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Annual Groundwater Monitoring Report

Dairyland Power Cooperative
Alma Off-Site Disposal Facility
Phase IV Landfill
Town of Belvidere, Wisconsin

January 2019

Prepared For
Dairyland Power Cooperative

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Executive Summary

This Annual Report presents the monitoring results and the statistical evaluation of the detection monitoring parameters (Appendix III to Part 257 of the CCR Rule) for the March and September 2018 semiannual groundwater monitoring at the Dairyland Power Cooperative (DPC) Alma Off-site Disposal Facility Phase IV Landfill (Landfill). This groundwater monitoring represents ongoing detection monitoring events performed to comply with §257.94. The detection monitoring data were evaluated to identify statistically significant increases (SSIs) over background levels.

There were no potential SSIs over background limits for the Appendix III parameters during the 2018 monitoring events. Therefore, DPC will continue to conduct detection monitoring, and DPC is not required to take additional actions at this time. The next semiannual monitoring events at the Landfill are scheduled for March and September of 2019.

Section 1
Introduction

1.1 Program Summary

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule). The CCR Rule, which became effective on October 19, 2015, applies to the Dairyland Power Cooperative (DPC) Alma Off-site Disposal Facility Phase IV Landfill (Landfill). Pursuant to the CCR Rule, no later than January 31, 2018, and annually thereafter, the owner or operator of a CCR unit must prepare an annual groundwater monitoring and corrective action report for the CCR unit documenting the status of groundwater monitoring and corrective action for the preceding year in accordance with §257.90(e).

TRC Environmental Corporation (TRC), prepared this Annual Groundwater Monitoring Report (Annual Report) for the Landfill on behalf of DPC. This Annual Report was prepared in accordance with the requirements of §257.90(e) and presents the monitoring results and the statistical evaluation of the detection monitoring parameters (Appendix III to Part 257 of the CCR Rule) for the 2018 semiannual groundwater monitoring events for the Landfill. The monitoring was performed in accordance with the *Groundwater Monitoring Program for Compliance with the Federal Coal Combustion Rule* (GWMP) (TRC, 2017). As part of the statistical evaluation, the data collected during detection monitoring events are evaluated to identify statistically significant increases (SSIs) of detection monitoring parameters compared to background levels.

1.2 Site Overview

The Landfill is owned and operated by DPC. The Landfill is located in the NE 1/4 of the NE 1/4 of Section 19 and portions of Sections 18 and 20, T21N, R12W, Town of Belvidere, Buffalo County, Wisconsin (refer to Figure 1). The Landfill accepts CCR produced from electricity generation. DPC operates the Landfill in compliance with the Plan of Operation (RMT, 2000) as permitted by the Wisconsin Department of Natural Resources (WDNR, License Number 4126).

1.3 Geology/Hydrogeology

The site is located within the Western Upland physiographic region of South-Central Wisconsin adjacent to the Mississippi River (Figure 1). This area of Wisconsin was not previously glaciated and is known as the "Driftless Area" and is characterized by a significant amount of

topographic relief. The facility is situated within a central valley area surrounded by steep slopes.

The thickness of unconsolidated soils beneath the Landfill ranges from approximately 15 to 60 feet. The predominant soil type includes fine- to coarse-grained silty sand, poorly graded sand with gravel, and/or poorly graded gravel with sand. The sandy soils range in thickness from 20 to 60 feet beneath the Landfill, and are interpreted to be the result of fluvial deposition with limited sand deposited by in-situ weathering of underlying sandstone bedrock. In some areas beneath the Landfill, silts and clays ranging in thickness from a few feet to 40 feet overlie the sandy soils. The silt and clay soils were associated with loess deposits and, to a lesser degree, isolated lacustrine sediments.

Bedrock in the area is composed of the Prairie du Chien Group dolomite overlying Cambrian sandstone units. However, the Prairie du Chien group is absent beneath the Landfill due to erosion, so the sandy soil is directly underlain by the Cambrian sandstone. The Cambrian sandstones were described as fine-grained, fissile, friable, and glauconitic with interbedded lenses of dark brown sandstone and calcareous shaley partings.

