

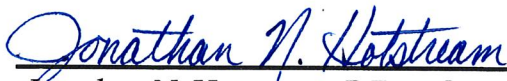



## **Location Restrictions Demonstrations**

### **Alma Off-Site Disposal Facility, Phase IV Landfill Buffalo County, Wisconsin**

**May 2018**

*Prepared For  
Dairyland Power Cooperative*

  
Jonathan N. Hotstream, P.E., P.G.  
Senior Geological Engineer

  
Todd Martin  
Principal Project Manager

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# Revision History

REVISION NUMBER	REVISION DATE	SECTION REVISED	SUMMARY OF REVISIONS

# Section 1

## Introduction

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This location restrictions demonstrations report (Report) was prepared by TRC Environmental Corporation (TRC) on behalf of Dairyland Power Corporation (DPC) for the Alma Off-Site Disposal Facility, Phase IV Landfill (Landfill) where coal combustion residuals (CCR) are disposed. The 32.1 acre Landfill is located in the NE  $\frac{1}{4}$  of the NE  $\frac{1}{4}$  of Section 19 and portions of Sections 18 and 20, T21N, R12W, the W  $\frac{1}{2}$  of the NE  $\frac{1}{4}$ , Section 23, T26N, R7E, Town of Belvidere, Buffalo County, Wisconsin (refer to Figure 1). DPC owns and operates the permitted Landfill in compliance with the Plan of Operation (POO) (RMT, 2000) approved by the Wisconsin Department of Natural Resources (WDNR).

The purpose of this Report is to demonstrate the compliance of the existing Landfill footprint and planned future lateral expansions to the Landfill with the location restrictions required by the U.S. Environmental Protection Agency's (USEPA) CCR rule, Title 40 Code of Federal Regulations (40 CFR) Parts 257 and 261 Subpart D—"Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments" (Federal Register §257.60 through §257.64). Currently, Cells 1 through 3 of the Landfill have been constructed and have received CCR. Future lateral expansions include Cell 4A and Cell 4B (refer to Figure 2). These two cells compose the lateral expansions in this Report. This document includes information from site permitting data, previously completed work, a desktop study, and engineering calculations to evaluate the Landfill concerning its location above the uppermost aquifer (§257.60), wetlands (§257.61), fault areas (§257.62), seismic impact zones (§257.63), and unstable areas (§257.64).

Supporting documents are provided in appendices to this report. Such documents include components of the Feasibility Report (FR), Plan of Operation (POO), and environmental monitoring data which were reviewed to evaluate site setting and conditions.



## Section 2

# Location Restrictions

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The location restrictions required by the federal CCR rule are presented below with a demonstration to show compliance with each restriction. The location restrictions address separation from the uppermost aquifer, wetlands, fault areas, seismic impact zones, and unstable areas. Supporting information for the demonstrations are attached as appendices to this report.

### 2.1 §257.60 – Placement Above the Uppermost Aquifer

The federal CCR rule requires that the Landfill lateral expansions must be constructed with a base that is located no less than 5 feet above the upper limit of the uppermost aquifer or must demonstrate that there will not be intermittent, recurring, or sustained hydraulic connection between any portion of the base of the Landfill. To determine the proximity of the upper limit of the uppermost aquifer in relation to the base of the lateral expansions, groundwater elevation data for the monitoring wells surrounding the Landfill for the period between November 1995 and September 2017 were reviewed to determine the upper limit of the uppermost aquifer. The upper limit of the uppermost aquifer was compared to the proposed subbase grades of the lateral expansions in the approved POO.

