



# 2024 Annual Groundwater Monitoring Report

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

**License 4126**

January 2025

**Prepared For:**

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A handwritten signature in blue ink, reading "Stephen Sellwood".

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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 Title 40 Code of Federal Regulations Part 257) for the March and September 2024 semiannual groundwater monitoring events 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 Title 40 Code of Federal Regulations §257.94. The detection monitoring data were evaluated to identify statistically significant increases (SSIs) over background levels.

There were no confirmed SSIs over background limits for the Appendix III parameters during the 2024 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 2025.

## 1.0 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) Subpart D - Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments (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 Title 40 Code of Federal Regulations (40 CFR) §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 40 CFR §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 2024 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 (Figure 1). The Landfill accepts CCR material produced from electricity generation and other industry-related waste streams as approved by the Wisconsin Department of Natural Resources (WDNR). DPC operates the Landfill in compliance with the Plan of Operation (RMT, 2000), and subsequent Plan of Operation Modifications, as permitted by the WDNR (License Number 4126).

### 1.3 Geology/Hydrogeology

The site is located within the Western Upland physiographic region of South-Central Wisconsin, northeast of 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 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 in boreholes performed during the Landfill siting.

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 elevation 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 2024). In-situ hydraulic conductivity data presented in the Feasibility Report (RMT, 1997) indicates a geometric mean hydraulic conductivity of  $1.4 \times 10^{-3}$  cm/s for the fluvial sand and gravel unit and  $1.1 \times 10^{-3}$  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 2024), 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 an upward gradient observed from bedrock to sand at W42/P42A during most measurement events.

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## 2.0 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 monitoring well locations are shown on Figure 2. There were no changes to the monitoring well network during 2024.

### 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). The background dataset has been expanded to include the semiannual monitoring events from September 2017 to September 2019 (TRC, 2021).

### 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 detection monitoring groundwater sampling events were performed by DPC personnel on March 21, 2024, and September 24-25, 2024. Samples were analyzed by Pace Analytical Services, LLC, in accordance with the GWMP. This laboratory is accredited with the WDNR.

Static water elevation data were collected at the seven monitoring well locations during each sampling event. 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 2024 events is 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 2024 sampling events show 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 2024 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 generally 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 1.1 ft/day or 390 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 generally 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.

## **3.0 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). The background datasets and tolerance limits were updated for several parameters in 2020. These updates were performed in accordance with the Groundwater Monitoring Program (TRC, 2017), and additional detail on the updates is provided in Appendix B of the 2020 Annual Groundwater Monitoring Report (TRC, 2021).

### **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, 2024) and Table 2 (September 24-25, 2024).

The evaluation of the 2024 results for Appendix III indicator parameters shows that there were no SSIs compared to background for boron, calcium, chloride, fluoride, pH, sulfate, or TDS. Since there were no SSIs in the tested parameters in 2024, the monitoring program has remained in detection monitoring.



## 4.0 Conclusions and Recommendations

DPC has established a monitoring program at the Landfill in accordance with the CCR Rule and has conducted compliance monitoring for 2024 in accordance with 40 CFR §257.94. There were no confirmed SSIs over background limits for the Appendix III parameters during the March and September 2024 monitoring events. Therefore, DPC will continue to conduct detection monitoring, and is not required to take additional action at this time.

The next semiannual monitoring events at the Landfill are scheduled for March and September of 2025. Sampling and analytical results will be reported in January 2026.

## 5.0 References

- RMT, Inc. 1997. Feasibility Report: Dairyland Power Cooperative Phase IV Disposal Area, Alma Off-Site Ash Disposal Facility. Town of Belvidere, Buffalo County, Wisconsin. September 1997.
- 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. 2017 Annual Groundwater Monitoring Report – Dairyland Power Cooperative Off-site Disposal Facility Phase IV Landfill, Town of Belvidere, Wisconsin. Prepared for Dairyland Power Cooperative.
- TRC Environmental Corporation. January 2021. 2020 Annual Groundwater Monitoring Report – Dairyland Power Cooperative Off-site Disposal Facility Phase IV Landfill, Town of Belvidere, Wisconsin. Prepared for Dairyland Power Cooperative.
- Wisconsin Department of Natural Resources. 2015. Water Well Data Disc. Database. January 2015.
- 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, 2024**  
**Dairyland Power Cooperative - Off-site Disposal Facility, Phase IV Landfill**  
**Buffalo County, Wisconsin**