The uppermost aquifer beneath the Landfill resides in the sandy soil and the underlying Cambrian sandstone. The saturated thickness of the aquifer ranges from 10 to 20 feet in the sandy soil. The Cambrian sandstone in the region is estimated to be approximately 400 feet in thickness (Young and Borman, 1973). Well drilling logs (WGNHS 2003 and WDNR 2015) in the vicinity of the Landfill present sandstone thicknesses of 338 feet to 435 feet. Precambrian igneous and metamorphic rock underlies the Cambrian sandstone.

Groundwater beneath the Landfill is first observed within the unconsolidated sandy deposits and the sandstone bedrock. A groundwater contour map (Figure 2) shows that groundwater flows toward the central part of the valley occupied by the facility and then south toward the Mississippi River.

Historical and recent groundwater elevation data are comparable and indicate that groundwater flow at the site is consistent with little temporal variation. The approximate horizontal gradient determined for the Feasibility Report was 0.06 ft/ft (RMT, 1997) and is currently estimated at 0.05 ft/ft over the past several years (2013 through 2018). In-situ hydraulic conductivity data presented in the Feasibility Report (RMT, 1997) indicates a geometric mean hydraulic conductivity of $1.4x10^{-3}$ cm/s for the fluvial sand and gravel unit and $1.1x10^{-3}$ cm/s for the Cambrian sandstone.

Vertical gradients were also evaluated in the Feasibility Report (RMT, 1997) and indicated that the vertical gradients within the sand and sand-to-bedrock were generally upward (0.02 ft/ft to

0.05 ft/ft) and the vertical gradients within the bedrock were generally downward (0.2 ft/ft to 0.49 ft/ft). By applying the same methods used in the Feasibility Report to recent water level data (2015 through 2018), the vertical gradients within the fluvial sand and gravel unit, from sand to bedrock, and within the bedrock are generally downward, with the exception of a slight upward gradients observed from bedrock to sand at W42/P42A and 102R/102AR and a flat vertical gradient observed within sandstone at W101/W101A during the September 2018 period. Current observations suggest hydrogeologic conditions have not changed since the preparation of the Feasibility Report.

Section 2
Groundwater Monitoring

2.1 Monitoring Well Network

A groundwater monitoring system has been established for the Landfill, as detailed in the GWMP (TRC, 2017). The detection monitoring well network for the Landfill consists of six water table monitoring wells and one piezometer (denoted with an "A" suffix). Three of the water table wells are upgradient (i.e. "background") wells: one represents groundwater within the fluvial sand and gravel unit (W-102R) and the other two represent groundwater within the sandstone bedrock (W-101 and W-107). The four downgradient monitoring wells are W-100R, W-100AR, W-105, and W-106. The four monitoring well locations are shown on Figure 2. There were no changes to the monitoring well network during 2018.

2.2 Background Sampling

Quarterly background groundwater monitoring was conducted at the Landfill from September 2015 through September 2017 in accordance with the GWMP. Groundwater data included eight background sampling events with field and laboratory analysis of the parameters required in the CCR Rule's Appendix III and Appendix IV to Part 257 from both the upgradient and downgradient wells. Background data was included in the first Annual GW monitoring and corrective active report (TRC, 2018).

2.3 Semiannual Groundwater Monitoring

The semiannual monitoring parameters for the detection groundwater monitoring program were selected per the CCR Rule's Appendix III to Part 257 – Constituents for Detection Monitoring. The Appendix III indicator parameters consist of boron, calcium, chloride, fluoride, pH (field), sulfate, and total dissolved solids (TDS). These parameters were analyzed in accordance with the groundwater monitoring program described in the GWMP.

2.3.1 Data Summary

The semiannual groundwater detection monitoring events were performed by DPC personnel on March 21-22, 2018 and September 19-20, 2018. Samples were analyzed by DPC's Chemical Services Laboratory and Pace Analytical Services, LLC in accordance with the GWMP. Static water elevation data were collected at all seven monitoring well locations. Groundwater samples were collected from each of the detection monitoring wells and analyzed for the Appendix III indicator parameters and field parameters. A

summary of the groundwater data collected during the March and September 2018 events are provided in Appendix A, including static groundwater elevation data, analytical results, and field data.

