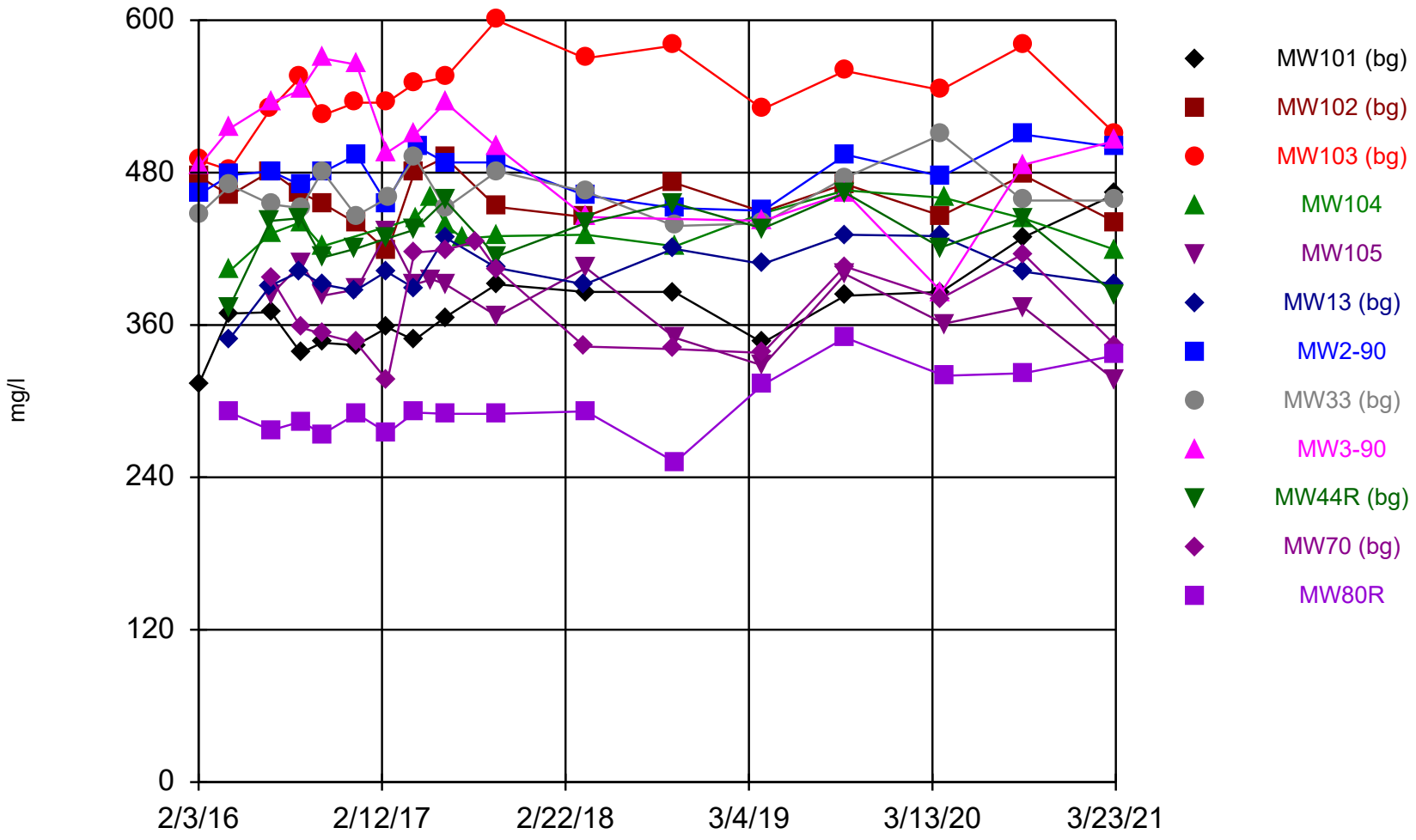
Time Series



Constituent: Boron, total Analysis Run 5/21/2021 11:05 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Time Series



Constituent: Calcium, Total Analysis Run 5/21/2021 11:05 AM

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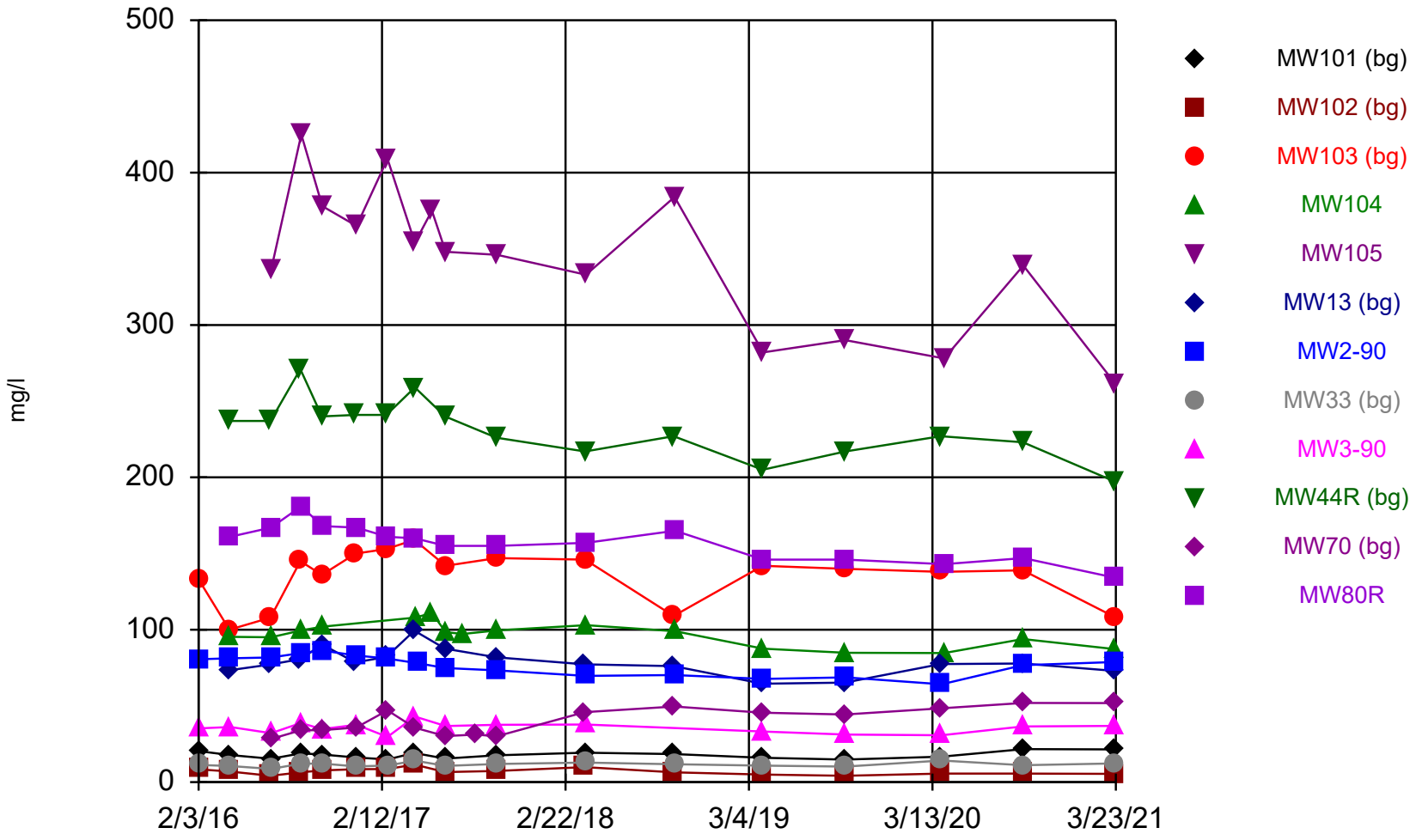
Time Series

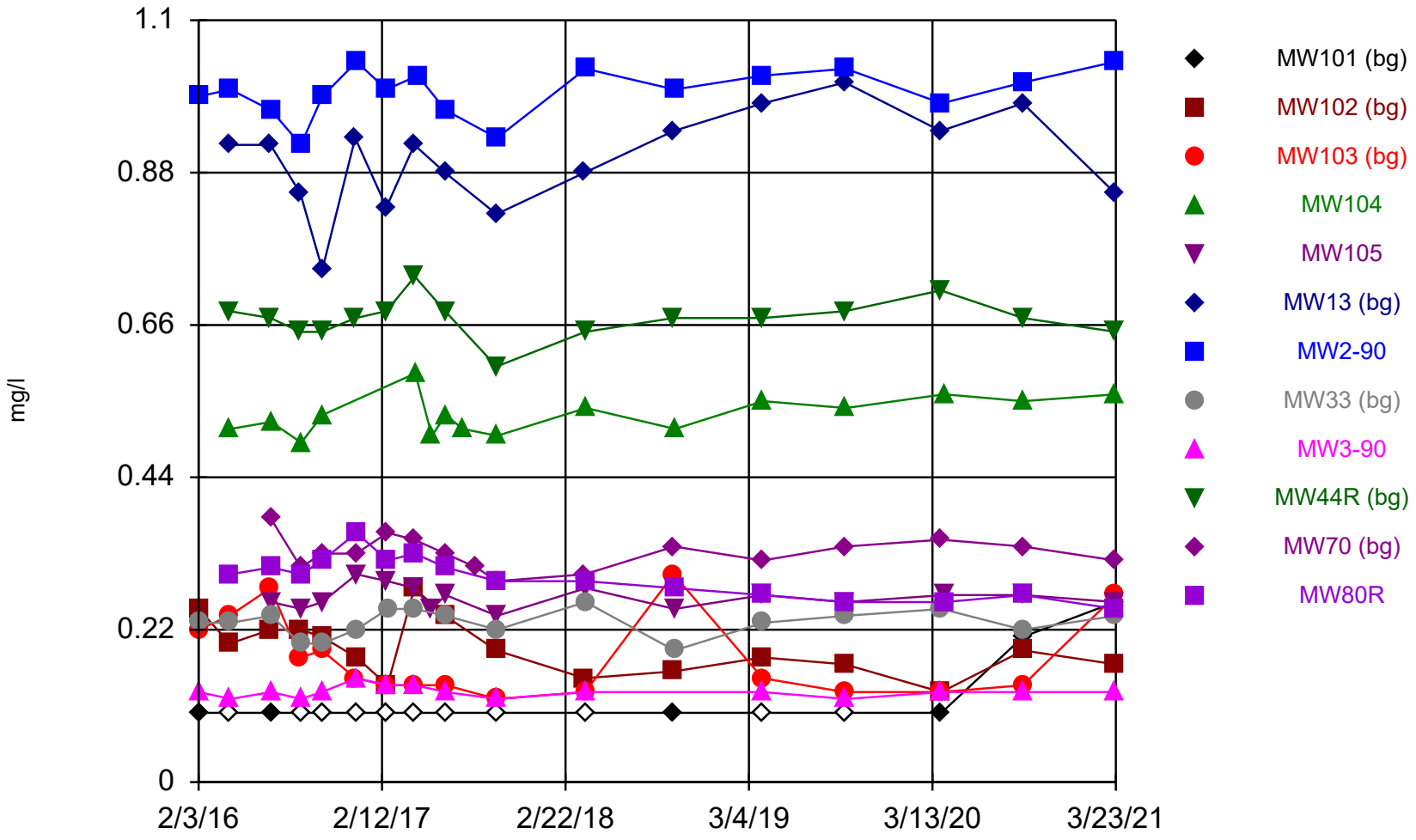


Constituent: Chloride Analysis Run 5/21/2021 11:05 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG
Hollow symbols indicate censored values.

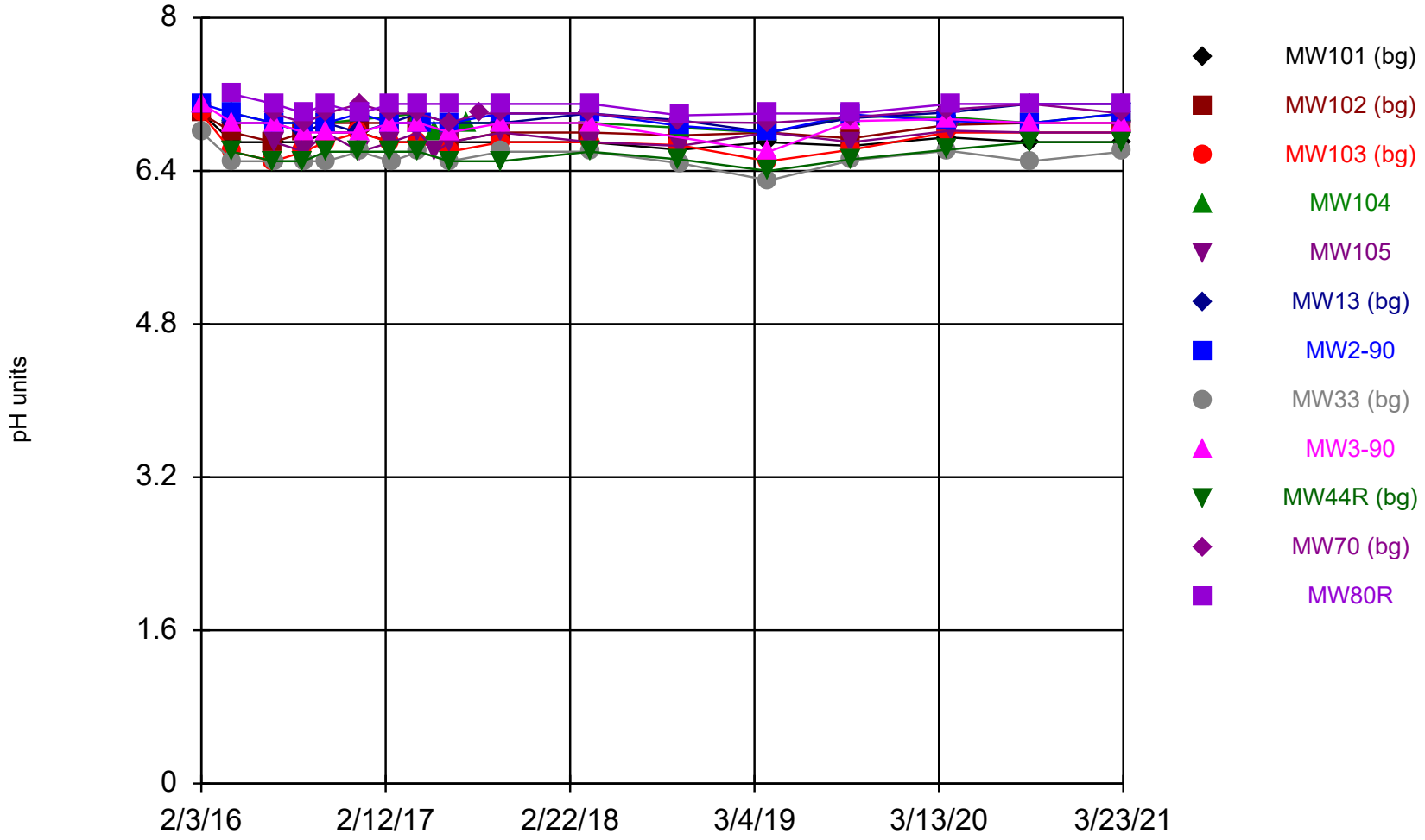
Time Series



Constituent: Fluoride Analysis Run 5/21/2021 11:05 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

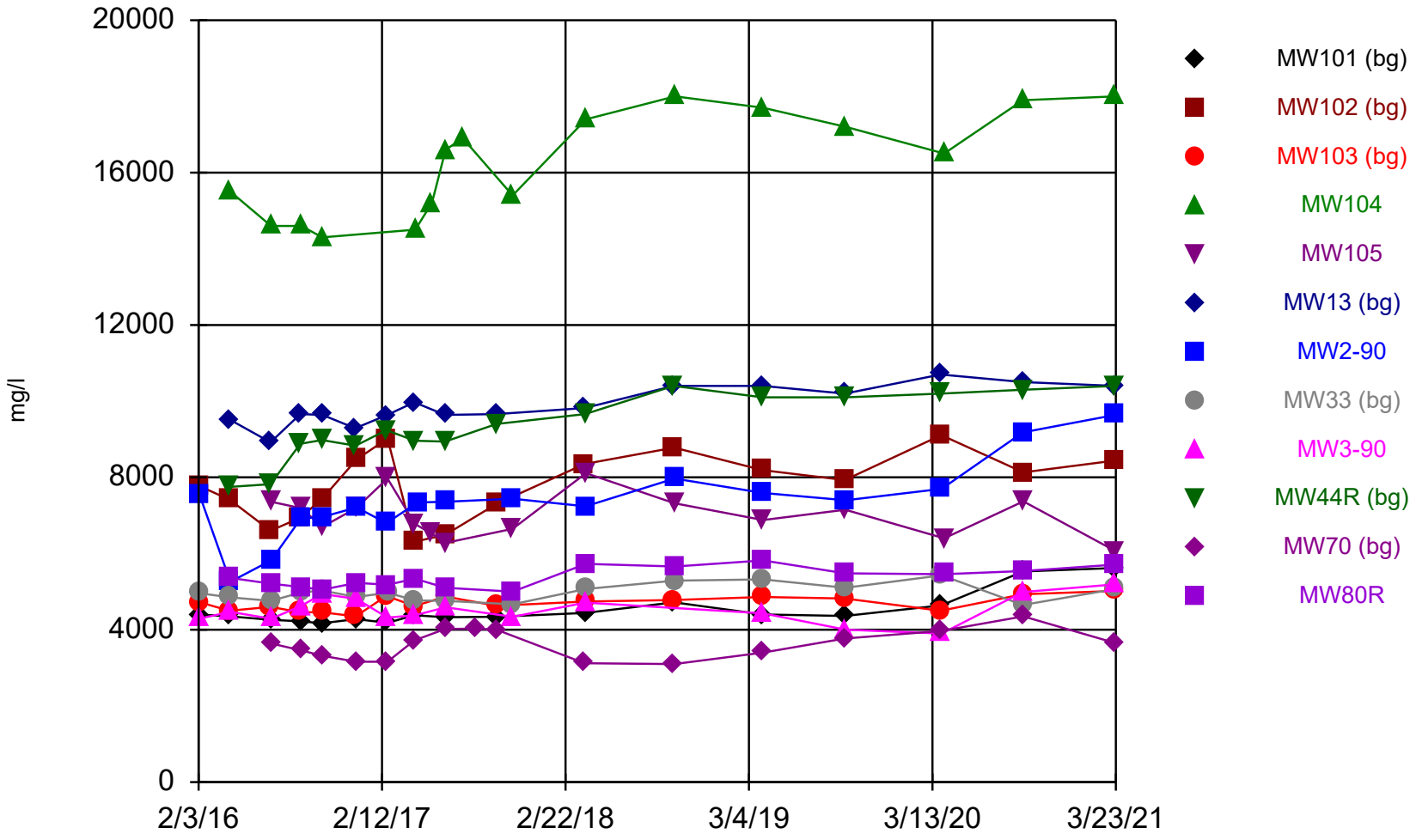
Time Series



Constituent: pH, Field Analysis Run 5/21/2021 11:05 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