Data from seven groundwater monitoring wells and piezometers installed between 1994 and 1997 located at the south side (wells W-100/W-100R, W-100A/W-100AR, and W-105), west side (well W-42), east side (wells W-102 and W-102A), and north side (well W-107) of the Landfill indicate that the observed groundwater elevation in the uppermost aquifer has been relatively constant over a 22 year period (1995 through 2017; Appendix A). The Landfill design grades and slopes at the upgradient and downgradient locations were reviewed to determine the distance between the subbase grades (bottom of liner grades) and the upper limit of the groundwater elevation. The Landfill grades slope from the north to the south, following the site topography. The south end subbase grade is a minimum elevation of 782 feet Mean Sea Level (MSL), and the north end subbase grade is a minimum elevation of 862 feet MSL (Appendix A).

Based on the monitoring results, the maximum groundwater elevation of the south side wells was 737.97 feet MSL (W-100/W-100R in June 2001), and the maximum groundwater elevation of the north side well was 831.82 feet MSL (W-107 in September 2017). The engineering cross sections from the POO were included in Appendix A to present the bottom of the Landfill in comparison to the groundwater level. The groundwater level monitoring indicates that the

groundwater levels shown on POO cross sections are representative of the current conditions. These comparisons show that there is over 5 feet of separation between the bottom of the Landfill and the observed upper limit of the uppermost aquifer.

Based on this evaluation, the future lateral expansions of the Landfill will be constructed with a base that is greater than 5 feet above the upper limit of the uppermost aquifer. Therefore, the future lateral expansions of Landfill are in compliance with the requirements of §257.60.

## 2.2 §257.61 – Wetlands

The federal CCR rule requires that the Landfill lateral expansions cannot be located in wetlands. To determine if the Landfill, and therefore planned lateral expansions, are located in a wetland, the approved FR for the Landfill and more recent sources were reviewed.

Section 7 of the FR (Appendix B) approved by the WDNR contains an Ecological Assessment which concluded no wetlands are known to be present within the approved Landfill footprint. In addition the Feasibility Determination (Appendix B) noted that “ephemeral waterways, which flow in direct response to precipitation, route surface water from the uplands and steep slopes into the central valley,” and “the nearest wetlands are located approximately 1 mile south of the proposed site along the Mississippi River.”

The WDNR Surface Water Data Viewer (2017) and hydric soil classifications from the United States Department of Agriculture (2017) were consulted to determine the presence of potential additional wetlands in the area. Wetlands were not identified in the area of the lateral expansions. The water data viewer identifies wetlands too small to map within the existing landfill footprint which is not representative of the current conditions since the landfill has been constructed in these areas. The soil types within the proposed lateral expansions were mapped as ‘not hydric’ (Appendix B). The mapped soil types, Norden silt loam, worthen silt loam, churchtown silt loam, and Urne fine sandy loam, have a hydric rating of zero, and are well drained (Appendix B). These soil units, except for the Worthen silt loam, have steep slopes that range from 12 to 45 percent. These soil conditions suggest there are not wetland soils and flat or nearly flat areas where ponding would occur. The WDNR surface Water Data Viewer shows intermittent streams in the area of the landfill which supports the conclusion of the Feasibility Determination. The hydric rating map, shows one stream to the east of the existing landfill which has been previously diverted around the existing landfill. Therefore, this desktop study indicates the lateral expansions of the Landfill comply with the requirements of §257.61. A wetlands delineation will be performed if requested by the regulatory agencies to confirm the conclusions of this desktop study.

## 2.3 §257.62 – Fault Areas

The federal CCR rule requires that the Landfill lateral expansions must not be located within 200 feet of the outermost damage zone of a fault that has had displacement in Holocene time (11,700 years ago to present). To determine recent fault activity in the area, the subsurface exploration data and USGS Earthquake Fault Map were reviewed.

The subsurface investigation performed in the FR included rock coring. Faulting was not observed in the rock cores (Appendix C). Additionally, the USGS Quaternary Earthquake Fault Map (Appendix C) does not map faults occurring within the past 1.6 million years in the region of the Landfill or lateral expansions.

No evidence of active faulting during the Holocene within 200 feet of the Landfill has been identified; therefore, the lateral expansions comply with the requirements of §257.62.