2.3.2 Data Quality Review

Data from each round were evaluated for completeness and potential sample contamination. The data were found to be complete and usable for the purposes of the CCR monitoring program.

2.3.3 Groundwater Flow Rate and Direction

Groundwater elevation data collected during the March and September 2018 sampling events showed that groundwater within the uppermost aquifer generally flows to the south at the site. Groundwater potentiometric surface elevations measured across the Landfill during the September 2018 sampling event are provided on Table 2 and were used to construct a groundwater potentiometric surface map (Figure 2).

The map indicates that current groundwater flow is consistent with previous monitoring events. The average hydraulic gradient throughout the Landfill during this event is estimated at 0.05 ft/ft, resulting in an estimated average seepage velocity of approximately 0.9 ft/day or 334 ft/year for this event, using the average hydraulic conductivity of 4 ft/day (TRC, 2017) and an assumed effective porosity of 20 percent.

The general flow rate and direction in the uppermost aquifer is similar to that identified in previous monitoring and continues to demonstrate that the compliance wells are appropriately positioned to detect the presence of Appendix III parameters that could potentially migrate from the Landfill.

Section 3
Statistical Evaluation

3.1 Establishing Background Limits

Background limits were established for the Appendix III indicator parameters following the collection of eight background monitoring events and established and described in the Annual Groundwater Monitoring Report (TRC, 2018).

3.2 Data Comparison to Background Limits

Concentrations of the indicator parameters in each of the detection monitoring wells (W-100R, W-100AR, W-105, and W-106) were compared to their respective statistical background limits. The comparisons are presented on Table 1 (March 21, 2018) and Table 2 (September 20, 2018).

The statistical evaluation of the March and September 2018 Appendix III indicator parameters shows that there were no potential SSIs compared to background for boron, calcium, chloride, fluoride, pH, sulfate, or TDS. Since there were no SSIs in the tested parameters in 2018, the monitoring program has remained in detection monitoring.

Section 4
Conclusions and Recommendations

DPC has established a monitoring program in accordance to the CCR Rule and has conducted compliance monitoring for 2018 in accordance with 257.94 of the CCR Rule. There were no potential SSIs over background limits for the Appendix III parameters during the March and September 2018 monitoring events. Therefore, DPC will continue to conduct detection monitoring, and will not be required to take additional action(s) at this time.

The next semiannual monitoring events at the Landfill are scheduled for March and September of 2019.

Section 5
References

RMT, Inc. October 2000. Dairyland Power Cooperative Plan of Operation Phase IV Disposal Area Alma Off-site Ash Disposal Facility, Town of Belvidere, Wisconsin. Prepared for Dairyland Power Cooperative.

TRC Environmental Corporation. October 2017. Groundwater Monitoring Program (GWMP) for Compliance with the Federal Coal Combustion Residual Rule – Dairyland Power Cooperative Off-site Disposal Facility Phase IV Landfill, Town of Belvidere, Wisconsin. Prepared for Dairyland Power Cooperative.

TRC Environmental Corporation. January 2018. Annual Groundwater Monitoring Report – Dairyland Power Cooperative Off-site Disposal Facility Phase IV Landfill, Town of Belvidere, Wisconsin. Prepared for Dairyland Power Cooperative.

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Wisconsin Geologic and Natural History Survey (WGNHS). 2003. wiscLITH: A Digital Lithologic and Stratigraphic Database of Wisconsin Geology. Database.

Young, H.L. and R.G. Borman. 1973. Water Resources of Wisconsin Trempealeau – Black River Basin. Hydrologic Investigations Atlas HA-474. U.S. Geological Survey. Washington, D.C. Maps. 4p.