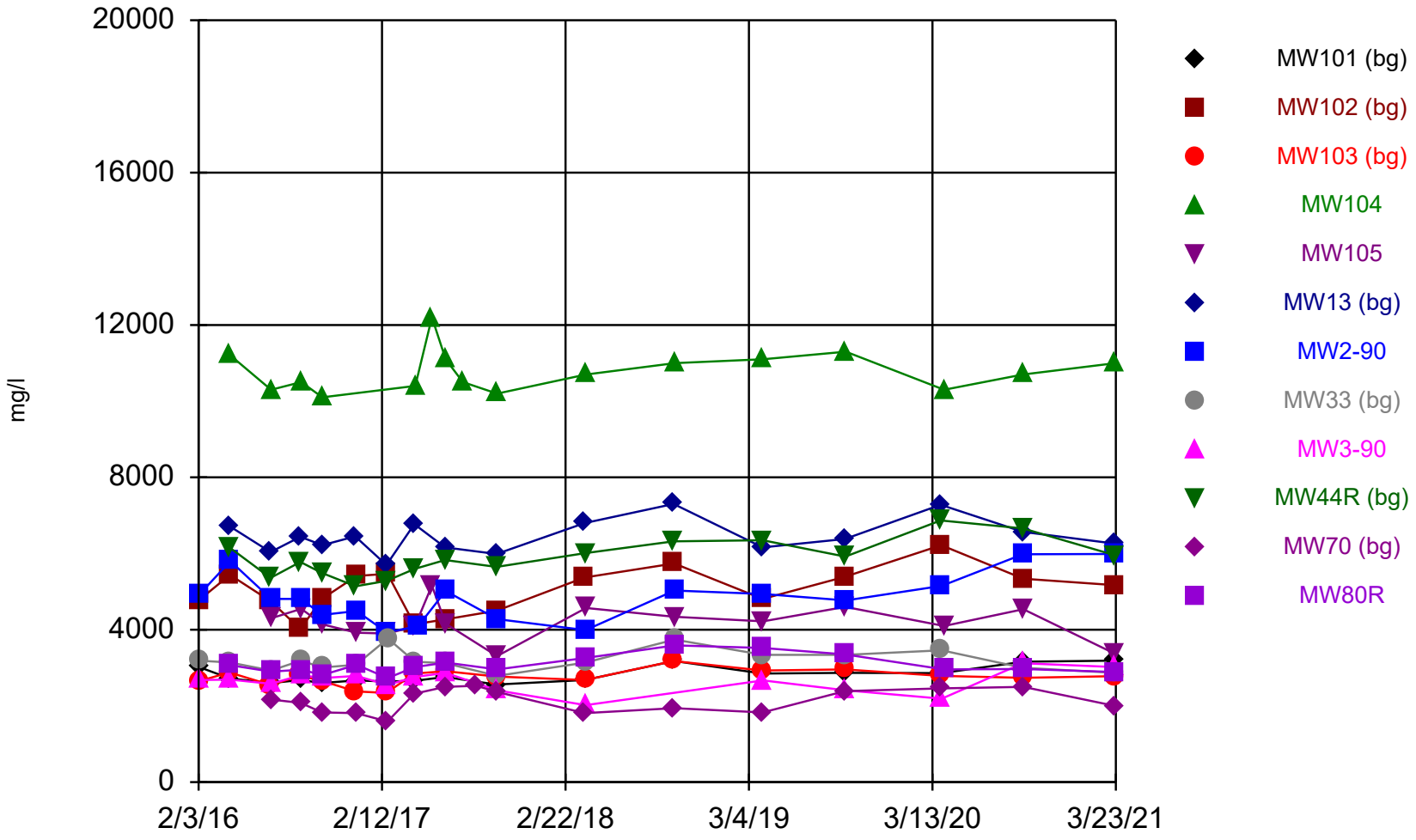
Time Series



Constituent: Solids, total dissolved Analysis Run 5/21/2021 11:05 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Time Series



Constituent: Sulfate, as SO4 Analysis Run 5/21/2021 11:05 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Appendix B

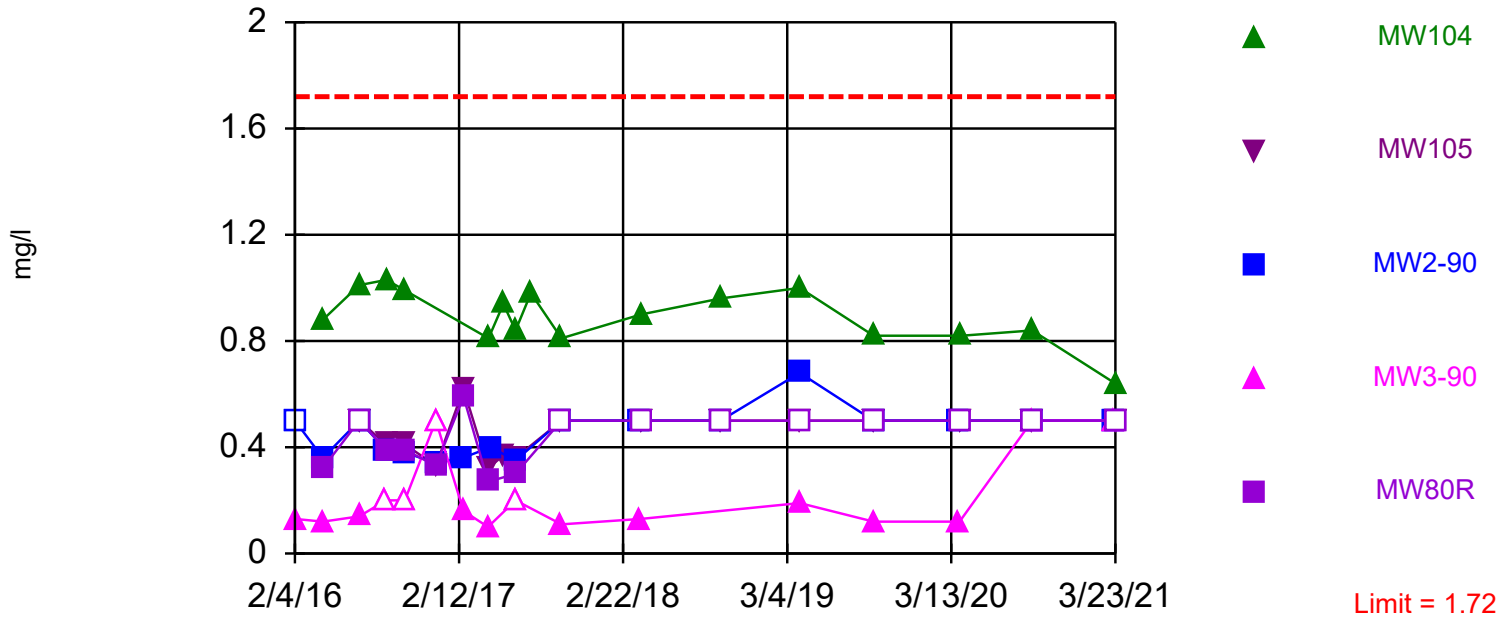
March 2021 Prediction Limit Plots

Hollow symbols indicate censored values.

Within Limit

Boron, total

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 88 background values. 17.05% NDs. Annual per-constituent alpha = 0.002497. Individual comparison alpha = 0.00025 (1 of 2). Comparing 5 points to limit. Seasonality was not detected with 95% confidence.

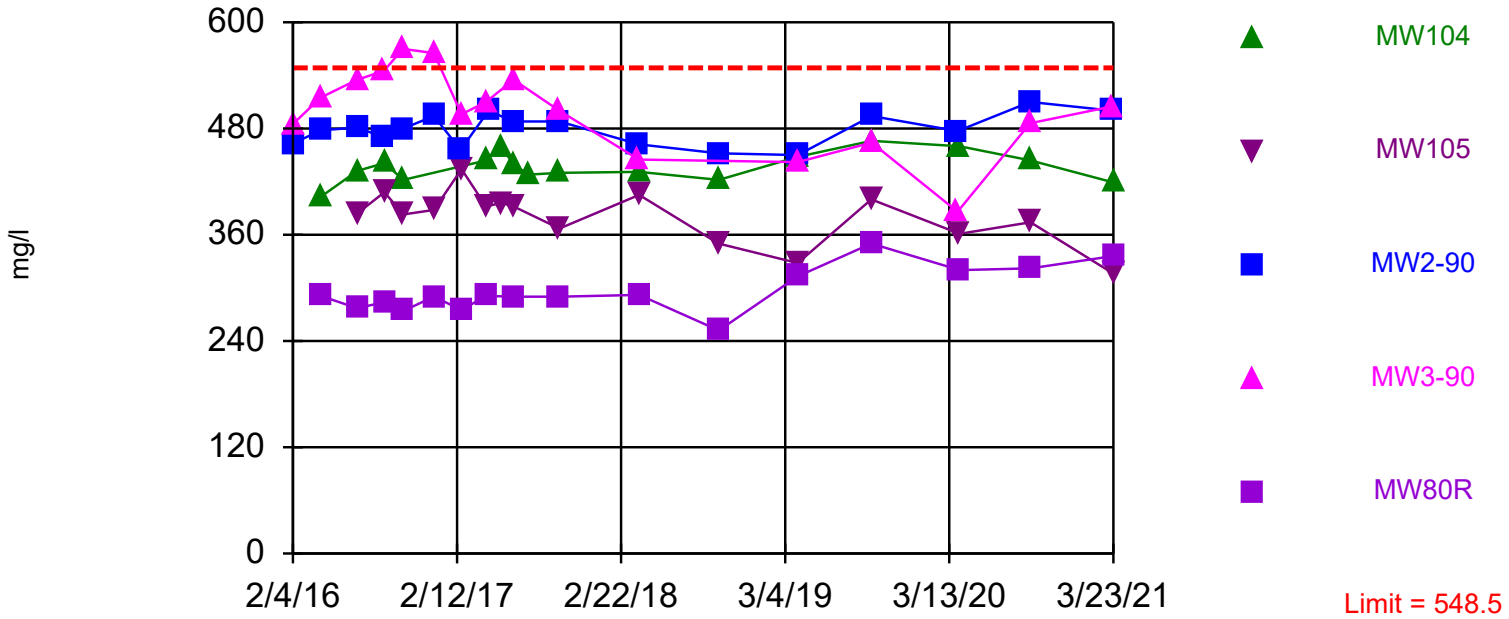
Prediction Limit Analysis Run 5/21/2021 11:52 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Within Limit

Calcium, Total

Interwell Parametric



Background Data Summary: Mean=432.4, Std. Dev.=64.15, n=88. Seasonality was not detected with 95% confidence. Normality test: Shapiro Francia @alpha = 0.05, calculated = 0.9786, critical = 0.972. Kappa = 1.81 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.001504. Comparing 5 points to limit.

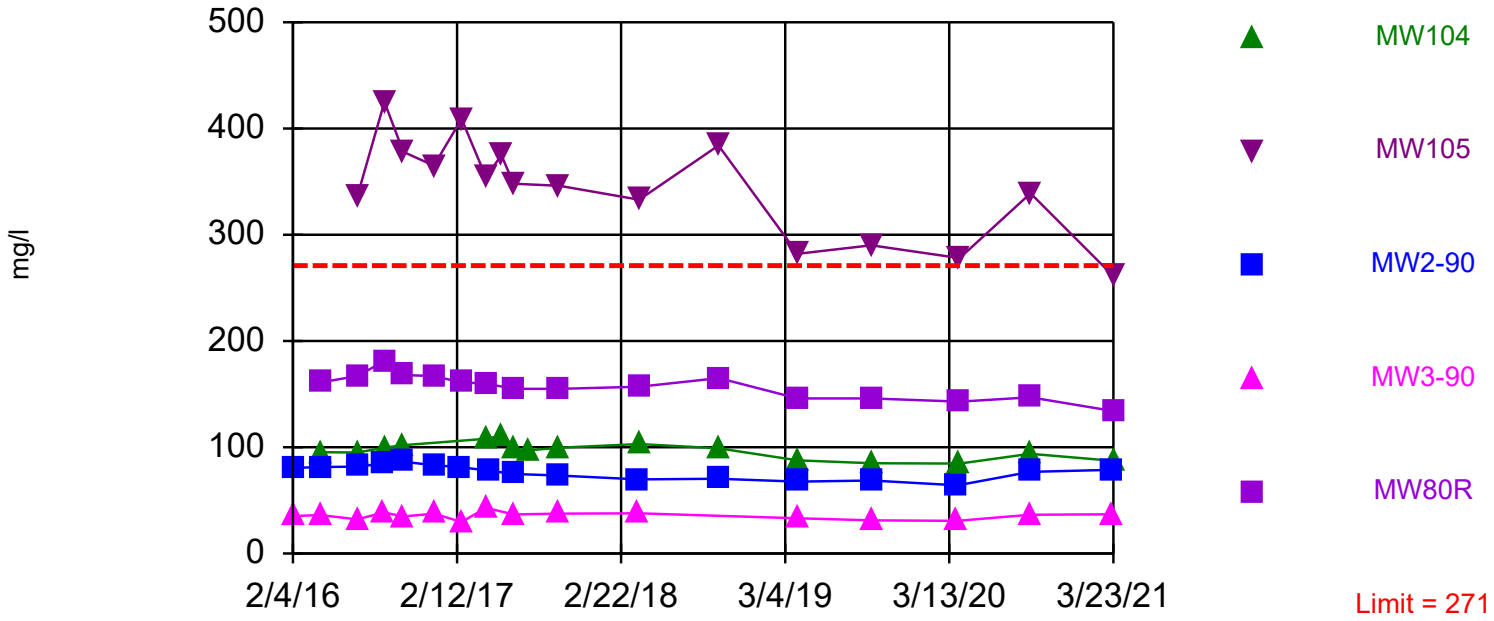
Prediction Limit Analysis Run 5/21/2021 11:52 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Within Limit

Chloride

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 88 background values. Annual per-constituent alpha = 0.002497. Individual comparison alpha = 0.00025 (1 of 2). Comparing 5 points to limit. Seasonality was not detected with 95% confidence.

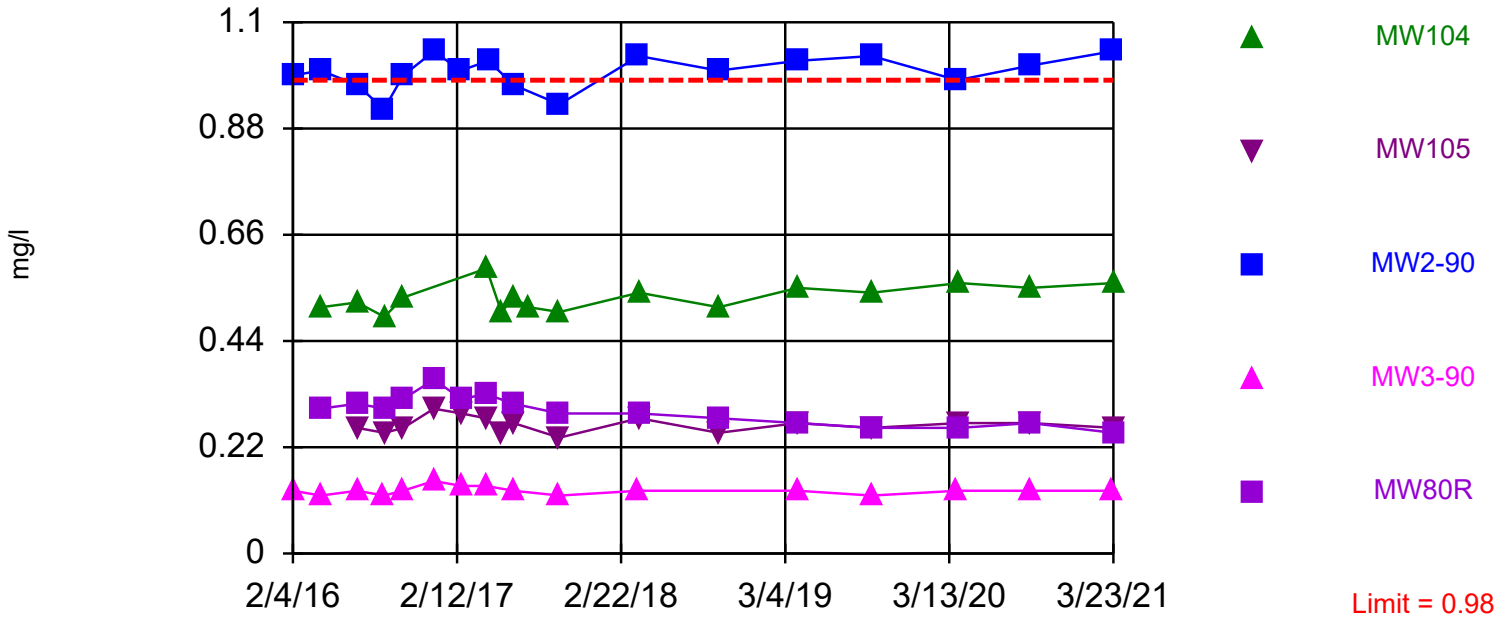
Prediction Limit Analysis Run 5/21/2021 11:52 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Exceeds Limit: MW2-90

Fluoride

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 88 background values. 11.36% NDs. Annual per-constituent alpha = 0.002497. Individual comparison alpha = 0.00025 (1 of 2). Comparing 5 points to limit. Seasonality was not detected with 95% confidence.