Parameter	W-100R		W-100AR		W-105		W-106	
	Data	TL <sup>(1)</sup>	Data	TL <sup>(1)</sup>	Data	TL <sup>(1)</sup>	Data	TL <sup>(1)</sup>
Boron, total (µg/L)	8.3 J	52.6	14	38.4	4.7 J	20	5.1 J	20
Calcium, total (µg/L)	77,100	92,200	77,400	89,100	72,700	80,700	78,400	80,700
Chloride, total (mg/L)	5.0	13.2	4.6	13.2	4.6	13.2	11.1	13.2
Fluoride, total (mg/L)	< 0.095	0.21	< 0.095	0.21	< 0.095	0.21	0.11 J	0.21
pH, field (SU)	7.28	6.61, 7.48	7.27	6.66, 7.60	7.40	6.80, 7.76	7.46	6.81, 7.91
Sulfate (mg/L)	16.1	32.7	17.0	29.0	14.5	29.0	20.5	29.0
Total Dissolved Solids (TDS) (mg/L)	320	488	338	551	306	448	352	448
Water elevation (Feet MSL)	726.76	--	716.17	--	733.34	--	773.40	--

Footnotes:

1. TL = tolerance limit for each parameter. Exceeding a tolerance limit would indicate a possible SSI.  
J = Estimated concentration at or above the limit of detection and below the limit of quantitation.

Created By: P. Popp, 1/6/2024

Checked By: S. Sellwood, 1/14/2025

**Table 2: Comparison of Appendix III Parameter Results to Background Limits - September 24-25, 2024  
Dairyland Power Cooperative - Off-site Disposal Facility, Phase IV Landfill  
Buffalo County, Wisconsin**

Parameter	W-100R		W-100AR		W-105		W-106	
	Data	TL <sup>(1)</sup>	Data	TL <sup>(1)</sup>	Data	TL <sup>(1)</sup>	Data	TL <sup>(1)</sup>
Boron, total (µg/L)	11	52.6	15	38.4	10	20	8.5 J	20
Calcium, total (µg/L)	72,500	92,200	72,500	89,100	67,400	80,700	73,800	80,700
Chloride, total (mg/L)	5.3	13.2	5.0	13.2	4.6	13.2	10.7	13.2
Fluoride, total (mg/L)	0.15 J	0.21	0.12 J	0.21	< 0.095	0.21	0.12 J	0.21
pH, field (SU)	7.25	6.61, 7.48	7.01	6.66, 7.60	7.40	6.80, 7.76	7.49	6.81, 7.91
Sulfate (mg/L)	16.0	32.7	16.2	29.0	14.0	29.0	19.7	29.0
Total Dissolved Solids (TDS) (mg/L)	324	488	334	551	300	448	328	448
Water elevation (Feet MSL)	726.87	--	716.15	--	733.61	--	773.43	--