Table 1
Comparison of Appendix III Parameter Results to Background Limits - March 21, 2018
Dairyland Power Cooperative - Off-site Disposal Facility, Phase IV Landfill
Buffalo County, Wisconsin

PARAMETER	W-100R		W-100AR		W-105		W-106	
	DATA	TL[1]	DATA	TL[1]	DATA	TL[1]	DATA	TL[1]
Boron, total (µg/L)	19	52.6	19.3	38.4	10.2	20	13.4	20
Calcium, total (µg/L)	78,100	92,200	83,300	89,100	68,500	80,000	69,900	80,000
Chloride, total (mg/L)	4.7	13.2	4.8	13.2	4.1	13.2	7.6	13.2
Fluoride, total (mg/L)	< 0.1	0.21	< 0.1	0.21	< 0.1	0.21	< 0.1	0.21
pH, field (SU)[2]	7.31	6.64, 7.39	6.96	6.59, 7.67	7.55	6.96, 7.61	7.63	6.90, 7.82
Sulfate (mg/L)	14.8	32.7	17.2	21.1	13.8	21.1	16.7	21.1
Total Dissolved Solids (TDS) (mg/L)	357	488	390	551	351	448	416	448
Water elevation (Feet MSL)[3]	726.82	NA	716.06	NA	733.25	NA	773.24	NA

Footnotes:

1. TL = tolerance limit for each parameter. Exceeding a tolerance limit would indicate a possible SSI.
2. TL for pH includes two valves: a lower limit and an upper limit.
3. NA = Not Applicable. The water elevation does not have a TL and is provided for referenece only.

Created By: P. Popp
Checked By: J. Hotstream

Table 2
Comparison of Appendix III Parameter Results to Background Limits - September 20, 2018
Dairyland Power Cooperative - Off-site Disposal Facility, Phase IV Landfill
Buffalo County, Wisconsin

PARAMETER	W-100R		W-100AR		W-105		W-106	
	DATA	TL[1]	DATA	TL[1]	DATA	TL[1]	DATA	TL[1]
Boron, total (µg/L)	14.2	52.6	14	38.4	< 10	20	< 10	20
Calcium, total (µg/L)	78,500	92,200	79,500	89,100	67,600	80,000	69,600	80,000
Chloride, total (mg/L)	4.7	13.2	4.5	13.2	3.7	13.2	6.7	13.2
Fluoride, total (mg/L)	< 0.1	0.21	< 0.1	0.21	< 0.1	0.21	< 0.1	0.21
pH, field (SU)[2]	6.79	6.64, 7.39	7.36	6.59, 7.67	7.18	6.96, 7.61	7.31	6.90, 7.82
Sulfate (mg/L)	17.6	32.7	17.9	21.1	15.1	21.1	18.2	21.1
Total Dissolved Solids (TDS) (mg/L)	361	488	364	551	315	448	342	448
Water elevation (Feet MSL)[3]	727.08	NA	716.88	NA	733.6	NA	773.54	NA

Footnotes:

1. TL = tolerance limit for each parameter. Exceeding a tolerance limit would indicate a possible SSI.
2. TL for pH includes two valves: a lower limit and an upper limit.
3. NA = Not Applicable. The water elevation does not have a TL and is provided for referenece only.