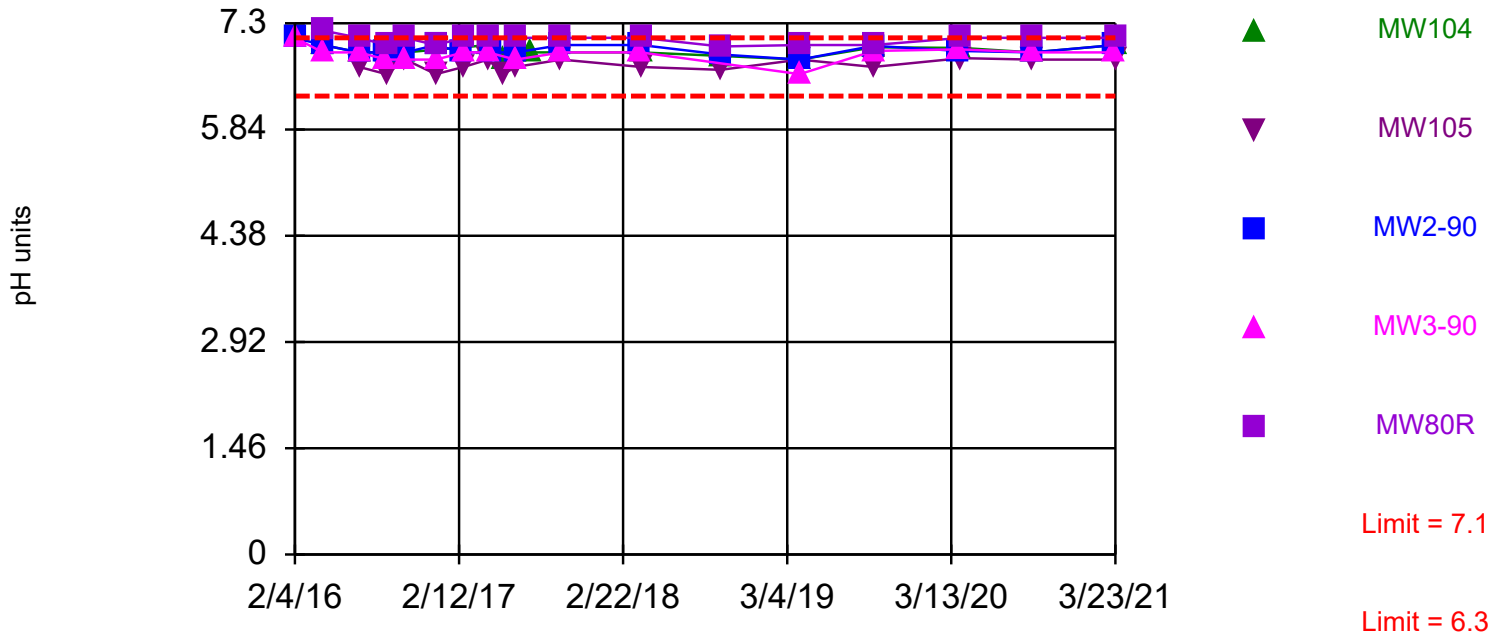
Prediction Limit Analysis Run 5/21/2021 11:52 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Within Limits

pH, Field

Interwell Non-parametric

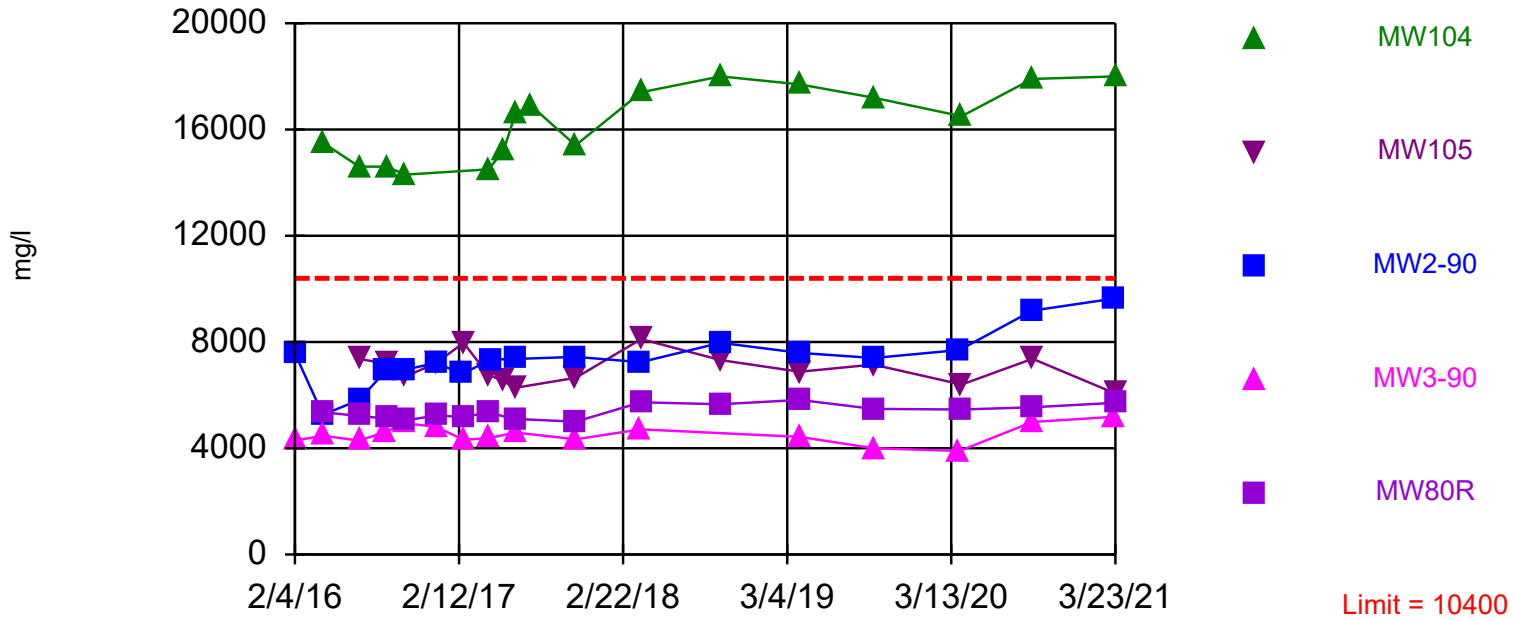


Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limits are highest and lowest of 88 background values. Annual per-constituent alpha = 0.004994. Individual comparison alpha = 0.0004999 (1 of 2). Comparing 5 points to limit. Seasonality was not detected with 95% confidence.

Exceeds Limit: MW104

Solids, total dissolved

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 84 background values. Annual per-constituent alpha = 0.002742. Individual comparison alpha = 0.0002746 (1 of 2). Comparing 5 points to limit. Seasonality was not detected with 95% confidence.

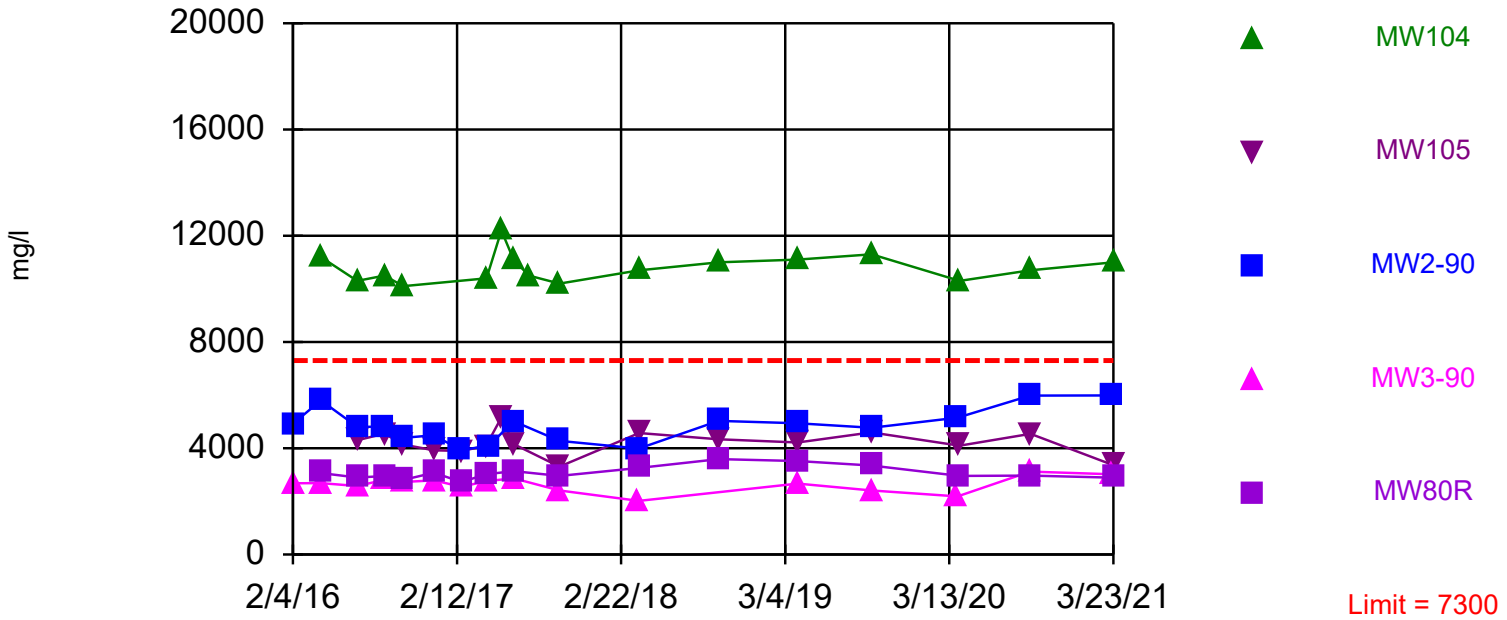
Prediction Limit Analysis Run 5/21/2021 11:52 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Exceeds Limit: MW104

Sulfate, as SO4

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 88 background values. Annual per-constituent alpha = 0.002497. Individual comparison alpha = 0.00025 (1 of 2). Comparing 5 points to limit. Seasonality was not detected with 95% confidence.

Prediction Limit Analysis Run 5/21/2021 11:52 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Prediction Limit

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII Printed 5/21/2021, 11:53 AM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	%NDs	Transform	Alpha	Method
Boron, total (mg/l)	MW104	1.72	n/a	3/23/2021	0.64	No	88	17.05	n/a	0.00025	NP Inter (normality) ...
Boron, total (mg/l)	MW105	1.72	n/a	3/23/2021	0.5ND	No	88	17.05	n/a	0.00025	NP Inter (normality) ...
Boron, total (mg/l)	MW2-90	1.72	n/a	3/22/2021	0.5ND	No	88	17.05	n/a	0.00025	NP Inter (normality) ...
Boron, total (mg/l)	MW3-90	1.72	n/a	3/22/2021	0.5ND	No	88	17.05	n/a	0.00025	NP Inter (normality) ...
Boron, total (mg/l)	MW80R	1.72	n/a	3/23/2021	0.5ND	No	88	17.05	n/a	0.00025	NP Inter (normality) ...
Calcium, Total (mg/l)	MW104	548.5	n/a	3/23/2021	419	No	88	0	No	0.001504	Param Inter 1 of 2
Calcium, Total (mg/l)	MW105	548.5	n/a	3/23/2021	316	No	88	0	No	0.001504	Param Inter 1 of 2
Calcium, Total (mg/l)	MW2-90	548.5	n/a	3/22/2021	500	No	88	0	No	0.001504	Param Inter 1 of 2
Calcium, Total (mg/l)	MW3-90	548.5	n/a	3/22/2021	505	No	88	0	No	0.001504	Param Inter 1 of 2
Calcium, Total (mg/l)	MW80R	548.5	n/a	3/23/2021	336	No	88	0	No	0.001504	Param Inter 1 of 2
Chloride (mg/l)	MW104	271	n/a	3/23/2021	87.2	No	88	0	n/a	0.00025	NP Inter (normality) ...
Chloride (mg/l)	MW105	271	n/a	3/23/2021	261	No	88	0	n/a	0.00025	NP Inter (normality) ...
Chloride (mg/l)	MW2-90	271	n/a	3/22/2021	78.8	No	88	0	n/a	0.00025	NP Inter (normality) ...
Chloride (mg/l)	MW3-90	271	n/a	3/22/2021	36.9	No	88	0	n/a	0.00025	NP Inter (normality) ...
Chloride (mg/l)	MW80R	271	n/a	3/23/2021	134	No	88	0	n/a	0.00025	NP Inter (normality) ...
Fluoride (mg/l)	MW104	0.98	n/a	3/23/2021	0.56	No	88	11.36	n/a	0.00025	NP Inter (normality) ...
Fluoride (mg/l)	MW105	0.98	n/a	3/23/2021	0.26	No	88	11.36	n/a	0.00025	NP Inter (normality) ...
Fluoride (mg/l)	**MW2-90**	**0.98**	**n/a**	**3/22/2021**	**1.04**	**Yes**	**88**	**11.36**	**n/a**	**0.00025**	**NP Inter (normality) ...**
Fluoride (mg/l)	MW3-90	0.98	n/a	3/22/2021	0.13	No	88	11.36	n/a	0.00025	NP Inter (normality) ...
Fluoride (mg/l)	MW80R	0.98	n/a	3/23/2021	0.25	No	88	11.36	n/a	0.00025	NP Inter (normality) ...
pH, Field (pH units)	MW104	7.1	6.3	3/23/2021	7	No	88	0	n/a	0.000...	NP Inter (normality) ...
pH, Field (pH units)	MW105	7.1	6.3	3/23/2021	6.8	No	88	0	n/a	0.000...	NP Inter (normality) ...
pH, Field (pH units)	MW2-90	7.1	6.3	3/22/2021	7	No	88	0	n/a	0.000...	NP Inter (normality) ...
pH, Field (pH units)	MW3-90	7.1	6.3	3/22/2021	6.9	No	88	0	n/a	0.000...	NP Inter (normality) ...
pH, Field (pH units)	MW80R	7.1	6.3	3/23/2021	7.1	No	88	0	n/a	0.000...	NP Inter (normality) ...
Solids, total dissolved (mg/l)	**MW104**	**10400**	**n/a**	**3/23/2021**	**18000**	**Yes**	**84**	**0**	**n/a**	**0.000...**	**NP Inter (normality) ...**
Solids, total dissolved (mg/l)	MW105	10400	n/a	3/23/2021	6060	No	84	0	n/a	0.000...	NP Inter (normality) ...
Solids, total dissolved (mg/l)	MW2-90	10400	n/a	3/22/2021	9640	No	84	0	n/a	0.000...	NP Inter (normality) ...
Solids, total dissolved (mg/l)	MW3-90	10400	n/a	3/22/2021	5190	No	84	0	n/a	0.000...	NP Inter (normality) ...
Solids, total dissolved (mg/l)	MW80R	10400	n/a	3/23/2021	5710	No	84	0	n/a	0.000...	NP Inter (normality) ...
Sulfate, as SO4 (mg/l)	**MW104**	**7300**	**n/a**	**3/23/2021**	**11000**	**Yes**	**88**	**0**	**n/a**	**0.00025**	**NP Inter (normality) ...**
Sulfate, as SO4 (mg/l)	MW105	7300	n/a	3/23/2021	3360	No	88	0	n/a	0.00025	NP Inter (normality) ...
Sulfate, as SO4 (mg/l)	MW2-90	7300	n/a	3/22/2021	5990	No	88	0	n/a	0.00025	NP Inter (normality) ...
Sulfate, as SO4 (mg/l)	MW3-90	7300	n/a	3/22/2021	3020	No	88	0	n/a	0.00025	NP Inter (normality) ...
Sulfate, as SO4 (mg/l)	MW80R	7300	n/a	3/23/2021	2890	No	88	0	n/a	0.00025	NP Inter (normality) ...

Appendix C

Ash SPLP Laboratory Report (2011)

MINNESOTA VALLEY TESTING LABORATORIES, INC.

1126 North Front St. ~ New Ulm, MN 56073 ~ 800-782-3557 ~ Fax 507-359-2890
2616 East Broadway Ave. ~ Bismarck, ND 58501 ~ 800-279-6885 ~ Fax 701-258-9724
51 West Lincoln Way ~ Nevada, IA 50201 ~ 800-362-0855 ~ Fax 515-382-3885
www.mvtl.com

MEMBER ACIL

Report Date: 8 Sep 11
Lab Number: 11-M2450
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit I Bottom Ash
Sample Site: MDU Heskett

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
SPLP Extraction				1312	22 Jul 11	SS
pH	12.2	units	N/A	SM4500 H+ B	22 Jul 11 17:00	Claudette
Specific Conductance	8778	umhos/cm	N/A	SM2510-B	22 Jul 11 17:00	Claudette
Total Suspended Solids	3	mg/l	1	SM2540-D	22 Jul 11 14:00	CLB
Total Alkalinity	1120	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Phenolphthalein Alk	1090	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Bicarbonate	< 4	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Carbonate	60	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Hydroxide	1060	mg/l CaCO3	0	SM2320-B	22 Jul 11 17:00	Claudette
Tot Dis Solids(Summation)	4860	mg/l	NA	SM1030-F	3 Aug 11 8:40	Calculated
Total Hardness as CaCO3	524	mg/l	NA	SM2340-B	3 Aug 11 8:40	Calculated
Hardness in grains/gallon	30.7	gr/gal	NA	SM2340-B	3 Aug 11 8:40	Calculated
Cation Summation	74.3	meq/L	NA	SM1030-F	3 Aug 11 8:40	Calculated
Anion Summation	74.6	meq/L	NA	SM1030-F	28 Jul 11 14:30	Calculated
Percent Error	-0.24	%	NA	SM1030-F	3 Aug 11 8:40	Calculated
Sodium Adsorption Ratio	27.1		NA	USDA 20b	3 Aug 11 8:40	Calculated
Gross Alpha Radiation	Attached	pCi/l			22 Aug 11 2:03	
Radon 222	Attached				28 Jul 11 4:37	
Radium 226	Attached	pCi/l			22 Aug 11 22:20	
Radium 228	Attached	pCi/l			16 Aug 11 16:50	
Total Organic Carbon	0.7	mg/l	0.5	SM5310-C	1 Aug 11 8:00	Eric
Fluoride	< 0.1	mg/l	0.10	SM4500-F-C	4 Aug 11 17:00	CLB
Sulfate	2440	mg/l	5.00	ASTM D516-02	27 Jul 11 9:00	KMP
Chloride	50.5	mg/l	1.0	SM4500-Cl-E	27 Jul 11 14:00	KMP
Nitrate-Nitrite as N	0.21	mg/l	0.10	EPA 353.2	28 Jul 11 14:30	KMP
Ammonia-Nitrogen as N	0.32	mg/l	0.10	EPA 350.1	28 Jul 11 10:45	KMP
Phosphorus as P - Total	< 0.1	mg/l	0.10	EPA 365.1	28 Jul 11 13:00	KMP
Mercury - Total	< 0.0002	mg/l	0.0002	EPA 245.1	28 Jul 11 8:00	Eric
Chemical Oxygen Demand	< 5	mg/l	5.0	HACH 8000	1 Aug 11 8:30	Wayne
Calcium - Total	210	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Magnesium - Total	< 2.5	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Sodium - Total	1440	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Potassium - Total	44.8	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Aluminum - Total	< 0.5	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Iron - Total	< 0.5	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Strontium - Total	28.2	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Titanium - Total	< 0.5	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Boron - Total	< 0.5	mg/l	0.10	6010	11 Aug 11 8:40	Stacy

RL = Method Reporting Limit

Elevated "Less Than Result" (<): @ = Due to sample matrix
! = Due to sample quantity
= Due to sample concentration
+ = Due to extract volume

CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

MINNESOTA VALLEY TESTING LABORATORIES, INC.
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51 West Lincoln Way ~ Nevada, IA 50201 ~ 800-362-0855 ~ Fax 515-382-3885
www.mvtl.com
MEMBER ACIL

Report Date: 8 Sep 11
Lab Number: 11-M2450
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit I Bottom Ash
Sample Site: MDU Heskett

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
Antimony - Total	< 0.002	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Arsenic - Total	0.0044	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Barium - Total	0.1135	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Beryllium - Total	< 0.001	mg/l	0.0010	6020	25 Jul 11 16:18	Claudette
Cadmium - Total	0.00164	mg/l	0.00100	6020	25 Jul 11 16:18	Claudette
Chromium - Total	0.0065	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Cobalt - Total	< 0.002	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Copper - Total	0.0213	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Lead - Total	< 0.002	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Manganese - Total	0.0027	mg/l	0.0010	6020	25 Jul 11 16:18	Claudette
Molybdenum - Total	0.6860	mg/l	0.0020	6020	26 Jul 11 12:46	Claudette
Nickel - Total	0.0074	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Selenium - Total	0.0133	mg/l	0.0020	6020	26 Jul 11 9:46	Claudette
Silver - Total	< 0.001	mg/l	0.0010	6020	25 Jul 11 16:18	Claudette
Thallium - Total	< 0.002	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Tin - Total	< 0.05	mg/l	0.0500	6020	25 Jul 11 16:18	Claudette
Vanadium - Total	0.0189	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Zinc - Total	0.0151	mg/l	0.0100	6020	25 Jul 11 16:18	Claudette
Uranium	< 0.002	mg/l	0.002	6020	25 Jul 11 16:18	Claudette

All analyses were performed on the extract from Method 1312 (SPLP) with a modified solution to solids ratio of 4:1.