## 2.4 §257.63 – Seismic Impact Zones

Federal CCR rule §257.63 requires that lateral expansions must not be located in seismic impact zones. The USGS Earthquake Hazards Program was consulted to determine the earthquake hazard for the site.

The 2015 National Earthquake Hazards Reduction Program (NEHRP) U.S. seismic design maps website (USGS 2015; Appendix D) indicates a mapped peak ground acceleration of 0.023g. Using a site adjustment factor of 1.6 based on the peak ground acceleration, and subsurface conditions, a design peak ground acceleration of 0.036g was calculated (Appendix D). This design peak ground acceleration is below the 0.1g lower limit specified by the federal CCR rule for seismic impact zones; therefore, this site is not located in a seismic impact zone as defined in §257.53. Because the site is not located in a seismic impact zone, the lateral expansions comply with the requirements of §257.63.

## 2.5 §257.64 – Unstable Areas

The federal CCR rule states that existing CCR units and lateral expansions may not be located in an unstable area. Risks presented by unstable areas caused by soil conditions, geologic or geomorphologic features, and human made features must be evaluated to be in compliance with the federal CCR rule. This analysis was performed by evaluating the results of the geotechnical exploration within the Landfill footprint during the siting and evaluation of the Landfill design.

A siting study was performed in the FR application to evaluate the potential for unstable conditions. The geotechnical exploration performed for the FR observed silt and lean clay

overlying medium to dense silty sand and sand to termination of soil borings, which ranged up to depths of 152 feet below the ground surface (Appendix C). Weathered bedrock consisting mainly of sandstone or dolomite were encountered in some borings. Within the footprint of the Landfill, the dolomite bedrock has been weathered away and the soils are underlain by sandstone. These observations do not suggest unstable foundation conditions considering the existing conditions and lateral expansions.

The Landfill design was performed by a professional engineer applying generally accepted good engineering practices. Global slope stability calculations were performed indicating acceptable factors of safety for critical slopes (RMT, 2000 POO; Appendix E). The subgrade of the existing Landfill was graded and prepared to provide suitable subgrade conditions according to the project specifications under the observation of an engineer's representative. The construction was performed and documented in accordance with the plans and specifications and certified by a professional engineer in the State of Wisconsin (RMT, 2001; RMT, 2008; TRC, 2013; and TRC, 2015).

Similar subgrade conditions are expected based on site activities and the results of the siting study. During construction, the subgrade for the lateral expansions will be prepared in a similar manner to comply with the POO.

Based on these analyses, the existing Landfill and lateral expansions are not located in an unstable area and comply with the requirements of §257.64.

## Section 3

# Conclusions

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Based upon the demonstrations provided in this report, the existing Landfill and planned future lateral expansions are in compliance with the location restrictions required by the CCR rule. No additional action or justification is required after this document has been placed in the operating record, posted to the publicly accessible website, and government notifications have been provided.

## Section 4

# References

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- Lundberg, D.R. Waste Management Team Leader, Wisconsin Department of Natural Resources, to Johnston, George, Dairyland Power Cooperative. 1999. *Feasibility Determination for the Proposed Dairyland Power Cooperative Phase IV Ash Disposal Facility, Town of Belvidere, Buffalo County, Wisconsin. License No. 4126.* September 10. [letter].
- RMT. 1997. Feasibility Report for the Phase IV Ash Disposal Area. September 19, 1997.
- RMT. 2000. Plan of Operation for the Phase IV Ash Disposal Area. October 19, 2000.
- RMT. 2001. Phase IV, Cell 1 Liner Construction Documentation Report. November 2001.
- RMT. 2007. Phase IV, Cell 2A Liner Construction Documentation Report. January 2007.
- RMT. 2008. Phase IV, Cell 2B Liner Construction Documentation Report. January 2008.
- RMT. 2015. Construction Documentation Report, Phase IV, Cell 3B Liner Construction Letter Report. November 2015.
- TRC. 2013. Phase IV, Cell 3A Liner Construction Documentation Report. January 2013.
- TRC. 2015. Phase IV, Cell 3B Liner Construction Documentation Report. October 2015.
- United States Department of Agriculture. 2017. Soil Survey Staff, Natural Resources Conservation Service, Web Soil Survey. Available online at <http://websoilsurvey.nrcs.usda.gov/>. Accessed [01/30/2017].
- United States Geological Survey (USGS). 2015. U.S. Seismic Design Maps: 2015 National Earthquake Hazards Reduction Program Provisions. Available Online at <http://earthquake.usgs.gov/designmaps/beta/us/>. Accessed [04/06/2017].
- Wisconsin Department of Natural Resources (WDNR). 2017. "Surface Water Data Viewer." Available online at <https://dnr.wi.gov/topic/surfacewater/swdv/>. Accessed [3/1/2018].