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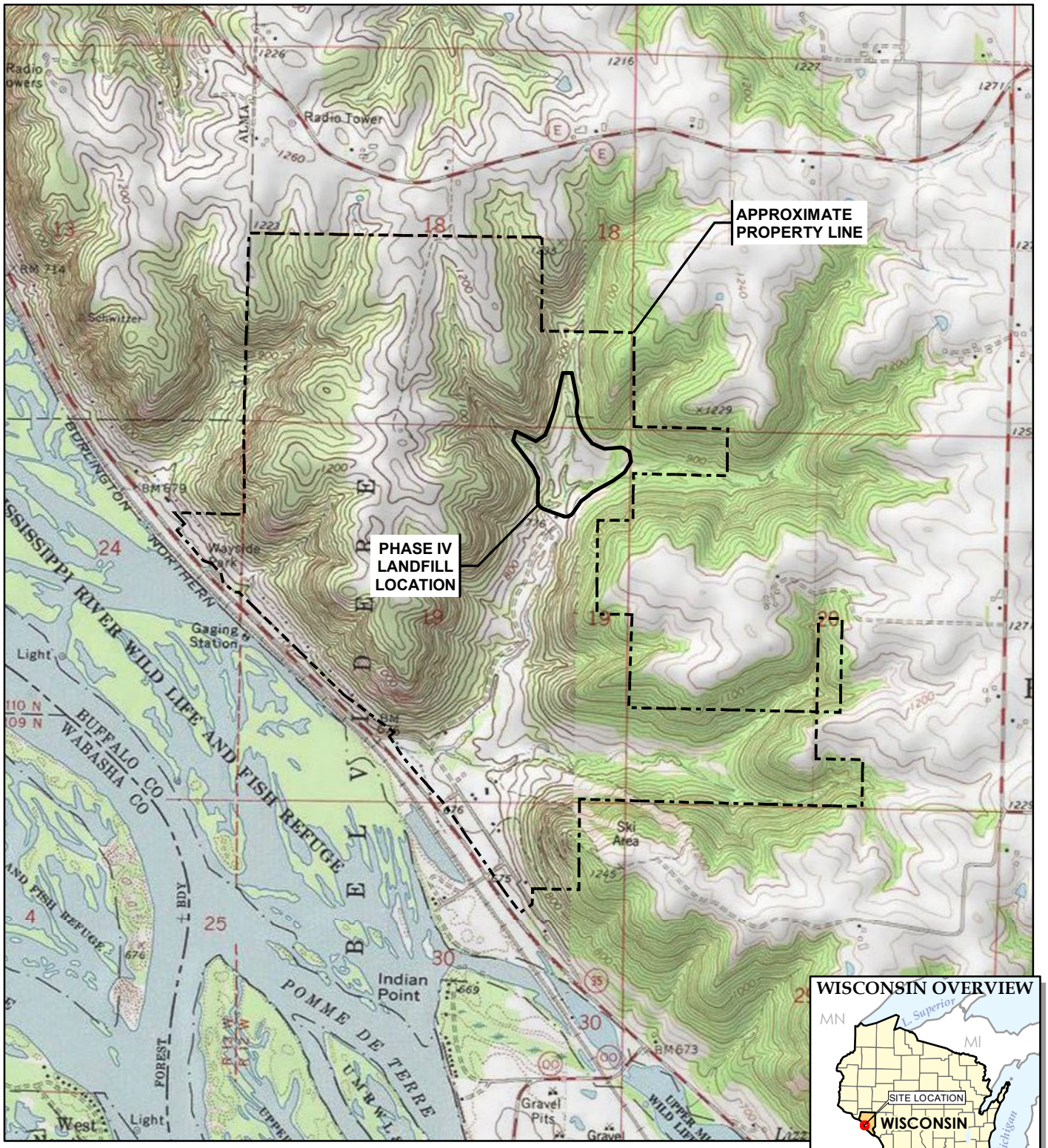

BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

1 " = 2,000 '
1:24,000

0 2,000 4,000 FEET

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TRC - GIS

PROJECT:
DAIRYLAND POWER COOPERATIVE
ALMA OFF-SITE DISPOSAL FACILITY, PHASE IV LANDFILL
ANNUAL GROUNDWATER MONITORING REPORT
BUFFALO COUNTY, WISCONSIN

TITLE:
SITE LOCATION MAP

DRAWN BY:	R. SUEMNICHT
CHECKED BY:	J. HOTSTREAM
APPROVED BY:	J. WEDEKIND
DATE:	JANUARY 2018
PROJ. NO.:	243332.0004
FILE:	243332-003slm.mxd

FIGURE 1

E:\DairylandPower\AlmaWI\2015_243332\243332-003slm.mxd -- Saved By: RSUEMNICHT on 1/29/2018, 12:58:23 PM

EXISTING PHASE II LANDFILL (CLOSED)

EXISTING PHASE IV, CELL 3A (ACTIVE)

EXISTING PHASE IV, CELL 2A

EXISTING PHASE IV, CELL 2B

EXISTING PHASE IV, CELL 1

CELL 4A (FUTURE)

CELL 4B (FUTURE)

AREA OF PHASE IV LANDFILL THAT HAS RECEIVED FINAL COVER

W106 (773.54)

P42B P42A W42 (788.83)

W100R (727.08)

W100AR

W105 (733.60)

W104 (772.64)

W104A

W101A

W101 (817.47)

W102AR

W102R (818.18)

W107 (831.85)