Approved by: D. Zander

RL = Method Reporting Limit

Elevated "Less Than Result" (<): @ = Due to sample matrix
! = Due to sample quantity
= Due to sample concentration
+ = Due to extract volume

CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

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MEMBER ACIL

Report Date: 8 Sep 11
Lab Number: 11-M2451
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit II Sand Ash
Sample Site: MDU Heskett

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
SPLP Extraction				1312	22 Jul 11	SS
pH	11.1	units	N/A	SM4500 H+ B	22 Jul 11 17:00	Claudette
Specific Conductance	20110	umhos/cm	N/A	SM2510-B	22 Jul 11 17:00	Claudette
Total Suspended Solids	21	mg/l	1	SM2540-D	22 Jul 11 14:00	CLB
Total Alkalinity	203	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Phenolphthalein Alk	171	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Bicarbonate	< 4	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Carbonate	64	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Hydroxide	139	mg/l CaCO3	0	SM2320-B	22 Jul 11 17:00	Claudette
Tot Dis Solids(Summation)	22500	mg/l	NA	SM1030-F	3 Aug 11 8:40	Calculated
Total Hardness as CaCO3	1200	mg/l	NA	SM2340-B	3 Aug 11 8:40	Calculated
Hardness in grains/gallon	70.2	gr/gal	NA	SM2340-B	3 Aug 11 8:40	Calculated
Cation Summation	318	meq/L	NA	SM1030-F	3 Aug 11 8:40	Calculated
Anion Summation	314	meq/L	NA	SM1030-F	28 Jul 11 14:30	Calculated
Percent Error	0.65	%	NA	SM1030-F	3 Aug 11 8:40	Calculated
Sodium Adsorption Ratio	80.9		NA	USDA 20b	3 Aug 11 8:40	Calculated
Gross Alpha Radiation	Attached	pCi/l			22 Aug 11 2:03	
Radon 222	See Attached				28 Jul 11 4:37	
Radium 226	Attached	pCi/l			22 Aug 11 22:20	
Radium 228	Attached	pCi/l			16 Aug 11 16:50	
Total Organic Carbon	< 0.5	mg/l	0.5	SM5310-C	1 Aug 11 8:00	Eric
Fluoride	< 0.1	mg/l	0.10	SM4500-F-C	4 Aug 11 17:00	CLB
Sulfate	14900	mg/l	5.00	ASTM D516-02	27 Jul 11 9:00	KMP
Chloride	2.0	mg/l	1.0	SM4500-Cl-E	27 Jul 11 14:00	KMP
Nitrate-Nitrite as N	< 0.1	mg/l	0.10	EPA 353.2	28 Jul 11 14:30	KMP
Ammonia-Nitrogen as N	0.10	mg/l	0.10	EPA 350.1	28 Jul 11 10:45	KMP
Phosphorus as P - Total	< 0.1	mg/l	0.10	EPA 365.1	28 Jul 11 13:00	KMP
Mercury - Total	< 0.0002	mg/l	0.0002	EPA 245.1	28 Jul 11 8:00	Eric
Chemical Oxygen Demand	< 5	mg/l	5.0	HACH 8000	1 Aug 11 8:30	Wayne
Calcium - Total	481	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Magnesium - Total	< 5	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Sodium - Total	6500	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Potassium - Total	459	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Aluminum - Total	1.09	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Iron - Total	< 1	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Strontium - Total	66.0	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Titanium - Total	< 1	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Boron - Total	5.96	mg/l	0.10	6010	11 Aug 11 8:40	Stacy

RL = Method Reporting Limit

Elevated "Less Than Result" (<): @ = Due to sample matrix
! = Due to sample quantity
= Due to sample concentration
+ = Due to extract volume

CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

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MEMBER ACIL

Report Date: 8 Sep 11
Lab Number: 11-M2451
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit II Sand Ash
Sample Site: MDU Heskett

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
Antimony - Total	< 0.002	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Arsenic - Total	0.0822	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Barium - Total	0.0930	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Beryllium - Total	< 0.001	mg/l	0.0010	6020	25 Jul 11 16:18	Claudette
Cadmium - Total	0.00182	mg/l	0.00100	6020	25 Jul 11 16:18	Claudette
Chromium - Total	0.0244	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Cobalt - Total	< 0.002	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Copper - Total	0.1108	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Lead - Total	< 0.002	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Manganese - Total	0.0052	mg/l	0.0010	6020	25 Jul 11 16:18	Claudette
Molybdenum - Total	0.1000	mg/l	0.0020	6020	26 Jul 11 12:46	Claudette
Nickel - Total	0.0136	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Selenium - Total	0.0937	mg/l	0.0020	6020	26 Jul 11 9:46	Claudette
Silver - Total	< 0.001	mg/l	0.0010	6020	25 Jul 11 16:18	Claudette
Thallium - Total	< 0.002	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Tin - Total	< 0.05	mg/l	0.0500	6020	25 Jul 11 16:18	Claudette
Vanadium - Total	0.3026	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Zinc - Total	0.0327	mg/l	0.0100	6020	25 Jul 11 16:18	Claudette
Uranium	< 0.002	mg/l	0.002	6020	25 Jul 11 16:18	Claudette

All analyses were performed on the extract from Method 1312 (SPLP) with a modified solution to solids ratio of 4:1.

Approved by: D. Zander

RL = Method Reporting Limit

Elevated "Less Than Result" (<): @ = Due to sample matrix
! = Due to sample quantity
= Due to sample concentration
+ = Due to extract volume

CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

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MEMBER ACIL

Report Date: 8 Sep 11
Lab Number: 11-M2452
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit I Fly Ash
Sample Site: MDU Heskett

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
SPLP Extraction				1312	22 Jul 11	SS
pH	12.9	units	N/A	SM4500 H+ B	22 Jul 11 17:00	Claudette
Specific Conductance	50660	umhos/cm	N/A	SM2510-B	22 Jul 11 17:00	Claudette
Total Suspended Solids	30	mg/l	1	SM2540-D	22 Jul 11 14:00	CLB
Total Alkalinity	7020	mg/l CaCO3	4	SM2320-B	25 Jul 11 17:00	Claudette
Phenolphthalein Alk	6900	mg/l CaCO3	4	SM2320-B	25 Jul 11 17:00	Claudette
Bicarbonate	< 4	mg/l CaCO3	4	SM2320-B	25 Jul 11 17:00	Claudette
Carbonate	240	mg/l CaCO3	4	SM2320-B	25 Jul 11 17:00	Claudette
Hydroxide	6780	mg/l CaCO3	0	SM2320-B	25 Jul 11 17:00	Claudette
Tot Dis Solids(Summation)	42200	mg/l	NA	SM1030-F	3 Aug 11 8:40	Calculated
Total Hardness as CaCO3	1750	mg/l	NA	SM2340-B	3 Aug 11 8:40	Calculated
Hardness in grains/gallon	102	gr/gal	NA	SM2340-B	3 Aug 11 8:40	Calculated
Cation Summation	663	meq/L	NA	SM1030-F	3 Aug 11 8:40	Calculated
Anion Summation	613	meq/L	NA	SM1030-F	28 Jul 11 14:30	Calculated
Percent Error	3.99	%	NA	SM1030-F	3 Aug 11 8:40	Calculated
Sodium Adsorption Ratio	143		NA	USDA 20b	3 Aug 11 8:40	Calculated
Gross Alpha Radiation	Attached	pCi/l			22 Aug 11 2:03	
Radon 222	Attached				28 Jul 11 4:37	
Radium 226	Attached	pCi/l			22 Aug 11 22:20	
Radium 228	Attached	pCi/l			16 Aug 11 16:50	
Total Organic Carbon	1.5	mg/l	0.5	SM5310-C	1 Aug 11 8:00	Eric
Fluoride	5.60	mg/l	0.10	SM4500-F-C	10 Aug 11 17:00	CLB
Sulfate	22600	mg/l	5.00	ASTM D516-02	27 Jul 11 9:00	KMP
Chloride	53.8	mg/l	1.0	SM4500-Cl-E	27 Jul 11 14:00	KMP
Nitrate-Nitrite as N	0.68	mg/l	0.10	EPA 353.2	28 Jul 11 14:30	KMP
Ammonia-Nitrogen as N	7.22	mg/l	0.10	EPA 350.1	28 Jul 11 10:45	KMP
Phosphorus as P - Total	< 0.1	mg/l	0.10	EPA 365.1	28 Jul 11 13:00	KMP
Mercury - Total	< 0.0002	mg/l	0.0002	EPA 245.1	28 Jul 11 8:00	Eric
Chemical Oxygen Demand	22.4	mg/l	5.0	HACH 8000	1 Aug 11 8:30	Wayne
Calcium - Total	700	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Magnesium - Total	< 25	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Sodium - Total	14100	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Potassium - Total	580	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Aluminum - Total	< 5	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Iron - Total	< 5	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Strontium - Total	59.5	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Titanium - Total	< 5	mg/l	0.10	6010	2 Aug 11 9:30	Stacy
Boron - Total	1.89	mg/l	0.10	6010	11 Aug 11 8:40	Stacy

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Elevated "Less Than Result" (<): @ = Due to sample matrix
! = Due to sample quantity
= Due to sample concentration
+ = Due to extract volume

CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

MINNESOTA VALLEY TESTING LABORATORIES, INC.
1126 North Front St. ~ New Ulm, MN 56073 ~ 800-782-3557 ~ Fax 507-359-2890
2616 East Broadway Ave. ~ Bismarck, ND 58501 ~ 800-279-6885 ~ Fax 701-258-9724
51 West Lincoln Way ~ Nevada, IA 50201 ~ 800-362-0855 ~ Fax 515-382-3885
www.mvtl.com

Report Date: 8 Sep 11
Lab Number: 11-M2452
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit I Fly Ash
Sample Site: MDU Heskett

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
Antimony - Total	< 0.002	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Arsenic - Total	0.1128	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Barium - Total	0.0906	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Beryllium - Total	< 0.001	mg/l	0.0010	6020	25 Jul 11 16:18	Claudette
Cadmium - Total	0.00244	mg/l	0.00100	6020	25 Jul 11 16:18	Claudette
Chromium - Total	0.0270	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Cobalt - Total	< 0.002	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Copper - Total	0.2934	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Lead - Total	0.0161	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Manganese - Total	0.0102	mg/l	0.0010	6020	25 Jul 11 16:18	Claudette
Molybdenum - Total	0.9246	mg/l	0.0020	6020	26 Jul 11 12:46	Claudette
Nickel - Total	0.0175	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Selenium - Total	0.1959	mg/l	0.0020	6020	26 Jul 11 9:46	Claudette
Silver - Total	< 0.001	mg/l	0.0010	6020	25 Jul 11 16:18	Claudette
Thallium - Total	< 0.002	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Tin - Total	< 0.05	mg/l	0.0500	6020	25 Jul 11 16:18	Claudette
Vanadium - Total	0.0158	mg/l	0.0020	6020	25 Jul 11 16:18	Claudette
Zinc - Total	0.3984	mg/l	0.0100	6020	25 Jul 11 16:18	Claudette
Uranium	< 0.002	mg/l	0.002	6020	25 Jul 11 16:18	Claudette

All analyses were performed on the extract from Method 1312 (SPLP) with a modified solution to solids ratio of 4:1.

Approved by: D. Zarda

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CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

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www.mvtl.com

MEMBER ACIL

Report Date: 8 Sep 11
Lab Number: 11-M2453
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit II Fly Ash
Sample Site: MDU Heskett

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
SPLP Extraction				1312	22 Jul 11	SS
pH	12.8	units	N/A	SM4500 H+ B	22 Jul 11 17:00	Claudette
Specific Conductance	27240	umhos/cm	N/A	SM2510-B	22 Jul 11 17:00	Claudette
Total Suspended Solids	13	mg/l	1	SM2540-D	22 Jul 11 14:00	CLB
Total Alkalinity	4570	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Phenolphthalein Alk	4520	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Bicarbonate	< 4	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Carbonate	100	mg/l CaCO3	4	SM2320-B	22 Jul 11 17:00	Claudette
Hydroxide	4470	mg/l CaCO3	0	SM2320-B	22 Jul 11 17:00	Claudette
Tot Dis Solids(Summation)	16000	mg/l	NA	SM1030-F	3 Aug 11 8:40	Calculated
Total Hardness as CaCO3	1960	mg/l	NA	SM2340-B	3 Aug 11 8:40	Calculated
Hardness in grains/gallon	115	gr/gal	NA	SM2340-B	3 Aug 11 8:40	Calculated
Cation Summation	252	meq/L	NA	SM1030-F	9 Aug 11 9:09	Calculated
Anion Summation	247	meq/L	NA	SM1030-F	28 Jul 11 14:30	Calculated
Percent Error	1.00	%	NA	SM1030-F	9 Aug 11 9:09	Calculated
Sodium Adsorption Ratio	46.1		NA	USDA 20b	3 Aug 11 8:40	Calculated
Gross Alpha Radiation	Attached	pCi/l			22 Aug 11 2:03	
Radon 222	Attached				28 Jul 11 4:37	
Radium 226	Attached	pCi/l			22 Aug 11 22:20	
Radium 228	Attached	pCi/l			16 Aug 11 16:50	
Total Organic Carbon	1.6	mg/l	0.5	SM5310-C	1 Aug 11 8:00	Eric
Fluoride	3.60	mg/l	0.10	SM4500-F-C	4 Aug 11 17:00	CLB
Sulfate	7400	mg/l	5.00	ASTM D516-02	27 Jul 11 9:00	KMP
Chloride	66.0	mg/l	1.0	SM4500-Cl-E	27 Jul 11 14:00	KMP
Nitrate-Nitrite as N	0.38	mg/l	0.10	EPA 353.2	28 Jul 11 14:30	KMP
Ammonia-Nitrogen as N	15.0	mg/l	0.10	EPA 350.1	28 Jul 11 10:45	KMP
Phosphorus as P - Total	< 0.1	mg/l	0.10	EPA 365.1	28 Jul 11 13:00	KMP
Mercury - Total	< 0.0002	mg/l	0.0002	EPA 245.1	28 Jul 11 8:00	Eric
Chemical Oxygen Demand	9.4	mg/l	5.0	HACH 8000	1 Aug 11 8:30	Wayne
Calcium - Total	785	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Magnesium - Total	< 5	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Sodium - Total	4720	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Potassium - Total	275	mg/l	1.0	6010	3 Aug 11 8:40	Stacy
Aluminum - Total	< 1	mg/l	0.10	6010	9 Aug 11 9:09	Stacy
Iron - Total	< 1	mg/l	0.10	6010	9 Aug 11 9:09	Stacy
Strontium - Total	85.0	mg/l	0.10	6010	9 Aug 11 9:09	Stacy
Titanium - Total	< 1	mg/l	0.10	6010	9 Aug 11 9:09	Stacy
Boron - Total	< 1	mg/l	0.10	6010	11 Aug 11 8:40	Stacy

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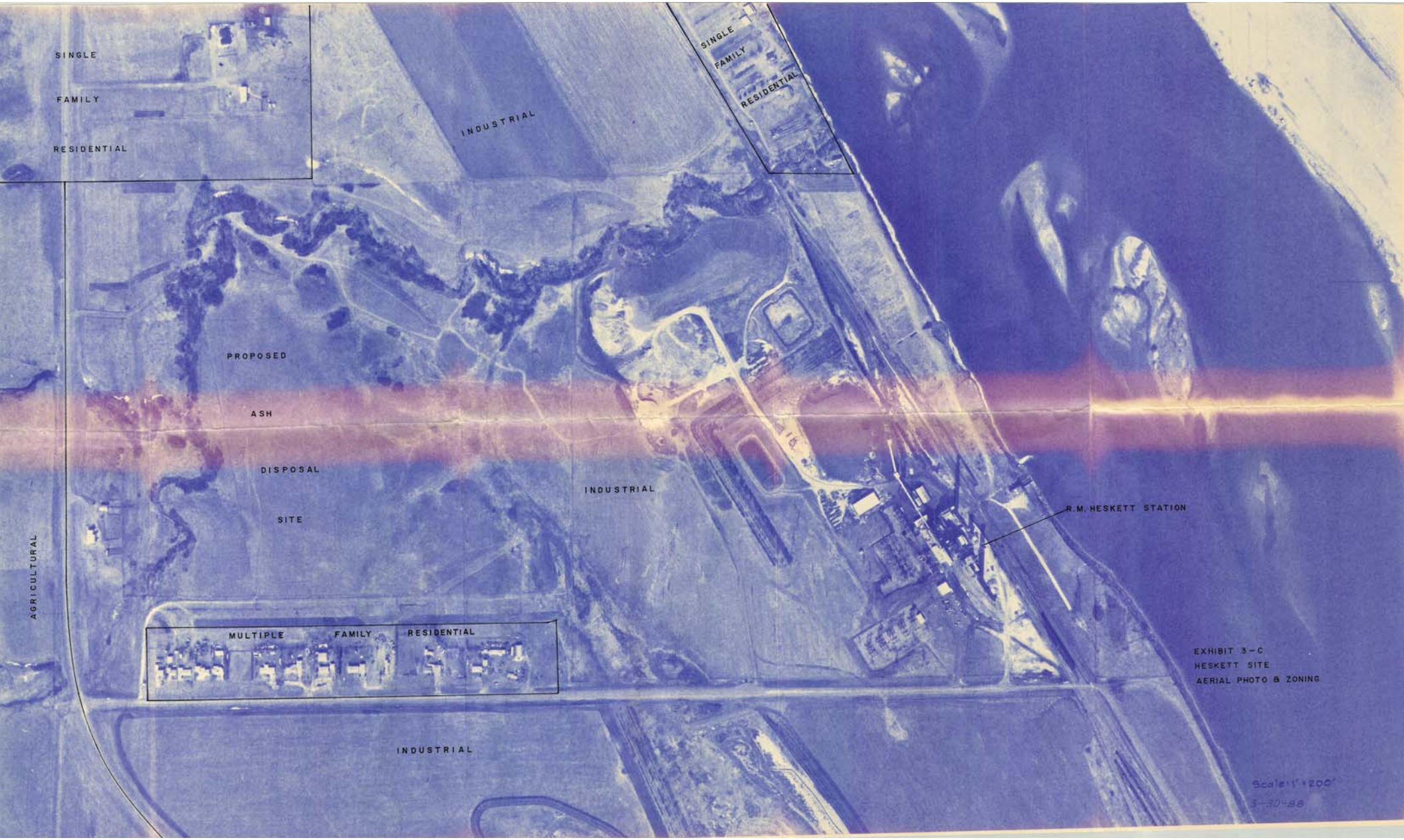
CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

Appendix D

Aerial Photo (March 30, 1988)


SINGLE
FAMILY
RESIDENTIAL
INDUSTRIAL
SINGLE
FAMILY
RESIDENTIAL
PROPOSED
ASH
DISPOSAL
SITE
INDUSTRIAL
R.M. HESKETT STATION
AGRICULTURAL
MULTIPLE FAMILY RESIDENTIAL
INDUSTRIAL
EXHIBIT 3-C
HESKETT SITE
AERIAL PHOTO & ZONING
Scale 1"=200'
1-30-88

Appendix E

Boring Logs

EXHIBIT 5-E

LITHOLOGIC LOGS

Wells 10, 11, 12 and 13

0-1	Top soil, silty, clayey, sandy, brown, calcareous; with some limestone pebbles.
1-11	Silt, clayey, brownish-tan, slightly indurated, very dry, calcareous; with thin coarse-grained, clean silt lenses and a few small (less than .5 in.) iron oxide concretions. Abundant small gypsum crystals (less than .13 in. long). Some small, black flakes of organic plant material. Cannonball-Ludlow Formations.
11-14	Silt, as above, with some (less than 20%) very fine- to fine-grained sand interspersed.
14-30	Silt, as above, clayey, less sand than above interval, oxidized; with very fine-grained silty sand lenses and very few gypsum crystals.
30-41	Silt, very clayey, with some (less than 20%) very fine-grained sand interspersed, steel-gray (color change), moderately indurated; with fewer small gypsum crystals than above intervals.
41-59	Silt, as above, very clayey, with some (less than 20%) fine- to medium-grained sand interspersed in a silt and clay matrix.
59-65	Silt, as above, with abundant (more than 20%) fine- to medium-grained sand interspersed.
65-81	Silt, clayey, steel-gray to bluish, moderately indurated; with thin coarse-grained silt to very fine-grained sand lenses in an otherwise fine silt to clay matrix.
81-84	Clay, silty, steel-gray to bluish, moderately indurated, dense.
84-91	Siltstone, sandy, clayey, steel-gray to bluish, slightly indurated; with small fine-grained sand lenses and abundant (more than 20%) sand interspersed in the matrix.
91-110	Silt, clayey, bluish-gray, moderately indurated; with thin (less than 1 foot) mudstone lenses.
110-120	Silt, very clayey, steel-gray to bluish, moderately indurated, very dense. Cannonball-Ludlow Formations.