# Engineer's Certifications

Pursuant to 40 CFR 257 Subpart D and by means of this certification I attest that:

- (i) I am familiar with the requirements of the CCR rule (40 CFR §257);
- (ii) the information in this demonstration is in accordance with current, good, and accepted engineering practices;
- (iii) the existing Landfill complies with the location restriction for unstable areas (40 CFR §257.64);
- (iv) the proposed lateral expansions within the footprint presented in the Plan of Operation (RMT, 2000) comply with the location restrictions of 40 §CFR 257.60 through 40 CFR §257.64.

For the purpose of this document, "certify" and "certification" shall be interpreted and construed to be a "statement of professional opinion." The certification is understood and intended to be an expression of my professional opinion as a Wisconsin licensed professional engineer, based upon knowledge, information, and belief. The statement(s) of professional opinion are not and shall not be interpreted or construed to be a guarantee or a warranty of the analysis herein.

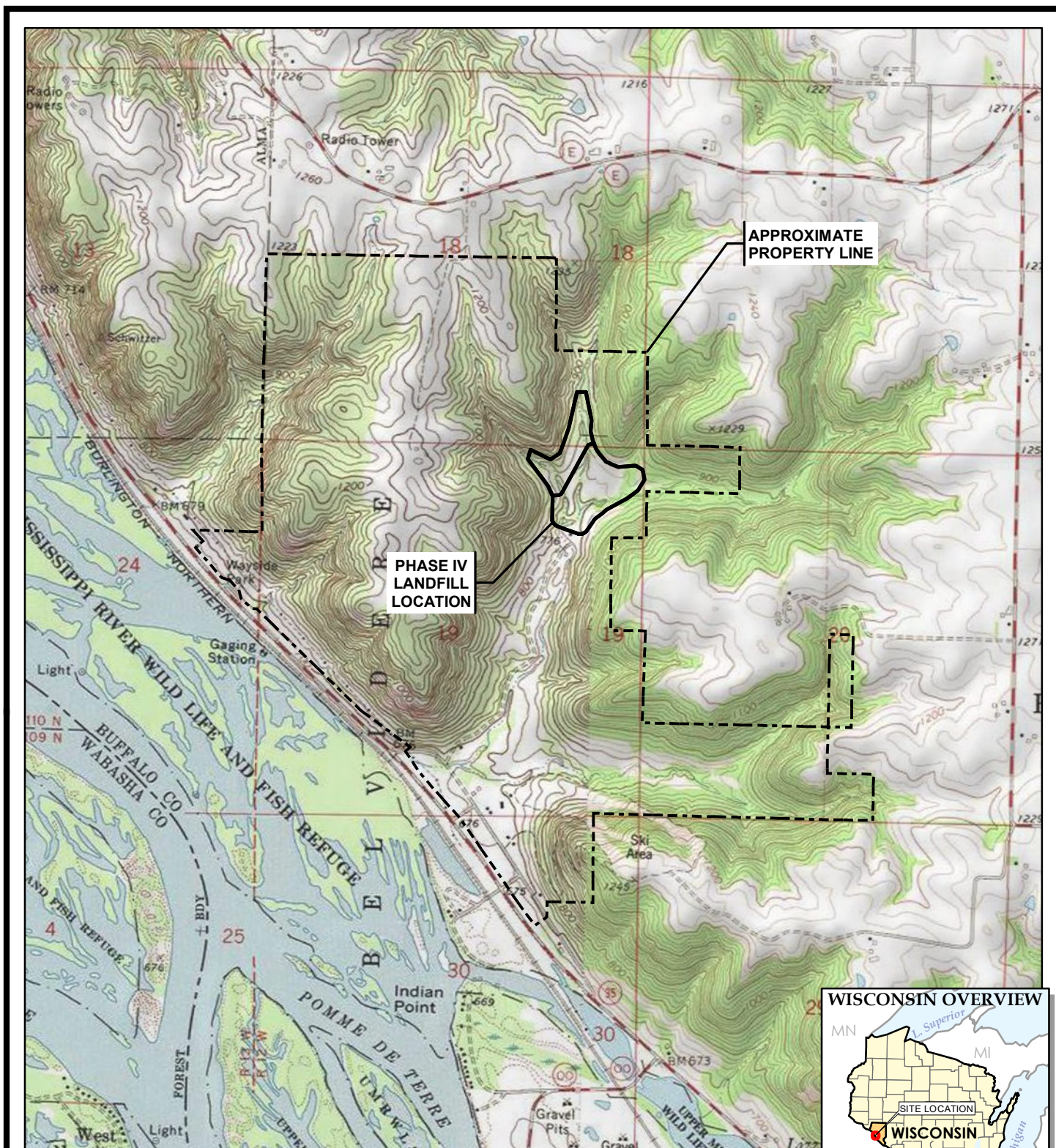


Signature of Registered Professional Engineer

Registration No. 42745-6 State: Wisconsin







BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.



708 Heartland Trail  
Suite 3000  
Madison, WI 53717  
Phone: 608.826.3600

TRC - GIS

PROJECT: **DAIRYLAND POWER COOPERATIVE  
ALMA OFF-SITE DISPOSAL FACILITY, PHASE IV LANDFILL  
LOCATIONS RESTRICTIONS DEMONSTRATIONS  
BUFFALO COUNTY, WISCONSIN**