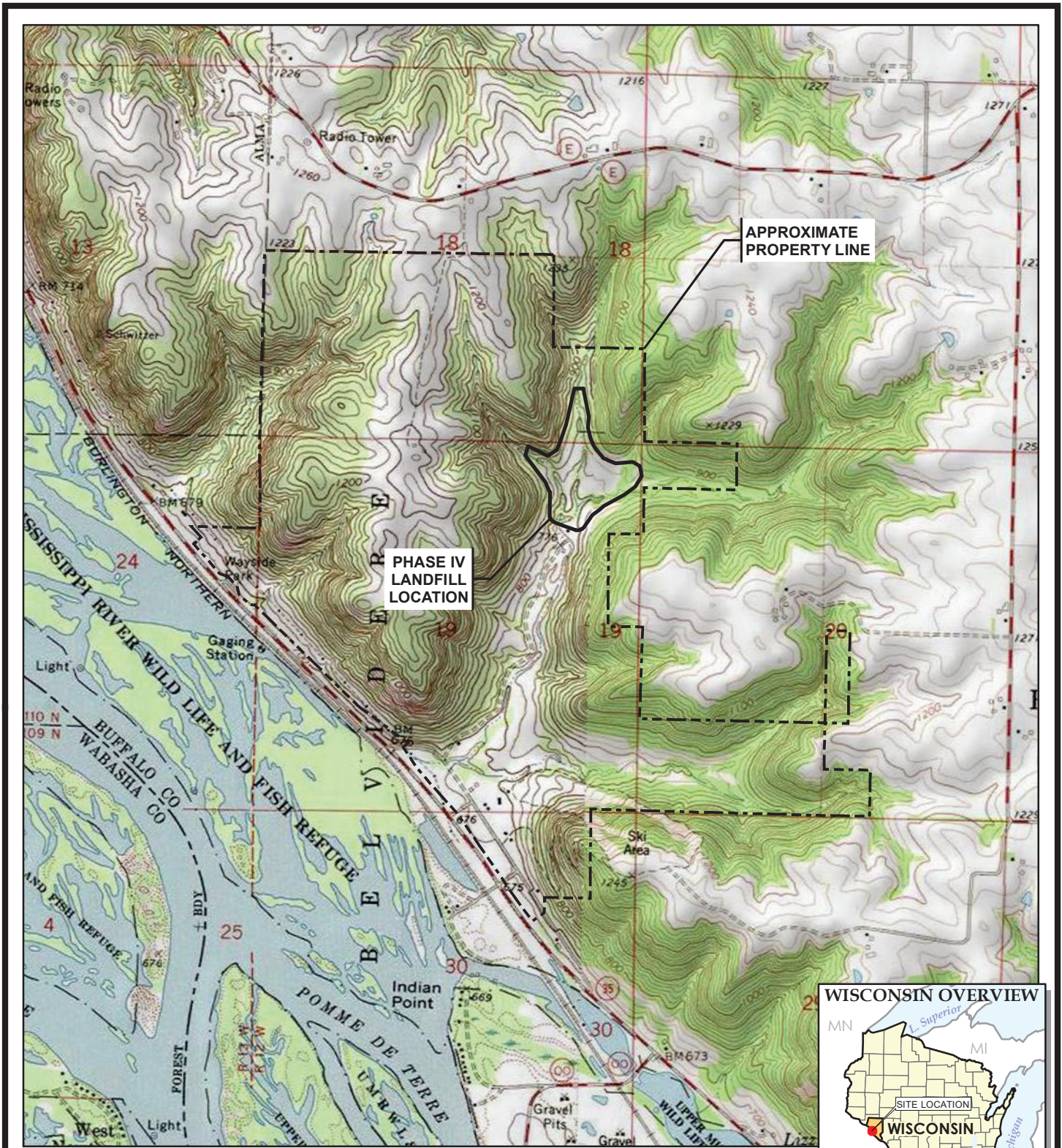
Footnotes:

1. TL = tolerance limit for each parameter. Exceeding a tolerance limit would indicate a possible SSI.  
J = Estimated concentration at or above the limit of detection and below the limit of quantitation.

Created By: P. Popp, 1/6/2024

Checked By: S. Sellwood, 1/14/2025





BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.