Wells 20 and 21

0-1	Top soil, silty, sandy, clayey, dark-brown, calcareous; with some limestone and granite pebbles.
1-21	Silt, clayey, with minor amounts (less than 10%) of very fine-grained sand interspersed, brownish-tan, slightly indurated, calcareous, oxidized; with small iron oxide concretions and abundant small gypsum crystals. Cannonball-Ludlow Formations.
21-26	Silt, as above, steel-gray (color change).
26-49	Silt, clayey, with some (less than 20%) very fine- to medium-grained sand interspersed, steel-gray to bluish, slightly indurated; with very few small gypsum crystals and some thin (less than 1 foot) siltstone lenses.
49-53	Silt, as above, with abundant (more than 20%) fine- to medium-grained sand interspersed.
53-63	Silt, as above, clayey, less sand, with thin (less than 1 foot) siltstone to mudstone lenses.
63-80	Silt, very clayey, steel-gray to bluish, moderately indurated, very dense. Cannonball-Ludlow Formations.

Wells 30, 31, 32 and 33

0-1	Top soil, silty, sandy, brownish, calcareous; with some granite and limestone pebbles.
1-2	Pebble-loam (glacial till), silty, sandy, clayey, yellowish-brown, dry, calcareous.
2-31	Silt, clayey, with minor amounts (less than 10%) of very fine-grained sand interspersed, brownish-tan, slightly indurated, calcareous, oxidized; with small iron oxide concretions. Some small, black flakes organic plant material. Cannonball-Ludlow Formations.
31-44	Silt, clayey, steel-gray (color change), slightly indurated, calcareous; with small iron oxide concretions, thin coarse silt lenses, small gypsum crystals and gray to reddish-brown mottling.

44-61	Silt, as above, with some (less than 20%) fine- to medium-grained sand interspersed.
61-65	Silt, as above, with abundant (more than 20%) fine- to medium-grained sand interspersed, dense.
65-76	Silt, as above, clayey, less sand, some thin (less than 1 foot) lenses of siltstone to mudstone.
76-80	Siltstone, sandy, clayey, steel-gray to bluish, slightly indurated; with small fine-grained sand lenses and abundant (more than 20%) fine-grained sand interspersed in the matrix.
80-92	Silt, clayey, steel-gray to bluish, moderately indurated, with some (less than 20%) very fine- to fine grained sand interspersed.
92-120	Silt, very clayey, steel-gray to bluish, moderately indurated, very dense. Cannonball-Ludlow Formations.

Well 40

0-1	Top soil, sandy, silty, brownish-tan, calcareous; with some granite and limestone pebbles.
1-5	Pebble-loam (glacial till), sandy, silty, with detrital lignite and organic matter, yellowish-brown, very dry, calcareous.
5-22	Sand, very fine- to medium-grained, unconsolidated, with thin lenses of clay and detrital lignite, brownish-yellow, calcareous.
22-40	Silt, clayey, with minor amounts (less than 10%) very fine-grained sand interspersed, brownish-tan, slightly indurated, calcareous, oxidized; with small iron oxide concretions and small gypsum crystals; Cannonball-Ludlow Formations.
40-51	Silt, clayey, with minor amounts (less than 10%) of very fine-grained sand interspersed, steel-gray (color change), moderately indurated; with some reddish-brown mottling and some very thin (less than 6 inches) mudstone lenses.
51-58	Silt, as above, with abundant (more than 20%) fine-grained sand and thin silty-clay lenses.

58-62	Siltstone, sandy, clayey, steel-gray to bluish, moderately indurated; with small fine-grained sand lenses and abundant (more than 20%) sand interspersed in the matrix.
62-70	Silt, clayey, with some (less than 20%) fine- to medium-grained sand interspersed, steel-gray to bluish, moderately indurated; with thin (less than 2 feet) sandy lenses.
70-80	Silt, as above, very clayey, some (less than 10%) fine-grained sand interspersed; less sand than above interval.
80-120	Silt, as above, dark-steel-gray. Cannonball-Ludlow Formations.

Wells 41, 42 and 43

0-1	Top soil, sandy, silty, dark-brown, calcareous; with some granite and limestone pebbles.
1-4	Pebble-loam (glacial till), sandy, silty, clayey, yellowish-brown, very dry, calcareous.
4-40	Silt, clayey, with some (less than 20%) very fine-grained sand interspersed, brownish-tan, unconsolidated, noncompacted, calcareous to 25 feet, oxidized; with small iron oxide concretions and abundant small gypsum crystals. Cannonball-Ludlow Formations.
40-51	Silt, clayey, with minor amounts (less than 10%) of very fine-grained sand interspersed, steel-gray (color change), moderately indurated; with some reddish-brown mottling and some very thin (less than 6 inches) mudstone lenses.
51-58	Silt, as above, with abundant (more than 20%) fine-grained sand and thin silty-clay lenses.
58-62	Siltstone, sandy, clayey, steel-gray to bluish, moderately indurated; with small fine-grained sand lenses and abundant (more than 20%) sand interspersed in the matrix.
62-70	Silt, clayey, with some (less than 20%) fine- to medium-grained sand interspersed, steel-gray to bluish, moderately indurated; with thin (less than 2 feet) sandy lenses.

70-80	Silt, as above, very clayey, some (less than 10%) fine-grained sand interspersed; less sand than above interval.

Wells 43 and 44

0-2	Top soil, clayey, silty, some sand, brownish-tan to light-gray, calcareous.
2-20	Silt, clayey, with some (less than 20%) fine-grained sand interspersed, brownish-tan, slightly indurated, very dry, calcareous; with small iron oxide concretions, abundant small gypsum crystals and occasional thin silt lenses. Cannonball-Ludlow Formations.
20-25	Silt, as above, very clayey, oxidized, with minor amounts (less than 10%) of fine-grained sand.
25-35	Silt, as above, dark-brownish-tan to bluish-gray (color change), with thin very fine-grained sand lenses.
35-60	Silt, clayey, with some (less than 20%) fine- to medium-grained sand interspersed, steel-gray to bluish, moderately indurated; with some indurated silty sand lenses. Cannonball-Ludlow Formations.

Wells 50, 51 and 52

0-4	Top soil, clayey, silty, very dark-brown.
4-10	Clay, silty, with some (less than 20%) fine-grained sand, dark-brownish-tan, soft, cohesive, wet, sticky; with some pebbles.
10-22	Silt, very clayey, with some (less than 20%) very fine-grained sand interspersed, brownish-tan, slightly indurated, calcareous, dense; with abundant small gypsum crystals and very thin silt and sand lenses; Cannonball-Ludlow Formations.
22-23	Sandstone, fine-grained, silty, indurated, oxidized, dark-brown.
23-30	Silt, very clayey, with some (less than 20%) very fine-grained sand interspersed, steel-gray (color change), moderately indurated; with thin medium grained sand lenses.

30-40	Silt, as above, very clayey, less sand than above interval, dark-steel-gray. Cannonball-Ludlow Formations.

Wells 53 and 54

0-4	Top soil, clayey, silty, very dark-brown, wet, sticky.
4-15	Clay, silty, with some (less than 20%) fine- to medium-grained sand interspersed, brownish-tan, slightly indurated, dry, calcareous; with small iron oxide concretions, small gypsum crystals and occasional reddish-brown mottling; Cannonball-Ludlow Formations.
15-20	Sand, very fine-grained to medium-grained, silty, clayey, unconsolidated, yellowish-brown, oxidized.
20-30	Silt, clayey, with some (less than 20%) fine-grained sand interspersed, steel-gray (color change), slightly indurated; with clay and sand lenses, some small concretions and some small gypsum crystals.
30-45	Silt, as above, very clayey.
45-60	Silt, as above, clayey, brownish-gray, moderately indurated, some reddish-brown mottling. Cannonball-Ludlow Formations.

Wells 55 and 56

0-5	Sandy-loam (glacial), with fine- to medium-grained sand, silty, calcareous; with small granite and limestone pebbles.
5-26	Clay, silty, with minor amounts (less than 10%) of very fine-grained sand, dark-brownish-tan, moderately indurated, brittle, very dry, calcareous; with small iron oxide concretions, small gypsum crystals and occasional thin sandstone laminae. Some small, black flakes of organic plant material. Cannonball-Ludlow Formations.
26-35	Clay, as above, very silty, sandy, brownish-tan, oxidized.

35-40 Silt, clayey, with some (less than 20%) very fine- to fine-grained sand interspersed, steel-gray (color change) moderately indurated; with small gypsum crystals and occasional clay lenses.

40-60 Silt, as above, with minor amounts (less than 10%) of fine-grained sand interspersed.

60-85 Silt, as above, clayey, less sand than above interval.

85-100 Silt, as above, very clayey, with minor amounts (less than 10%) of sand interspersed, light-gray. Cannonball-Ludlow Formations.

Wells 60, 61 and 62

0-2 Top soil, silty, clayey, dark-brown to tanish-brown, calcareous.

2-25 Silt, very clayey, with some minor amounts (less than 10%) of very fine- to fine-grained sand interspersed, brownish-tan, slightly indurated, dry, calcareous; with abundant small gypsum crystals and thin silt and sand lenses; Cannonball-Ludlow Formations.

25-29 Silt, as above, with abundant (more than 20%) fine- to medium-grained sand interspersed.

29-36 Silt, as above, clayey, less sand than above interval, dark-brownish-tan, oxidized.

36-60 Silt, very clayey, with some (less than 20%) very fine-grained sand interspersed, steel-gray (color change), moderately indurated; with thin (less than 1 foot) sandy-silt lenses. Cannonball-Ludlow Formations.

Well 70 0-2 Pebble-loam (glacial till), clayey, sandy, yellowish-brown, unconsolidated, damp, calcareous.

2-21 Silty, clayey, with some (less than 20%) fine-grained sand interspersed, brownish-tan, moderately indurated, very dry, calcareous, oxidized; with small iron oxide concretions and abundant small gypsum crystals. Cannonball-Ludlow Formations.

21-24	Shale, silty, steel- to dark-gray (color change), indurated, fissile, very dry; with occasional thin silt and sand lenses.
24-31	Silt, clayey, with abundant (more than 30%) sand, steel-gray, moderately indurated.
31-62	Silt, clayey, with some (less than 20%) very fine- to fine- grained sand interspersed, steel-gray, moderately indurated; with some small gypsum crystals and small iron oxide concretions.
62-76	Silt, as above, with some (less than 20%) fine-grained sand interspersed.
76-82	Silt, as above, with abundant (more than 20%) fine- to medium-grained sand.
82-100	Silt, as above, clayey, with some (less than 20%) fine-grained sand interspersed, dark-gray. Cannonball-Ludlow Formations.

The litnologic logs for wells 1-4 were described by personal from Water Supply Incorporated (WS), Bismarck, North Dakota. The wells were installed during a previous ground water investigation at Heskett Station.

Well WS 2

0-1	Top soil, silty, black.
1-4	Pebble-loam (glacial till), silty, clayey, some cobbles, yellowish-brown.
4-7	Gravel, sand and rocks.
7-21	Sand, fine- to coarse-grained, some pebbles.
21-39	Clay, silty, sandy, yellowish-brown to gray.
39-52	Clay, silty, sandy, gray.
52-67	Sand, fine-grained, bluish, with some clay layers.
67-89	Clay, silty, sandy, brown to gray.

Wells WS 1, 1A and 1B

0-1	Top soil, silty, black
1-4	Clay, (glacial), silty, with pebbles, yellowish-brown.
4-21	Sand, fine- to medium-grained, yellowish-brown; with clay and silt lenses.
21-25	Clay, silty, yellowish-brown.
25-30	Sand, fine-grained, yellowish-brown, some indurated layers.
30-35	Clay, silty, yellowish-brown.
35-45	Sand, fine-grained, yellowish-brown.
45-50	Clay, silty, sandy, gray, about 50 percent shale.
50-56	Sand, fine-grained, with clay layers.
56-73	Clay, silty, sandy, gray.

WEll WS 4, 4A and 4B

0-13	Pebble-loam (glacial till), silty, sandy, with some cobbles, yellowish-brown.
13-23	Sand, fine- to medium-grained, yellowish-brown.
23-25	Slay, silty, sandy, yellowish-brown.
25-27	Sandstone, indurated.
27-30	Clay, sandy, silty, gray.
30-36	Sand, fine-grained, gray.
36-52	Clay, silty, sandy, gray; with some sand layers.

Wells WS 3 and 3A

0-1	Top soil, silty, black.
1-12	Pebble-loam, clayey, silty, with some cobbles, yellowish-brown.
12-16	Clay, silty, gray; with some shale layers.
16-18	Limestone, indurated.
18-23	Clay, silty, yellowish-brown; with some sand layers.
23-44	Sand, fine- to medium-grained, gray; with some clay layers.
44-50	Clay, silty, medium-gray.

Barr Engineering Company
234 West Century Avenue
Bismarck, ND 58503
Telephone: 701-255-5460

LOG OF BORING MW-44 R

Project:Heskett Station
Project No.:34301012
Location:Mandan, ND
Coordinates:Lat: 46.86620° Long: -100.89313°
Datum:

Surface Elevation:
Drilling Method:HSA
Sampling Method:Split Spoon
Completion Depth:46.0 ft

Unique Well No.:MW-44 R

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION
0		1	3-3-5-8.	OL/OH		0-1': TOPSOIL (OL/OH): Very Dark Brown (2.5/2 7.5YR); low to medium plasticity; roots, fine to medium grained sand.
						1-46': SANDY CLAY (CL): Brown (5/4 7.5YR) to Dark Gray (4/1 7.5YR); medium to high plasticity; massive; fine to medium grained sand. Moist; 20% gravel, 30% sand, 50% fines. At 1-5': Gravel sized inclusions.
		2	9-9-7-7.			Moist; 10% gravel, 20% sand, 70% fines.
5		3	7-5-5-7.			Moist; 0% gravel, 30% sand, 70% fines.
		4	7-9-11-13.			Moist; 0% gravel, 20% sand, 80% fines.
		5	7-9-12-13.			At 8': Oxidized staining.
10		6	6-7-11-13.			
		7	7-10-12-14.	CL		
15		8	6-10-14-14.			
20		9	10-10-13-16.			At 20': Interbedded layer of sand.
25		10	10-10-12-16.	CL		(CL): At 24': Color change to dark brown (3/3 7.5YR). Moist; 0% gravel, 20% sand, 80% fines. At 25': Sand lens.

WELL OR PIEZOMETER CONSTRUCTION DETAIL

PRO. CASING
Diameter: 4" by 4"
Type: Steel
Interval: 3' up & 3' down

RISER CASING
Diameter: 2"
Type: Schd 40 PVC
Interval: Stick up to screen (23')

GROUT
Type: Cement
Interval: 0-0.5' BGS

SEAL
Type: Bentonite Chips
Interval: 0.5-21' BGS

SANDPACK
Type: Granusil
Interval: 21-46' BGS

SCREEN
Diameter: 2"
Type: No. 10 Slot
Interval: 23-43' BGS

Elevation, feet

Date Boring Started: 10/20/14
Date Boring Completed: 10/20/14
Logged By: JEG3
Drilling Contractor: Midwest Testing (Terracon)
Drill Rig:

Remarks: Water encountered at 28.7' BGS in MW-44R while drilling on 10/2014

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
234 West Century Avenue
Bismarck, ND 58503
Telephone: 701-255-5460

LOG OF BORING MW-44 R

Project:Heskett Station
Project No.:34301012
Location:Mandan, ND
Coordinates:Lat: 46.86620° Long: -100.89313°
Datum:

Surface Elevation:
Drilling Method:HSA
Sampling Method:Split Spoon
Completion Depth:46.0 ft

Unique Well No.:MW-44 R

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
30		11	8-12-14-18.	CL		(CL): At 24': Color change to dark brown (3/3 7.5YR). *(continued)* Wet; 0% gravel, 20% sand, 80% fines. At 30.5': Sand lens.		
35		12	8-13-16-27.			(CL): At 32': Color change to dark gray (4/1 7.5YR).		
40		13	11-19-25-27.	CL				
45		14	14-18-27-34.	SC		(SC): At 45.8': Clayey Sand (SC), fine to medium grained, low to medium plasticity, dark greenish gray (4/10G Gley 2).		
50								
55								

PRO. CASING
Diameter: **4" by 4"**
Type: **Steel**
Interval: **3' up & 3' down**

RISER CASING
Diameter: **2"**
Type: **Schd 40 PVC**
Interval: **Stick up to screen (23')**

GROUT
Type: **Cement**
Interval: **0-0.5' BGS**

SEAL
Type: **Bentonite**
Interval: **Chips 0.5-21' BGS**

SANDPACK
Type: **Granusil**
Interval: **21-46' BGS**

SCREEN
Diameter: **2"**
Type: **No. 10 Slot**
Interval: **23-43' BGS**

Date Boring Started: 10/20/14
Date Boring Completed: 10/20/14
Logged By: JEG3
Drilling Contractor: Midwest Testing (Terracon)
Drill Rig:

Remarks: Water encountered at 28.7' BGS in MW-44R while drilling on 10/2014

Additional data may have been collected in the field which is not included on this log.
Weather:

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State of North Dakota

BOARD OF WATER WELL CONTRACTORS

900 E. BOULEVARD • BISMARCK, NORTH DAKOTA 58505

MONITORING WELL REPORT

State law requires that this report be filed with the State Board of Water Well Contractors within 30 days after completion or abandonment of the well.

1. WELL OWNER

Name MDU-Heskett Station

Address 2025 38th Street

Mandan, North Dakota

2. WELL LOCATION **(MW-44R)**

Address (if in city) (see attached drawing)

County Morton

SE ¼ SE ¼ SW ¼ Sec. 10 Twp. 139 N. Rge. 81 W.

Lat. 46.86620 Long.: -100.89313

Altitude:

3. METHOD DRILLED

■ Auger Other

4. WELL CONSTRUCTION

Diameter of Hole 8 inches Depth 46 feet

Riser: ■ PVC □ Other

■ Threaded □ Solvent □ Other

Riser rating SDR Schedule 40

Diameter 2.0 inches

From +2 ft. to 23 ft.