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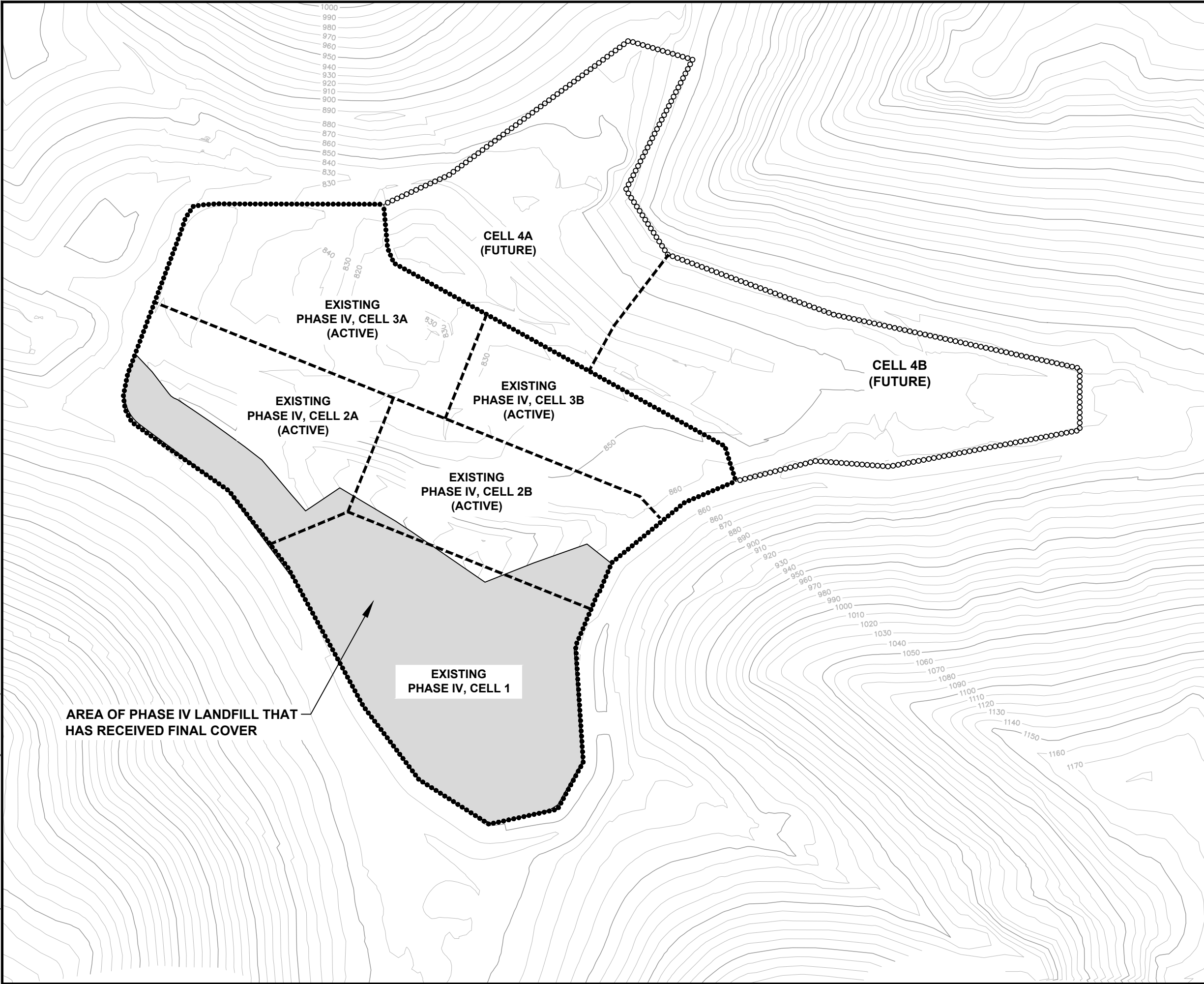
## SITE LOCATION MAP

DRAWN BY:	R. SUENMICH
CHECKED BY:	J. HOTSTREAM
APPROVED BY:	T. MARTIN
DATE:	MAY 2018
PROJ. NO.:	243332.0003
FILE:	243332-004slm.mxd

**FIGURE 1**

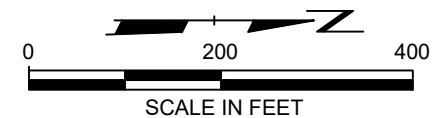


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DRAWING NAME: J:\Dairyland Power\Alma\243332\0003\243332.0003.01.dwg -- PLOT DATE: May 22, 2018 - 11:17AM -- LAYOUT: FIGURE 1



LEGEND	
	890 EXISTING 10' CONTOUR
	LIMITS OF CCR DISPOSAL (EXISTING LANDFILL)
	LIMITS OF LATERAL EXPANSION
	PHASE LINE

- 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.



PROJECT: <b>LOCATION RESTRICTIONS DEMONSTRATIONS ALMA OFF-SITE PHASE IV LANDFILL BUFFALO COUNTY, WISCONSIN</b>	
TITLE: <b>EXISTING CONDITIONS</b>	
DRAWN BY: L. STORMER	PROJ NO.: 243332.0003
CHECKED BY: J. HOTSTREAM	<b>FIGURE 2</b>
APPROVED BY: T. MARTIN	
DATE: MAY 2018	
708 Heartland Trail Suite 3000 Madison, WI 53717 Phone: 608.826.3600	
FILE NO.: 243332.0003.01.dwg	