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Phone: 608.826.3663

TRC - GIS

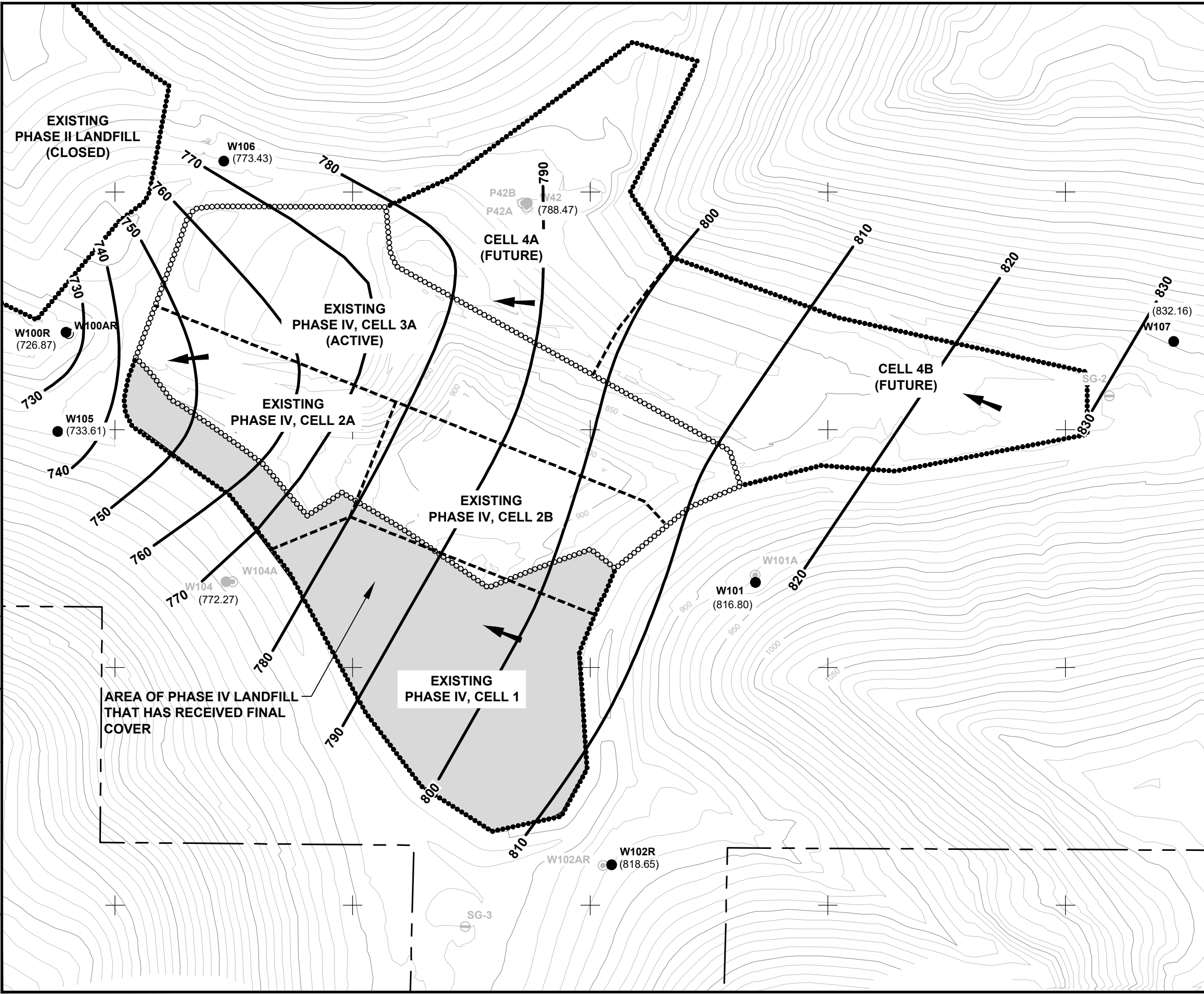
PROJECT:	<b>DAIRYLAND POWER COOPERATIVE ALMA OFF-SITE DISPOSAL FACILITY, PHASE IV LANDFILL ANNUAL GROUNDWATER MONITORING REPORT BUFFALO COUNTY, WISCONSIN</b>
TITLE:	<b>SITE LOCATION MAP</b>

DRAWN BY:	A. ADAIR
CHECKED BY:	B. KAHNK
APPROVED BY:	S. SELLWOOD
DATE:	JANUARY 2025
PROJ. NO.:	563618.0000
FILE:	563618_101slm.mxd

**FIGURE 1**



11x17 -- USER: T:\Projects\2024\2024-11-12 -- ATTACHED IMAGES: WELLS\2004\_GROUNDWATER\_MONITORING -- PROPOSED: 02/20/2024 -- PLOT DATE: January 22, 2025 - 9:05AM -- LAYOUT: FIGURE 2 GROUNDWATER ELEVATION MAP  
 DRAWING NAME: M:\Dairyland Power\Alma\563618 - Annual Groundwater Report\00001\_563618.01.dwg -- PLOT DATE: January 22, 2025 - 9:05AM -- LAYOUT: FIGURE 2 GROUNDWATER ELEVATION MAP  
 Version: 2017-10-21



**LEGEND**

- APPROXIMATE PROPERTY BOUNDARY
- GRID LOCATION
- EXISTING 10' CONTOUR
- EXISTING SPOT ELEVATION
- LIMITS OF PERMITTED 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
- GROUNDWATER ELEVATION
- GROUNDWATER FLOW DIRECTION
- GROUNDWATER EQUIPOTENTIAL LINE