Was a well screen installed? ■ Yes □ No

Material Schedule 40 PVC Diameter 2.0 inches

Slot Size #10 set from 23 feet to 43 feet

Sand packed from 21 ft to 46 ft

Depth grouted from 1 ft to 21 ft

Grouting Material

Bentonite x Other

If other explain:

One foot concrete collar at surface

Well head completion:

24" above grade Other x

If other, specify 4" x 4" x 5' steel cover

Was protective casing installed? ■ Yes □ No

Was well disinfected upon completion? □ Yes ■ No

5. WATER LEVEL

Static water level 28.5 feet below surface

If flowing: closed in pressure psi or ft. above land surface

6. WELL LOG

Formation	Depth (Ft.) From	To
Topsoil	0	0.5
Sandy lean clay	0.5	5
Sandy fat clay	5	46

(Use separate sheet if necessary)

7. WAS THE HOLE PLUGGED OR ABANDONED?

□ Yes ■ No

If so, how?

8. REMARKS

3 steel bumpers installed around well head

9. DATE COMPLETED 10-21-14

10. CONTRACTOR CERTIFICATION

This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

Midwest Testing Laboratory, Inc. 444

Monitoring Well Contractor Certificate No.

P.O. Box 2084, Bismarck, ND 58502-2084

Address

Signature 10-22-14

Date

Barr Engineering Company
234 West Century Avenue
Bismarck, ND 58503
Telephone: 701-255-5460

LOG OF BORING MW-80 R

SHEET 1 OF 1

Project:Heskett Station
Project No.:34301012
Location:Mandan, ND
Coordinates:Lat: 46.86789° Long: -100.89320°
Datum:

Surface Elevation:
Drilling Method:HSA
Sampling Method:Split Spoon
Completion Depth:27.0 ft

Unique Well No.:MW-80 R

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0				OL/OH		0-0.5': TOPSOIL (OL/OH): Black; organic roots.		
		1	4-4-4-5.			0.5-27': SANDY CLAY (CL): Brown (4/4 7.5 YR) to Black (2.5/1 7.5YR); medium to high plasticity; fine to medium grained sand. Moist; 0% gravel, 30% sand, 70% fines.	PRO. CASING Diameter: 4" by 4" Type: Steel Interval: 3' up & 3' down	
		2	4-5-7-9.			At 2': Gravel inclusions. Moist; 10% gravel, 30% sand, 60% fines.		
5		3	4-4-5-8.	CL		Moist; 0% gravel, 20% sand, 80% fines.	RISER CASING Diameter: 2" Type: Schd 40 PVC Interval: Stick up to screen (7')	
		4	4-4-6-6.					
		5	3-4-5-6.	CL		(CL): At 8': Color change to 2.5/1 7.5YR black, no odor.	GROUT Type: Cement Interval: 0-0.5' BGS	
10		6	1-3-3-4.	CL		(CL): At 9': Color change to 2.5/2 7.5YR very dark brown. Moist; 0% gravel, 20% sand, 80% fines.	SEAL Type: Bentonite Interval: Chips 0.5-5' BGS	
		7	1-1-2-1.	CL		(CL): At 11': Color change to 3/3 7.5YR dark brown. Moist; 0% gravel, 20% sand, 80% fines.	SANDPACK Type: Granusil Interval: 5-27' BGS	
15		8	1-2-2-1.			(CL): At 13': Color change to 4/4 7.5YR brown. Wet; 0% gravel, 20% sand, 80% fines.	SCREEN Diameter: 2" Type: No 10 Slot Interval: 7-27' BGS	
20		9	7-11-12-17.	CL		At 21': Thin sand lens less than 0.1" thick. Wet; 0% gravel, 20% sand, 80% fines. At 21.5': Thin sand lens less than 0.1" thick.		
25		10	7-11-17-17.			Wet; 0% gravel, 20% sand, 80% fines. At 26.5': Thin sand lens less than 0.1" thick.		

Date Boring Started: 10/20/14
Date Boring Completed: 10/20/14
Logged By: JEG3
Drilling Contractor: Midwest Testing (Terracon)
Drill Rig:

Remarks: Water encountered at 11.8' BGS in MW-80R while drilling on 10/20/14

Additional data may have been collected in the field which is not included on this log.
Weather:

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State of North Dakota

BOARD OF WATER WELL CONTRACTORS

900 E. BOULEVARD • BISMARCK, NORTH DAKOTA 58505

MONITORING WELL REPORT

State law requires that this report be filed with the State Board of Water Well Contractors within 30 days after completion or abandonment of the well.

1. WELL OWNER

Name MDU-Heskett Station

Address 2025 38th Street

Mandan, North Dakota

2. WELL LOCATION **(MW-80R)**

Address (if in city) (see attached drawing)

County Morton

NE ¼ SE ¼ SW ¼ Sec. 10 Twp. 139 N. Rge. 81 W.

Lat. 46.86789 Long.: -100.89320

Altitude:

3. METHOD DRILLED

■ Auger Other

4. WELL CONSTRUCTION

Diameter of Hole 8 inches Depth 27 feet

Riser: ■ PVC □ Other

■ Threaded □ Solvent □ Other

Riser rating SDR Schedule 40

Diameter 2.0 inches

From +2.5 ft. to 7 ft.

Was a well screen installed? ■ Yes □ No

Material Schedule 40 PVC Diameter 2.0 inches

Slot Size #10 set from 7 feet to 27 feet

Sand packed from 5 ft to 27 ft

Depth grouted from 1 ft to 5 ft

Grouting Material

Bentonite x Other

If other explain:

One foot concrete collar at surface

Well head completion:

24" above grade Other x

If other, specify 4" x 4" x 5' steel cover

Was protective casing installed? ■ Yes □ No

Was well disinfected upon completion? □ Yes ■ No

5. WATER LEVEL

Static water level 12 feet below surface

If flowing: closed in pressure psi or ft. above land surface

6. WELL LOG

Formation	Depth (Ft.) From	To
Topsoil	0	0.5
Sandy lean clay	0.5	27

(Use separate sheet if necessary)

7. WAS THE HOLE PLUGGED OR ABANDONED?

□ Yes ■ No

If so, how?

8. REMARKS

3 steel bumpers installed around well head

9. DATE COMPLETED 10-21-14

10. CONTRACTOR CERTIFICATION

This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

Midwest Testing Laboratory, Inc. 444

Monitoring Well Contractor Certificate No.

P.O. Box 2084, Bismarck, ND 58502-2084

Address

Signature 10-22-14

Date

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING MW-101
DRAFT

Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438844.919° Long: 1868647.777°
Datum:NAD 83

Surface Elevation:1716.6 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:58.0 ft

Unique Well No.:

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0						TOPSOIL: Brown (5/4 7.5YR).		
		1	4-4-4-6.			SANDY LEAN CLAY WITH GRAVEL (CL): fine to medium grained; Brown (5/3 7.5YR); moist; thinly laminated; some mottling; low plasticity; [Cannonball Formation].	PRO. CASING Diameter: **4"** Type: **Steel pipe** Interval: **3.5' ags - 1.5' bgs**	1715
		2	4-6-6-7.			At 2': Start to see gravel inclusions.		
5		3	7-9-14-16.			At 4': Oxidized staining. At 5': Oxidized staining.	RISER CASING Diameter: **2"** Type: **PVC SCH 80** Interval: **2.98' ags - 34' bgs**	1710
		4	8-9-12-15.			At 7': Oxidized staining and white staining.	GROUT Type: **Neat cement** Interval: **0 - 29' bgs**	
		5	10-15-21-26.				SEAL Type: **Bentonite chips** Interval: **29 - 32' bgs**	
10		6	7-18-24-27.	CL		At 11': Oxidized staining.	SANDPACK Type: **Silica 40-70** Interval: **32 - 56' bgs**	1705
		7	8-12-19-23.					
15		8	8-14-18-23.			At 15': Gypsum. 16-20': No recovery.	SCREEN Diameter: **2"; No.6 slot** Type: **PVC SCH 80** Interval: **34 - 54' bgs**	1700
20		9	7-10-13-15.			At 20.5': Gypsum. LEAN CLAY (CL): Dark Brown (3/2 7.5YR); oxidized staining, some mottling; medium to high plasticity; [Cannonball Formation].		1695
		10	7-9-13-15.	CL		At 22': Color change to Brown (4/2 7.5YR). At 24': Interbedded sand, fine grained.		
25								

Date Boring Started: 8/18/15
Date Boring Completed: 8/19/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: Hole caved in from 56 - 58' bgs.
DTW = 36.66' TOR on 9/23/2015 (elev. 1682.87)

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING MW-101
DRAFT

Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438844.919° Long: 1868647.777°
Datum:NAD 83

Surface Elevation:1716.6 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:58.0 ft

Unique Well No.:

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
25		11	7-11-13-15.	CL		LEAN CLAY (CL): Dark Brown (3/2 7.5YR); oxidized staining, some mottling; medium to high plasticity; [Cannonball Formation]. *(continued)* At 25' and 25.5': Gypsum.		
		12	8-11-15-19.			At 26.5': Gypsum.	PRO. CASING Diameter: **4"** Type: **Steel pipe** Interval: **3.5' ags - 1.5' bgs**	1690
		13	8-11-13-15.				RISER CASING Diameter: **2"** Type: **PVC SCH 80** Interval: **2.98' ags - 34' bgs**	
30		14	6-11-14-17.			At 29.5': Gypsum.		1685
		15	8-13-17-22.			At 33': Gypsum.	GROUT Type: **Neat cement** Interval: **0 - 29' bgs**	
35		16	8-14-19-21.			At 34.5': Gypsum. At 35.5-36': Color change to Black (2.5/1 7.5YR), turns back to brown.	SEAL Type: **Bentonite chips** Interval: **29 - 32' bgs**	1680
		17	11-16-20-27.	CH		FAT CLAY (CH): Black (2.5/1 7.5YR); very stiff; hight plasticity; wet at 43'; [Cannonball Formation].	SANDPACK Type: **Silica 40-70** Interval: **32 - 56' bgs**	
		18	9-13-20-25.			At 38': Oxidized staining.	SCREEN Diameter: **2"; No.6 slot** Type: **PVC SCH 80** Interval: **34 - 54' bgs**	
40		19	7-14-23-26.			At 41': Oxidized staining.		1675
		20	9-16-23-26.					
45								1670
50								

Date Boring Started: 8/18/15
Date Boring Completed: 8/19/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: Hole caved in from 56 - 58' bgs.
DTW = 36.66' TOR on 9/23/2015 (elev. 1682.87)

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING MW-101
DRAFT

Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438844.919° Long: 1868647.777°
Datum:NAD 83

Surface Elevation:1716.6 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:58.0 ft

Unique Well No.:

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
50				CH		FAT CLAY (CH): Black (2.5/1 7.5YR); very stiff; hight plasticity; wet at 43'; [Cannonball Formation]. *(continued)*	PRO. CASING Diameter: **4"** Type: **Steel pipe** Interval: **3.5' ags - 1.5' bgs** RISER CASING Diameter: **2"** Type: **PVC SCH 80** Interval: **2.98' ags - 34' bgs** GROUT Type: **Neat cement** Interval: **0 - 29' bgs** SEAL Type: **Bentonite chips** Interval: **29 - 32' bgs** SANDPACK Type: **Silica 40-70** Interval: **32 - 56' bgs** SCREEN Diameter: **2"; No.6 slot** Type: **PVC SCH 80** Interval: **34 - 54' bgs**	1665
55								1660
						End of boring 58.0 feet		
60								
65								
70								
75								

Date Boring Started: 8/18/15
Date Boring Completed: 8/19/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: Hole caved in from 56 - 58' bgs.
DTW = 36.66' TOR on 9/23/2015 (elev. 1682.87)

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING MW-102
DRAFT

Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438161.145° Long: 1868782.871°
Datum:NAD 83

Surface Elevation:1703.8 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:46.0 ft

Unique Well No.:

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0						TOPSOIL: Brown (5/4 7.5YR).		
		1	3-3-3-2.			LEAN CLAY (CL): medium grained; Brown (4/3 7.5YR); moist; low to medium plasticity; with gravel to 4'; [Cannonball Formation].	PRO. CASING Diameter: **4"** Type: **Steel pipe** Interval: **3.5' ags - 1.5' bgs**	
		2	3-2-2-3.					1700
5		3	3-3-4-5.	CL			RISER CASING Diameter: **2"** Type: **PVC SCH 80** Interval: **2.85' ags - 10' bgs**	
		4	3-4-5-7.				GROUT Type: **None** Interval: **None**	
		5	4-8-7-4.					1695
				ML		SANDY SILT WITH GRAVEL (ML): Strong Brown (5/6 7.5YR); fine to coarse sand, fine to medium gravel, unconsolidated; [Cannonball Formation].		
10						LEAN CLAY WITH GRAVEL (CL): fine to medium grained; Brown (5/3 7.5YR); some mottling; medium plasticity; [Cannonball Formation].	SEAL Type: **Bentonite chips** Interval: **0 - 8' bgs**	
		6	4-3-5-9.	CL				
		7	3-5-7-9.			LEAN CLAY (CL): Dark Brown (3/2 7.5YR); medium to high plasticity; [Cannonball Formation].	SANDPACK Type: **Silica 40-70** Interval: **8 - 31' bgs**	
	▼							1690
15		8	6-8-12-14.				SCREEN Diameter: **2"; No.6 slot** Type: **PVC SCH 80** Interval: **20 - 30' bgs**	▼
		9	6-10-12-16.					
				CL				
		10	5-9-14-16.					1685
20								
		11	5-12-15-18.			At 21': Color changes to Black (2.5/1).		
		12	9-15-18-22.					
								1680
25								

Date Boring Started: 8/18/15
Date Boring Completed: 8/18/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: Lithological descriptions for a hole that was abandoned. Monitoring well blind drilled and installed next to abandoned hole.
DTW = 17.09' TOR on 8/21/2015 (elev. 1689.51

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING MW-102
DRAFT

Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438161.145° Long: 1868782.871°
Datum:NAD 83

Surface Elevation:1703.8 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:46.0 ft

Unique Well No.:

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
25		13	9-14-19-22.			LEAN CLAY (CL): Dark Brown (3/2 7.5YR); medium to high plasticity; [Cannonball Formation]. *(continued)*	PRO. CASING Diameter: **4"** Type: **Steel pipe** Interval: **3.5' ags - 1.5' bgs**	
		14	10-17-18-24.					
		15	6-15-18-26.			At 29': Gypsum.		1675
30		16	7-14-18-22.				RISER CASING Diameter: **2"** Type: **PVC SCH 80** Interval: **2.85' ags - 10' bgs**	
		17	11-16-20-27.			At 33.5' and 34': Gypsum.	GROUT Type: **None** Interval: **None**	1670
35		18	10-14-15-24.	CL			SEAL Type: **Bentonite chips** Interval: **0 - 8' bgs**	
		19	13-19-25-35.				SANDPACK Type: **Silica 40-70** Interval: **8 - 31' bgs**	
		20	8-17-26-31.					1665
40		21	10-20-27-38.				SCREEN Diameter: **2"; No.6 slot** Type: **PVC SCH 80** Interval: **20 - 30' bgs**	
		22	13-20-27-37.					1660
45		23	15-27-27-32.	SM		SILTY SAND (SM): fine to medium grained; Dark Gray (4/1 7.5YR); wet; [Cannonball Formation].		
						End of boring 46.0 feet		
50								

Date Boring Started: 8/18/15
Date Boring Completed: 8/18/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: Lithological descriptions for a hole that was abandoned. Monitoring well blind drilled and installed next to abandoned hole.
DTW = 17.09' TOR on 8/21/2015 (elev. 1689.51

Additional data may have been collected in the field which is not included on this log.
Weather:

M:\GINT\PROJECTS\34300014.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING MW-103
DRAFT

Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 437578.205° Long: 1869355.992°
Datum:NAD 83

Surface Elevation:1714.7 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:44.0 ft

Unique Well No.:

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	Elevation, feet
0				OL/OH		TOPSOIL (OL/OH): Brown (5/4 7.5YR).	
		1	3-4-5-5.			LEAN CLAY (CL): Very Dark Gray (3/1 7.5YR); moist; stiff; medium to high plasticity; [Cannonball Formation].	
		2	5-5-8-8.	CL			
5		3	5-8-10-11.				1710
		4	6-9-15-15.			POORLY GRADED SAND WITH GRAVEL (SP): fine to coarse grained; Brown (5/4 7.5YR); some oxidized staining, some mottling; [Cannonball Formation].	
		5	5-6-5-4.	SP			
10		6	4-5-5-7.				1705
		7	2-2-2-3.			POORLY GRADED SAND WITH SILT (SP-SM): fine to medium grained; Brown (5/4 7.5YR); [Cannonball Formation].	
				SP-SM			
15		8	3-3-3-3.				1700
						NO RECOVERY (16 - 20').	
20		9	3-3-5-5.			SANDY LEAN CLAY (CL): fine to medium grained; Light Brown (6/4 7.5YR); wet; some mottling and oxidized staining, cohesive; low to medium plasticity; [Cannonball Formation].	1695
				CL			
25							1690

WELL OR PIEZOMETER CONSTRUCTION DETAIL

PRO. CASING
Diameter: **4"**
Type: **Steel pipe**
Interval: **3.5' ags - 1.5' bgs**

RISER CASING
Diameter: **2"**
Type: **PVC SCH 80**
Interval: **2.79' ags - 24' bgs**

GROUT
Type: **Neat cement**
Interval: **0 - 19' bgs**

SEAL
Type: **Bentonite chips**
Interval: **19 - 22' bgs**

SANDPACK
Type: **Silica 40-70**
Interval: **22 - 44' bgs**

SCREEN
Diameter: **2"; No.6 slot**
Type: **PVC SCH 80**
Interval: **24 - 44' bgs**

Date Boring Started: 8/19/15
Date Boring Completed: 8/20/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 33.24' TOR on 8/20/2015 (elev. 1684.29)

Additional data may have been collected in the field which is not included on this log.
Weather:

M:\GINT\PROJECTS\34300014.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING MW-103
DRAFT

Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 437578.205° Long: 1869355.992°
Datum:NAD 83

Surface Elevation:1714.7 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:44.0 ft

Unique Well No.:

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
25		10	2-2-4-4.	CL		SANDY LEAN CLAY (CL): fine to medium grained; Light Brown (6/4 7.5YR); wet; some mottling and oxidized staining, cohesive; low to medium plasticity; [Cannonball Formation]. *(continued)*	PRO. CASING Diameter: **4"** Type: **Steel pipe** Interval: **3.5' ags - 1.5' bgs**	
30				SM		SILTY SAND WITH GRAVEL (SM): wet; [Cannonball Formation].	RISER CASING Diameter: **2"** Type: **PVC SCH 80** Interval: **2.79' ags - 24' bgs**	1685
		11	10-10-7-9.			LEAN CLAY (CL): Brown (4/4 7.5YR); moist; oxidized staining; medium to high plasticity; [Cannonball Formation].	GROUT Type: **Neat cement** Interval: **0 - 19' bgs**	
		12	8-15-17-22.			At 32.5': Sand lens, color changes to Black (2.5/1 7.5YR).		
35		13	7-19-15-25.			At 33.5': Sand lens. At 34': Interbedded sand with oxidized staining.	SEAL Type: **Bentonite chips** Interval: **19 - 22' bgs**	1680
		14	11-16-21-50 for 5".	CL		At 36.5': Sand lens. At 37': Sand lens. At 37.5': Color change to Gray (5/1 7.5YR). At 38-38.5': 6" thick layer of hard material.	SANDPACK Type: **Silica 40-70** Interval: **22 - 44' bgs**	
		15	50 for 2"`-.				SCREEN Diameter: **2"; No.6 slot** Type: **PVC SCH 80** Interval: **24 - 44' bgs**	
40		16	12-17-22-30.			At 42-42.5': Silt layer.		1675
		17	9-18-24-50.			At 43.5-44': Silt layer.		
45						End of boring 44.0 feet		
50								