# Appendix A

## Supporting Material for §257.60

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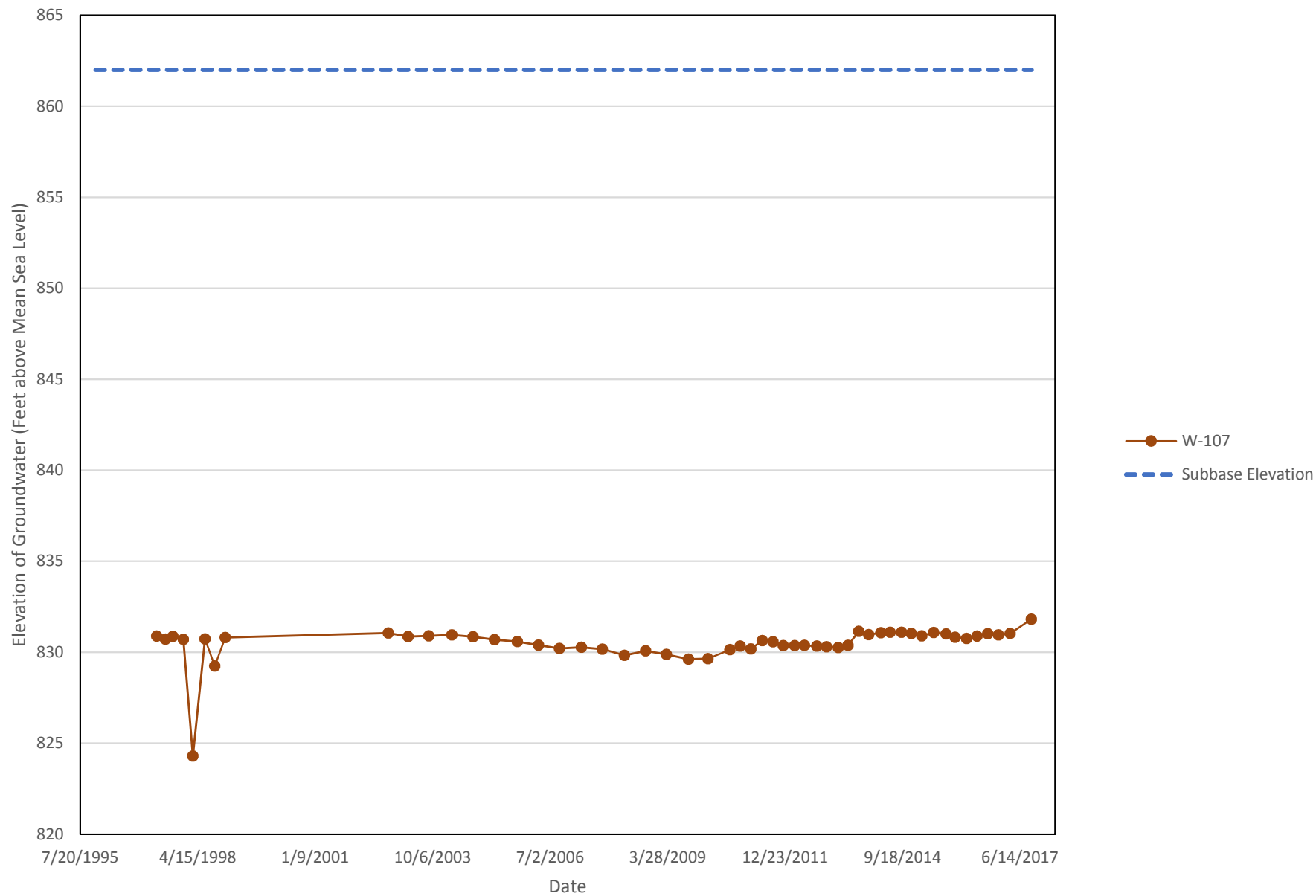
### Table of Contents

- Appendix A-1: Groundwater Elevations (1995-2017)
- Appendix A-2: Landfill Subbase Grades (RMT 2000)