SG-2

SG-3

LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- GRID LOCATION
- EXISTING UNPAVED ROAD
- EXISTING FENCE
- 890 EXISTING 10' CONTOUR
- x 895.7 EXISTING SPOT ELEVATION
- LIMITS OF CCR DISPOSAL (LANDFILL)
- LIMITS OF CCR DISPOSAL (ACTIVE LANDFILL)
- PHASE LINE
- W42 MONITORING WELL (NOT INCLUDED IN FEDERAL GWMP)
- W42B PIEZOMETER (NOT INCLUDED IN FEDERAL GWMP)
- W101 MONITORING WELL LOCATION
- W101A PIEZOMETER LOCATION
- (787.22) GROUNDWATER ELEVATION
- GROUNDWATER FLOW DIRECTION
- 800 GROUNDWATER CONTOUR

NOTES

1. THE BASE MAP WAS MODIFIED FROM THE CELL 3B LINER CONSTRUCTION DOCUMENTATION REPORT (OCTOBER, 2016).
2. THE HORIZONTAL DATUM IS REFERENCED TO THE WISCONSIN STATE PLANE COORDINATE SYSTEM, CENTRAL ZONE, NORTH AMERICAN DATUM 1983, US SURVEY FEET.
3. VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988. CONTOUR INTERVAL IS 10 FEET.
4. GROUNDWATER ELEVATIONS BASED ON MEASUREMENTS TAKEN SEPTEMBER 19-20, 2018. GROUNDWATER ELEVATIONS ARE BASED ON MEAN SEA LEVEL DATUM.
5. THE FEDERAL GWMP DOES NOT REPLACE THE REQUIREMENTS FROM THE STATE OF WISCONSIN.

0 200 400

SCALE IN FEET

PROJECT: DAIRYLAND POWER COOPERATIVE
ANNUAL GROUNDWATER MONITORING REPORT
ALMA OFF-SITE PHASE IV LANDFILL
BUFFALO COUNTY, WISCONSIN

TITLE: GROUNDWATER ELEVATION MAP

DRAWN BY:	B. YUNUSOV	PROJ NO.:	320002
CHECKED BY:	J. HOTSTREAM		
APPROVED BY:	J. WEDEKIND		FIGURE 2
DATE:	JANUARY 2019		

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FILE NO.: 320002.01.dwg

Appendix A
2018 Detection Monitoring Data

Dairyland Power Cooperative - Alma Off-Site Groundwater Data
2018

PARAMETER	UNITS	W-100AR 3/21/2018 180321-X01	W-100R 3/21/2018 180321-X02	W-101 3/21/2018 180321-X04	W-102R 3/21/2018 180321-X03	W-105 3/22/2018 180321-X05	W-106 3/22/2018 180321-X06	W-107 3/21/2018 180321-X07
Water elevation	Feet	716.06	726.82	815.92	816.65	733.25	773.24	831.51
Appendix III								
Boron, total	µg/L	19.3	19	10.5	< 10	10.2	13.4	< 10
Calcium, total	µg/L	83300	78100	69900	65200	68500	69900	76300
Chloride, total	mg/L	4.8	4.7	6.8	3.3	4.1	7.6	12.4
Fluoride, total	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
pH, field	SU	6.96	7.31	7.06	7.22	7.55	7.63	7.66
Total Dissolved Solids (TDS)	mg/L	390	357	354	340	351	416	350
Sulfate	mg/L	17.2	14.8	16.2	15.5	13.8	16.7	18.5

PARAMETER	UNITS	W-100AR 9/20/2018 180920-X01	W-100R 9/20/2018 180920-X02	W-101 9/19/2018 180920-X04	W-102R 9/19/2018 180920-X03	W-105 9/20/2018 180920-X05	W-106 9/20/2018 180920-X06	W-107 9/19/2018 180920-X07
Water elevation	Feet	716.88	727.08	817.47	818.18	733.6	773.54	831.85
Appendix III								
Boron, total	µg/L	14	14.2	< 10	< 10	< 10	< 10	< 10
Calcium, total	µg/L	79500	78500	69000	63700	67600	69600	76700
Chloride, total	mg/L	4.5	4.7	6	3.1	3.7	6.7	11
Fluoride, total	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
pH, field	SU	7.36	6.79	7.38	7.31	7.18	7.31	7.31
Total Dissolved Solids (TDS)	mg/L	364	361	316	278	315	342	346
Sulfate	mg/L	17.9	17.6	16.7	15	15.1	18.2	18.3