Date Boring Started: 8/19/15
Date Boring Completed: 8/20/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 33.24' TOR on 8/20/2015 (elev. 1684.29)

Additional data may have been collected in the field which is not included on this log.
Weather:

M:\GINT\PROJECTS\34300014.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING MW-104
DRAFT

Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438853.542° Long: 1869832.72°
Datum:NAD 83

Surface Elevation:1681.5 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:32.0 ft

Unique Well No.:

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0						TOPSOIL: Brown (5/4 7.5YR).		
		1	4-5-5-5.	CL		LEAN CLAY WITH SAND (CL): fine to medium grained; Brown (5/4 7.5YR); moist; gravel; medium plasticity; [Cannonball Formation].	PRO. CASING Diameter: **4"** Type: **Steel pipe** Interval: **3.5' ags - 1.5' bgs**	1680
		2	3-5-6-8.					
5		3	3-7-9-10.			LEAN CLAY (CL): Brown (4/4 7.5YR); oxidized staining and mottling; medium to high plasticity; with gypsum throughout; [Cannonball Formation].	RISER CASING Diameter: **2"** Type: **PVC SCH 80** Interval: **3.06' ags - 9' bgs**	1675
		4	5-7-9-10.				GROUT Type: **None** Interval: **None**	
		5	5-9-9-10.				SEAL Type: **Bentonite chips** Interval: **0 - 7' bgs**	
10		6	5-7-9-10.	CL		At 12': Heavily oxidized.	SANDPACK Type: **Silica 40-70** Interval: **7 - 32' bgs**	1670
		7	5-8-8-12.					
15		8	5-9-11-15.			At 15': Start seeing black staining.	SCREEN Diameter: **2"; No.6 slot** Type: **PVC SCH 80** Interval: **9 - 29' bgs**	
		9	6-9-11-13.			At 17': Heavily oxidized.		1665
		10	4-7-16-19.	SM		SILTY SAND (SM): Strong Brown (5/6 7.5YR); wet; [Cannonball Formation].		
20						At 19.5': Color change to Brown (5/4 7.5YR).		
		11	5-16-22-26.			At 21': Oxidized layer.		1660
		12	7-11-14-16.	CH		FAT CLAY (CH): Dark Gray (4/1 7.5YR); moist; stiff; high plasticity; with interbedded sand layers below 27'; [Cannonball Formation].		
25								

Date Boring Started: 8/20/15
Date Boring Completed: 8/20/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 13.25' TOR on 8/21/2015 (elev. 1671.26)

Additional data may have been collected in the field which is not included on this log.
Weather:

M:\GINT\PROJECTS\34300014.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING MW-104
DRAFT

Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438853.542° Long: 1869832.72°
Datum:NAD 83

Surface Elevation:1681.5 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:32.0 ft

Unique Well No.:

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
25		13	6-12-16-17.			FAT CLAY (CH): Dark Gray (4/1 7.5YR); moist; stiff; high plasticity; with interbedded sand layers below 27'; [Cannonball Formation]. *(continued)*		1655
		14	8-12-16-21.	CH				
		15	8-12-16-20.					
30		16				Driller notes: sluff.		1650
						End of boring 32.0 feet		
35								
40								
45								
50								

PRO. CASING
Diameter: **4"**
Type: **Steel pipe**
Interval: **3.5' ags - 1.5' bgs**

RISER CASING
Diameter: **2"**
Type: **PVC SCH 80**
Interval: **3.06' ags - 9' bgs**

GROUT
Type: **None**
Interval: **None**

SEAL
Type: **Bentonite chips**
Interval: **0 - 7' bgs**

SANDPACK
Type: **Silica 40-70**
Interval: **7 - 32' bgs**

SCREEN
Diameter: **2"; No.6 slot**
Type: **PVC SCH 80**
Interval: **9 - 29' bgs**

Date Boring Started: 8/20/15
Date Boring Completed: 8/20/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 13.25' TOR on 8/21/2015 (elev. 1671.26)

Additional data may have been collected in the field which is not included on this log.
Weather:

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING MW-105
DRAFT

Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438042.079° Long: 1870325.657°
Datum:NAD 83

Surface Elevation:1686.0 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:30.0 ft

Unique Well No.:

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0						TOPSOIL: Brown (5/4 7.5YR).		
		1	6-7-6-5.			SANDY LEAN CLAY (CL): fine to medium grained; Brown (4/2 7.5YR); moist; gravel; medium plasticity; [Cannonball Formation].	PRO. CASING Diameter: **4"** Type: **Steel pipe** Interval: **3.5' ags - 1.5' bgs**	1685
		2	5-5-5-6.				RISER CASING Diameter: **2"** Type: **PVC SCH 80** Interval: **3.16' ags - 10' bgs**	
5		3	3-2-4-5.	CL				1680
		4	2-2-2-3.				GROUT Type: **None** Interval: **None**	
		5	2-1-2-2.			LEAN CLAY (CL): Brown (4/2 7.5YR); soft; high plasticity; wet at 16'; [Cannonball Formation].	SEAL Type: **Bentonite chips** Interval: **0 - 7' bgs**	
10		6	2-1-2-1.			At 10.5': Color change to Reddish-Yellow (6/6 7.5YR).		1675
		7	2-1-1-3.				SANDPACK Type: **Silica 40-70** Interval: **7 - 30' bgs**	
15		8	4-3-5-5.	CL		At 14.5-15.5': Gravel inclusions. At 15.5': Color change to Brown (4/3 7.5YR).	SCREEN Diameter: **2"; No.6 slot** Type: **PVC SCH 80** Interval: **10 - 30' bgs**	1670
		9	7-9-11-13.					
						At 18': Color change to Brown (5/3 7.5YR).		
20		10	7-9-11-13.					
		11	7-9-13-15.					1665
		12	19-26-28-30.	SP-SM		POORLY GRADED SAND WITH SILT (SP-SM): medium to coarse grained; Brown (5/4 7.5YR); [Cannonball Formation].		
25								

Date Boring Started: 8/17/15
Date Boring Completed: 8/17/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 13.22' TOR on 8/21/2015 (elev. 1675.92)

Additional data may have been collected in the field which is not included on this log.
Weather:

M:\GINT\PROJECTS\34300014.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING MW-105
DRAFT

Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438042.079° Long: 1870325.657°
Datum:NAD 83

Surface Elevation:1686.0 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:30.0 ft

Unique Well No.:

Depth, feet	Sample Type & Recovery	Sample No.	Blows/6in.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
25		13	15-25-31-40.					
		14	10-15-18-30.	CL		FAT CLAY (CL): Dark Brown (3/4 7.5YR); high plasticity; sand lens at 26.5'; [Cannonball Formation]. At 26': Color change to Gray (5/1 7.5YR).		1660
		15	11-16-22-32.					
30						End of boring 30.0 feet		
35								
40								
45								
50								

PRO. CASING
Diameter: **4"**
Type: **Steel pipe**
Interval: **3.5' ags - 1.5' bgs**

RISER CASING
Diameter: **2"**
Type: **PVC SCH 80**
Interval: **3.16' ags - 10' bgs**

GROUT
Type: **None**
Interval: **None**

SEAL
Type: **Bentonite chips**
Interval: **0 - 7' bgs**

SANDPACK
Type: **Silica 40-70**
Interval: **7 - 30' bgs**

SCREEN
Diameter: **2"; No.6 slot**
Type: **PVC SCH 80**
Interval: **10 - 30' bgs**

Date Boring Started: 8/17/15
Date Boring Completed: 8/17/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 13.22' TOR on 8/21/2015 (elev. 1675.92)

Additional data may have been collected in the field which is not included on this log.
Weather:

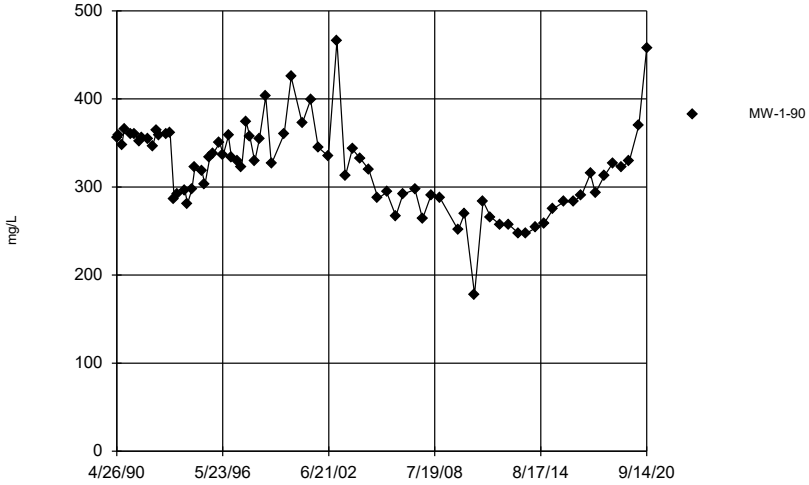
M:\GINT\PROJECTS\34300014.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Appendix F

MW1-90 Time Series Plots

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series



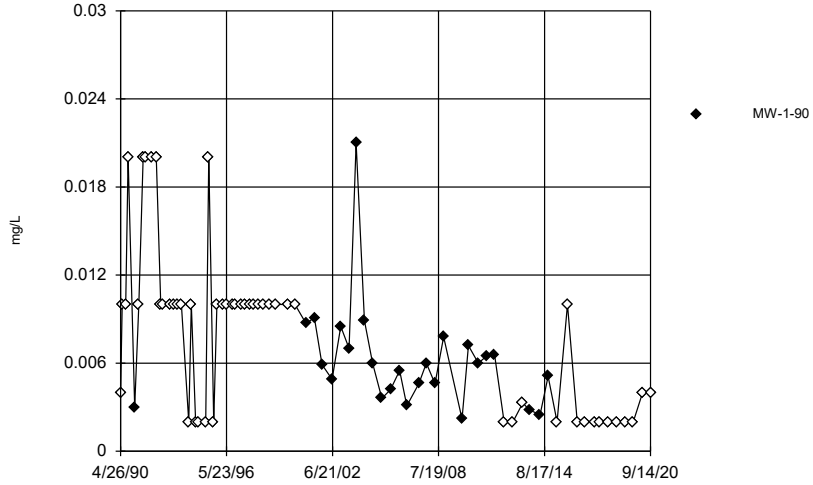
Constituent: Alkalinity, bicarbonate Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Hollow symbols indicate censored values.

Time Series



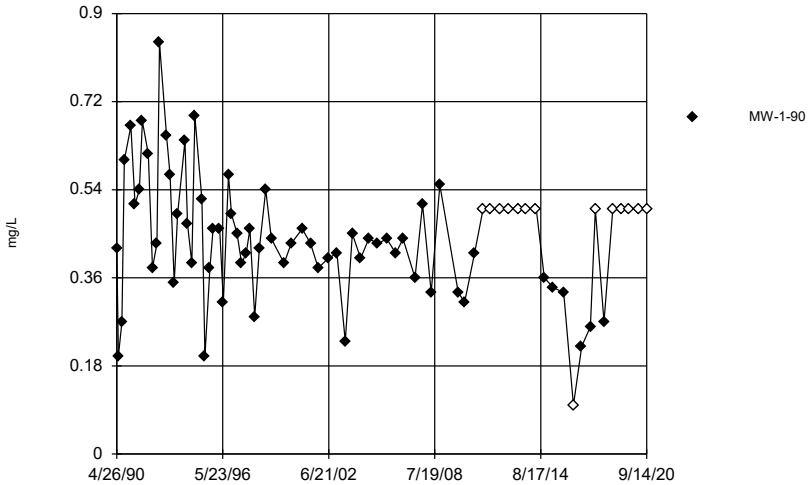
Constituent: Arsenic Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Hollow symbols indicate censored values.