**NOTES**

1. THE BASEMAP WAS DEVELOPED BY SPLICING THE FOLLOWING SOURCES:  
 THE NOVEMBER 13, 2023 EXETER DESIGN GROUND SURVEY AND PERMITTED TOP OF GRANULAR DRAINAGE LAYER BEYOND THE SURVEYED WASTE LIMITS WITHIN CELLS 2A, 2B, 3A & 3B.  
 CELL 1 DOCUMENTED SELECT AND CONDITIONED TOP OF ASH GRADES, TAKEN FROM THE RMT, INC., PHASE IV, CELL 1 FINAL COVER CONSTRUCTION DOCUMENTATION REPORT, DATED DECEMBER, 2009.  
 CELL 2A AND 2B DOCUMENTED TOP OF SELECT AND CONDITIONED ASH GRADES, TAKEN FROM THE TRC, PHASE IV, CELL 2A FINAL COVER CONSTRUCTION DOCUMENTATION REPORT, DATED DECEMBER 2011 AND THE TRC PHASE IV, AREA C FINAL COVER CONSTRUCTION DOCUMENTATION REPORT, DATED FEBRUARY, 2017.
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 24-25, 2024. GROUNDWATER ELEVATIONS ARE BASED ON MEAN SEA LEVEL DATUM.



PROJECT: <b>DAIRYLAND POWER COOPERATIVE ANNUAL GROUNDWATER MONITORING REPORT ALMA OFF-SITE PHASE IV LANDFILL BUFFALO COUNTY, WISCONSIN</b>	
TITLE: <b>GROUNDWATER ELEVATION MAP</b>	
DRAWN BY: T. FIEBRANZ	PROJ NO.: 563618
CHECKED BY: C. ZUMM	<b>FIGURE 2</b>
APPROVED BY: S. SELLWOOD	
DATE: JANUARY 2025	
999 Fourier Drive Suite 101 Madison, WI 53717 Phone: 608.826.3600	
FILE NO.:	563618.01.dwg

## Appendix A: 2024 Detection Monitoring Data

**Dairyland Power Cooperative - Alma Off-Site Groundwater Data**

**March 2024**

PARAMETER	UNITS	W-100R	W-100AR	W-101	W-102R	W-105	W-106	W-107
		3/21/2024	3/21/2024	3/21/2024	3/21/2024	3/21/2024	3/21/2024	3/21/2024
		40275967002	40275967001	40275967004	40275967003	40275967005	40275967006	40275967007
Water elevation	Feet	726.76	716.17	816.42	817.06	733.34	773.40	832.08
<b>Appendix III</b>								
Boron, total	µg/L	8.3 J	14	3.7 J	4.8 J	4.7 J	5.1 J	4.6 J
Calcium, total	µg/L	77100	77400	75100	69600	72700	78400	87400
Chloride, total	mg/L	5.0	4.6	8.8	3.6	4.6	11.1	17.6
Fluoride, total	mg/L	< 0.095	< 0.095	< 0.095	< 0.095	< 0.095	0.11 J	0.12 J
pH, field	SU	7.28	7.27	7.47	7.50	7.40	7.46	7.44
Sulfate, total	mg/L	16.1	17.0	17.1	15.3	14.5	20.5	22.9
Total Dissolved Solids (TDS)	mg/L	320	338	326	300	306	352	376

**September 2024**

PARAMETER	UNITS	W-100R	W-100AR	W-101	W-102R	W-105	W-106	W-107
		9/25/2024	9/25/2024	9/25/2024	9/24/2024	9/24/2024	9/24/2024	9/24/2024
		40284696002	40284696001	40284696004	40284696003	40284696005	40284696006	40284696007
Water elevation	Feet	726.87	716.15	816.80	817.65	733.61	773.43	832.16
<b>Appendix III</b>								
Boron, total	µg/L	11	15	6.1 J	6.6 J	10	8.5 J	7.2 J
Calcium, total	µg/L	72500	72500	71400	64300	67400	73800	83500
Chloride, total	mg/L	5.3	5.0	9.0	3.7	4.6	10.7	16.8
Fluoride, total	mg/L	0.15 J	0.12 J	0.12 J	< 0.095	< 0.095	0.12 J	0.13 J
pH, field	SU	7.25	7.01	7.40	7.33	7.40	7.49	7.36
Sulfate, total	mg/L	16.0	16.2	16.5	14.6	14.0	19.7	22.1
Total Dissolved Solids (TDS)	mg/L	324	334	334	290	300	328	380