Time Series

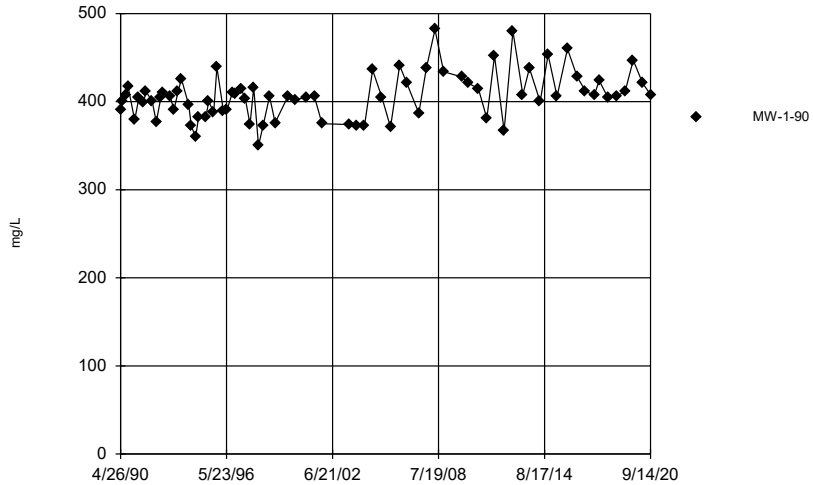


Constituent: Boron Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

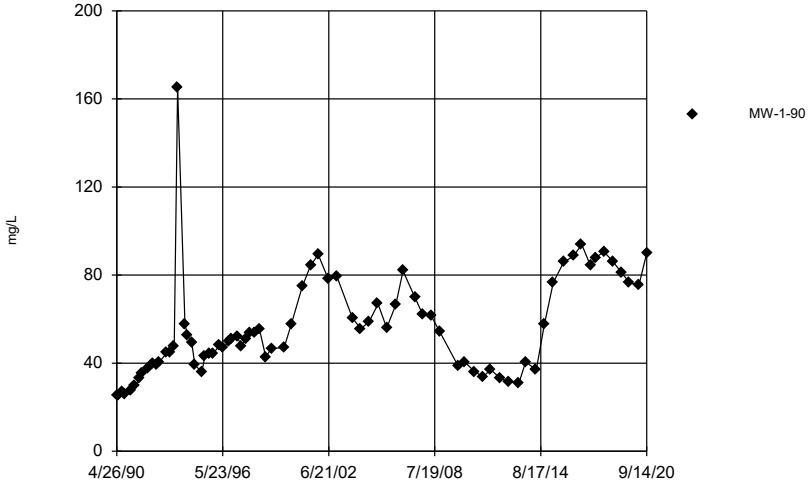


Constituent: Calcium Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

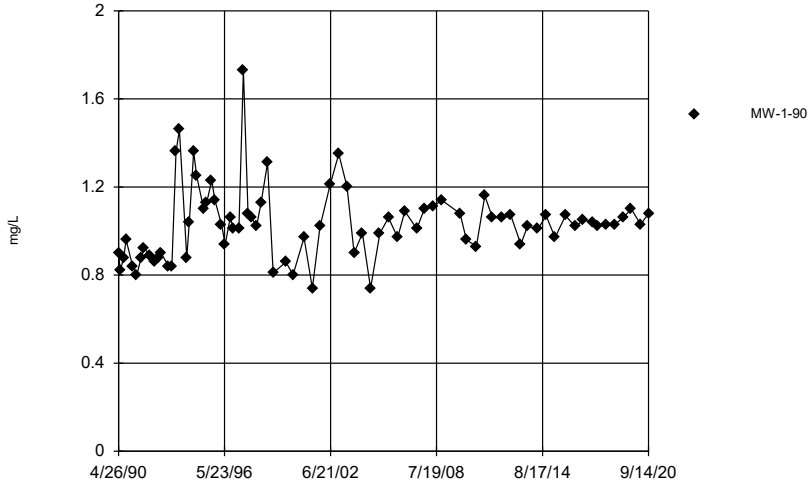


Constituent: Chloride Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

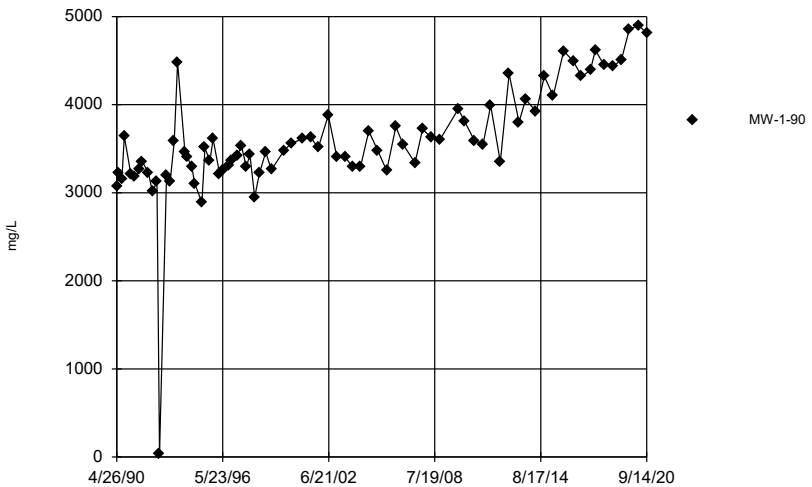


Constituent: Fluoride Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

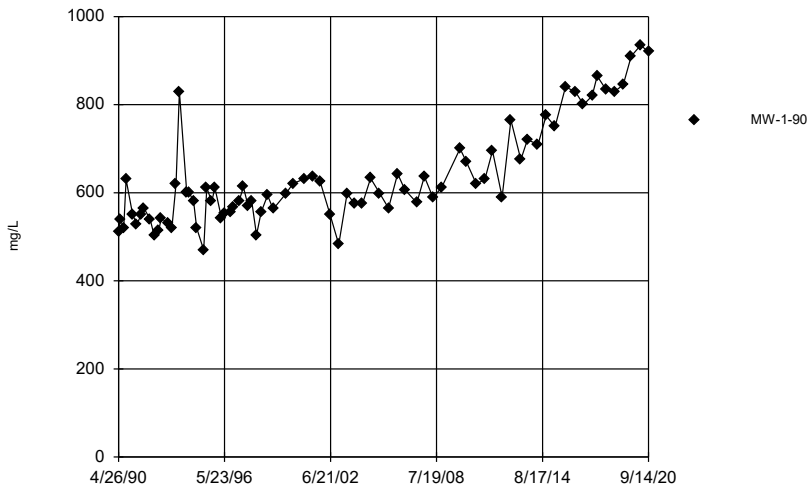


Constituent: Hardness Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

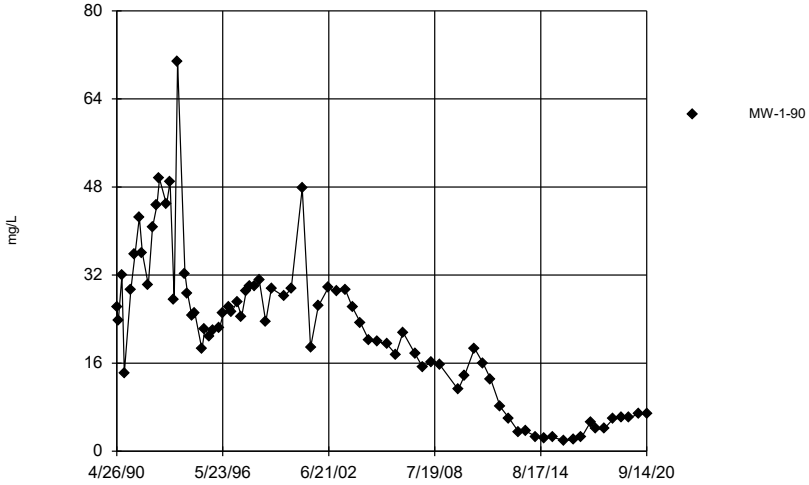


Constituent: Magnesium Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

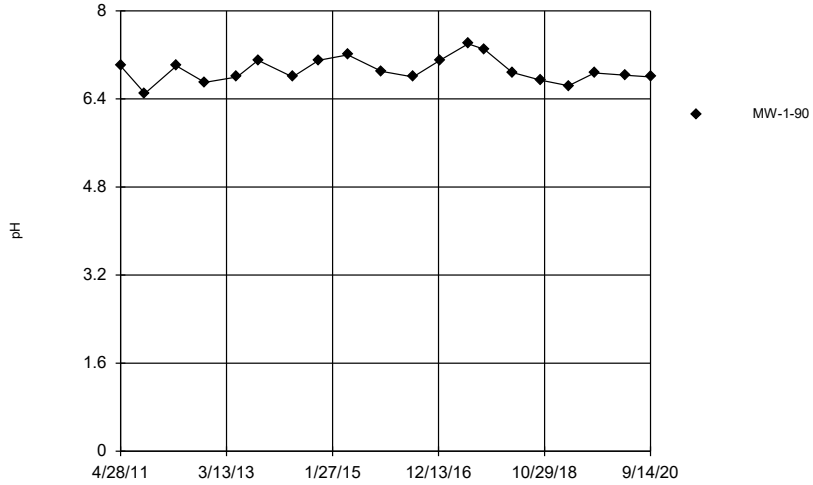


Constituent: Nitrogen Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

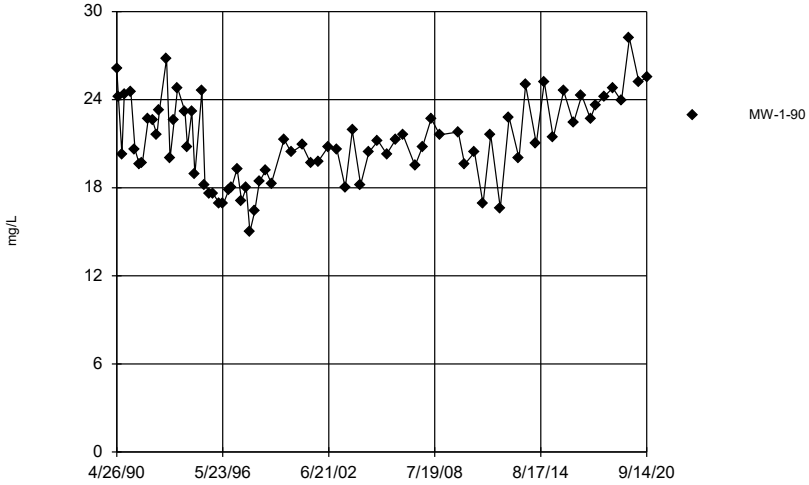


Constituent: pH Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

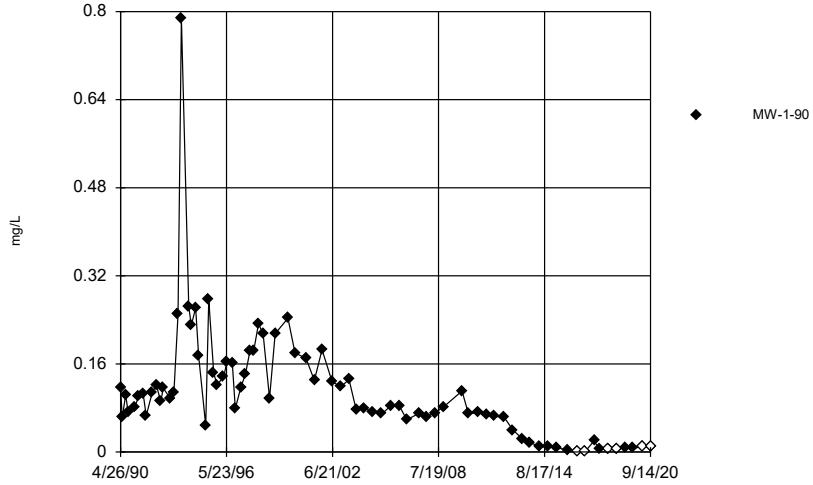


Constituent: Potassium Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG
Hollow symbols indicate censored values.

Time Series

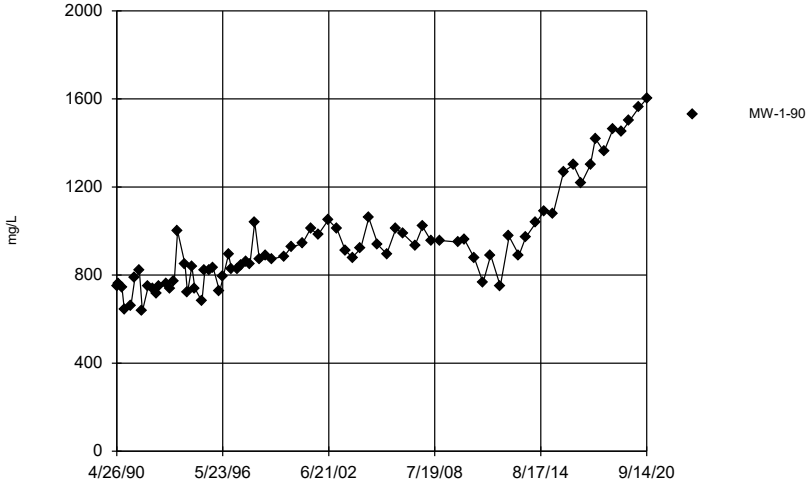


Constituent: Selenium Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

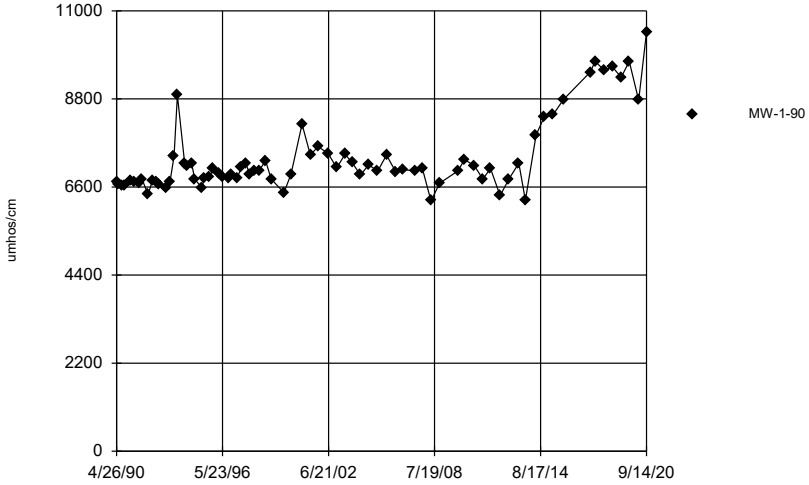


Constituent: Sodium Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

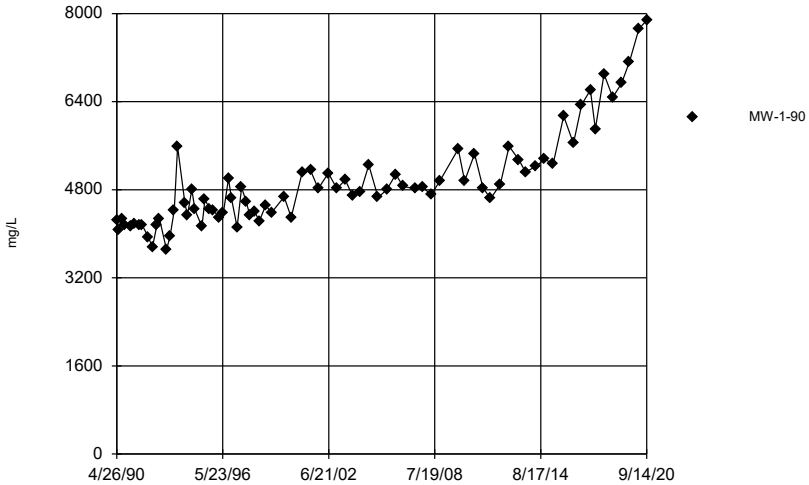


Constituent: Specific conductance Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

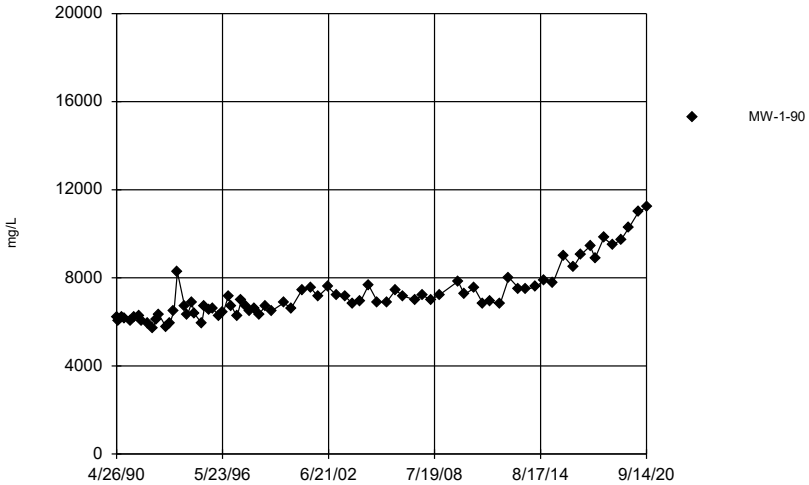


Constituent: Sulfate Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.9.6.28 For the statistical analyses of ground water by Barr Engineering Company only. UG

Time Series

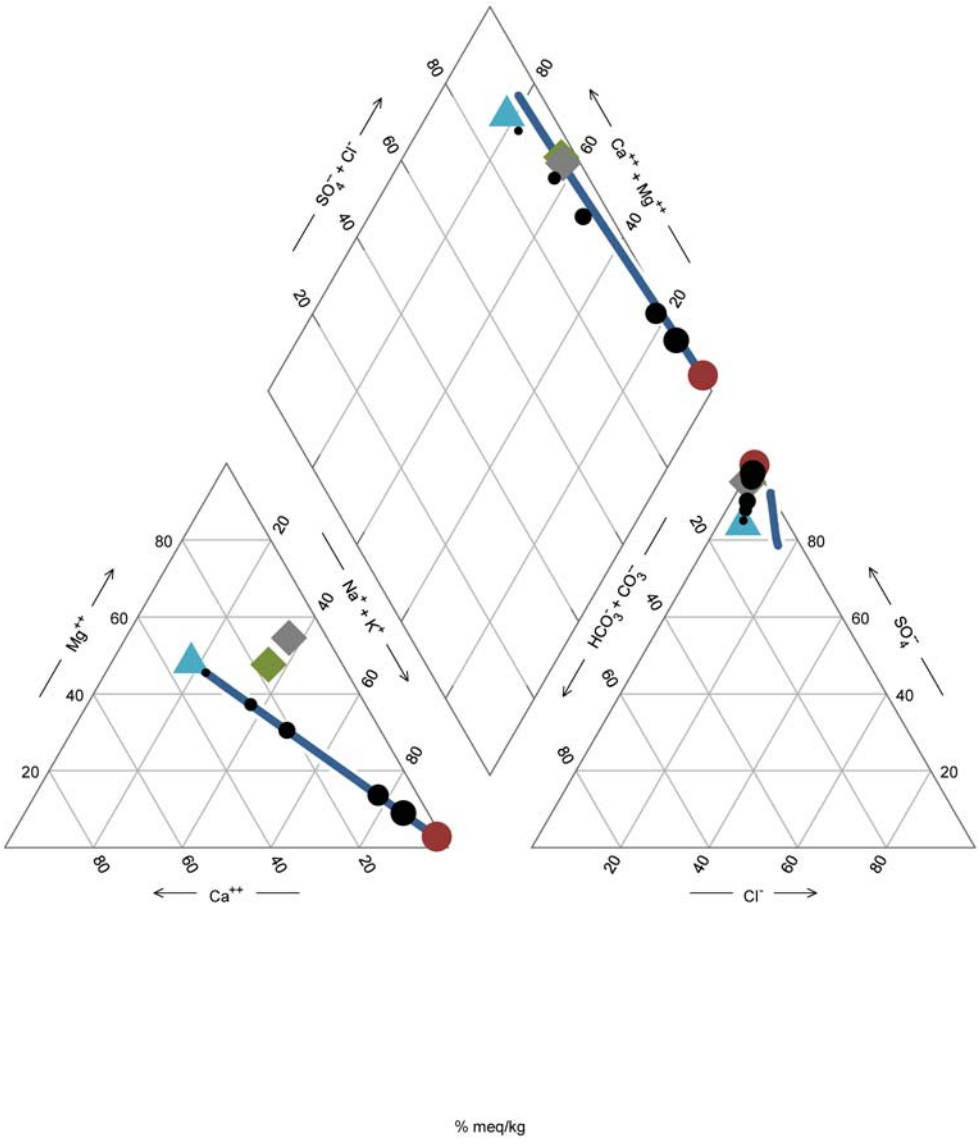


Constituent: TDS Analysis Run 3/15/2021 10:26 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

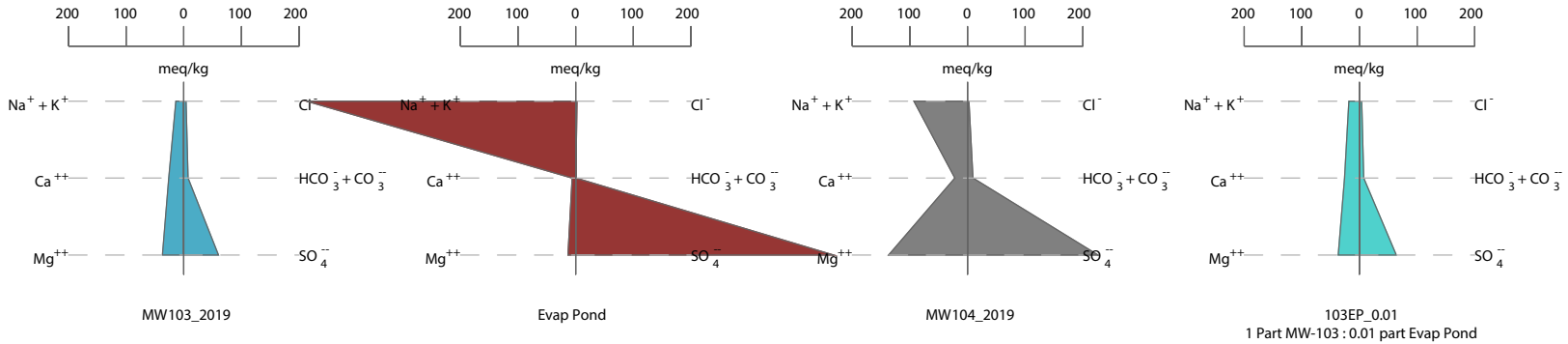
Appendix G

Geochemist's Workbench Results



- MW103_2019
- Evap Pond
- 1 part MW-103 : 1 part Evap Pond
- 1 part MW-103 : 0.50 part Evap Pond
- 1 part MW-103 : 0.10 part Evap Pond
- 1 part MW-103 : 0.05 part Evap Pond
- 1 part MW-103 : 0.01 part Evap Pond
- MW1-90
- MW104_2019

Figure G.1
Piper Plot for Mixing
Evaporation Pond into MW-103
R.M. Heskett Station
Alternative Source Demonstration
March 2021 Event
Montana Dakota Utilities
Mandan, North Dakota



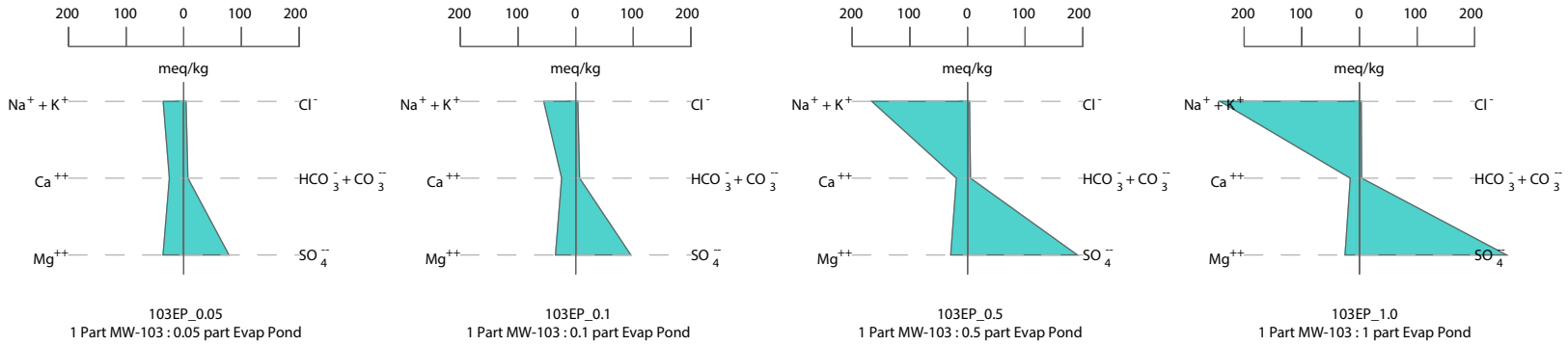


Figure G.2
Stiff Plot for Mixing
Evaporation Pond into MW-103
R.M. Heskett Station
Alternative Source Demonstration
March 2021 Event
Montana Dakota Utilities
Mandan, North Dakota

Table G.1

Geochemist's Workbench Mixing Model Results

Description		Upgradient	Evap Pond	Mixing Evap Pond into MW-103					Downgradient	
Sample ID		MW103	Evap Pond	1 : 0.01	1 : 0.05	1 : 0.1	1 : 0.5	1 : 1	MW1-90	MW-104
HCO3-	mg/l	457	20	452.7	436.2	417.3	311.3	238.5	259	591
Ca++	mg/l	530	125	526	510.7	493.2	395	327.5	453	448
Cl-	mg/l	142	79.8	141.4	139	136.3	121.3	110.9	57.4	87.6
F-	mg/l	0.15	0.1	0.1495	0.1476	0.1455	0.1334	0.125	1.07	0.55
Mg++	mg/l	458	165	455.1	444.1	431.4	360.4	311.5	775	1700
pH	SU	6.5	10.7	6.502	6.511	6.523	6.643	6.854	7.1	6.8
K+	mg/l	18.8	734	25.88	52.87	83.85	257.3	376.6	25.2	37
Na+	mg/l	311	10600	412.9	801.2	1247	3742	5458	1090	2160
SO4--	mg/l	2930	22100	3120	3843	4674	9323	12520	5350	11100
TDS	mg/kg	4860	34000	5152	6265	7541	14660.2	19527.5	7910	17700