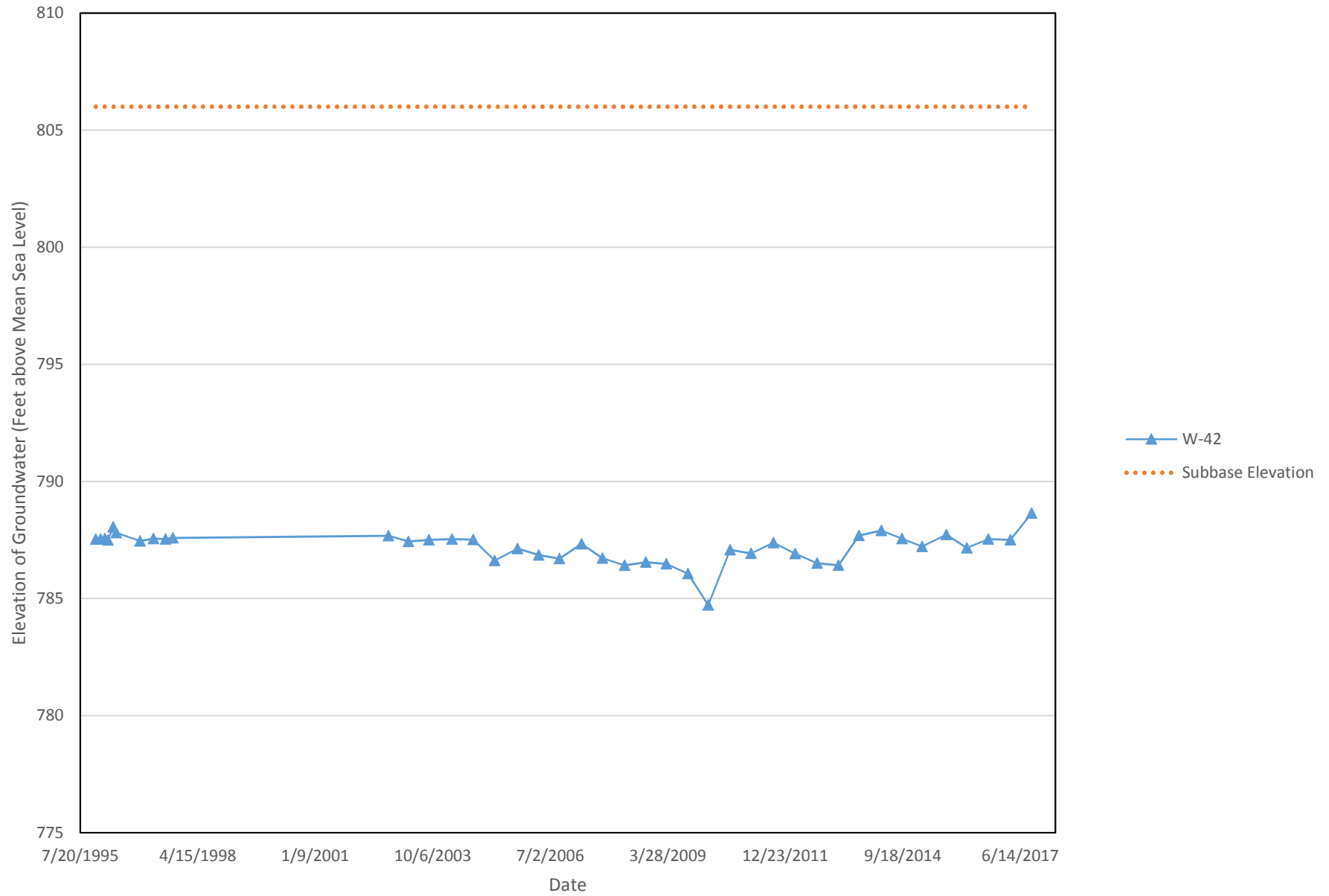
## Appendix A-1

### Groundwater Elevations (1995-2017)

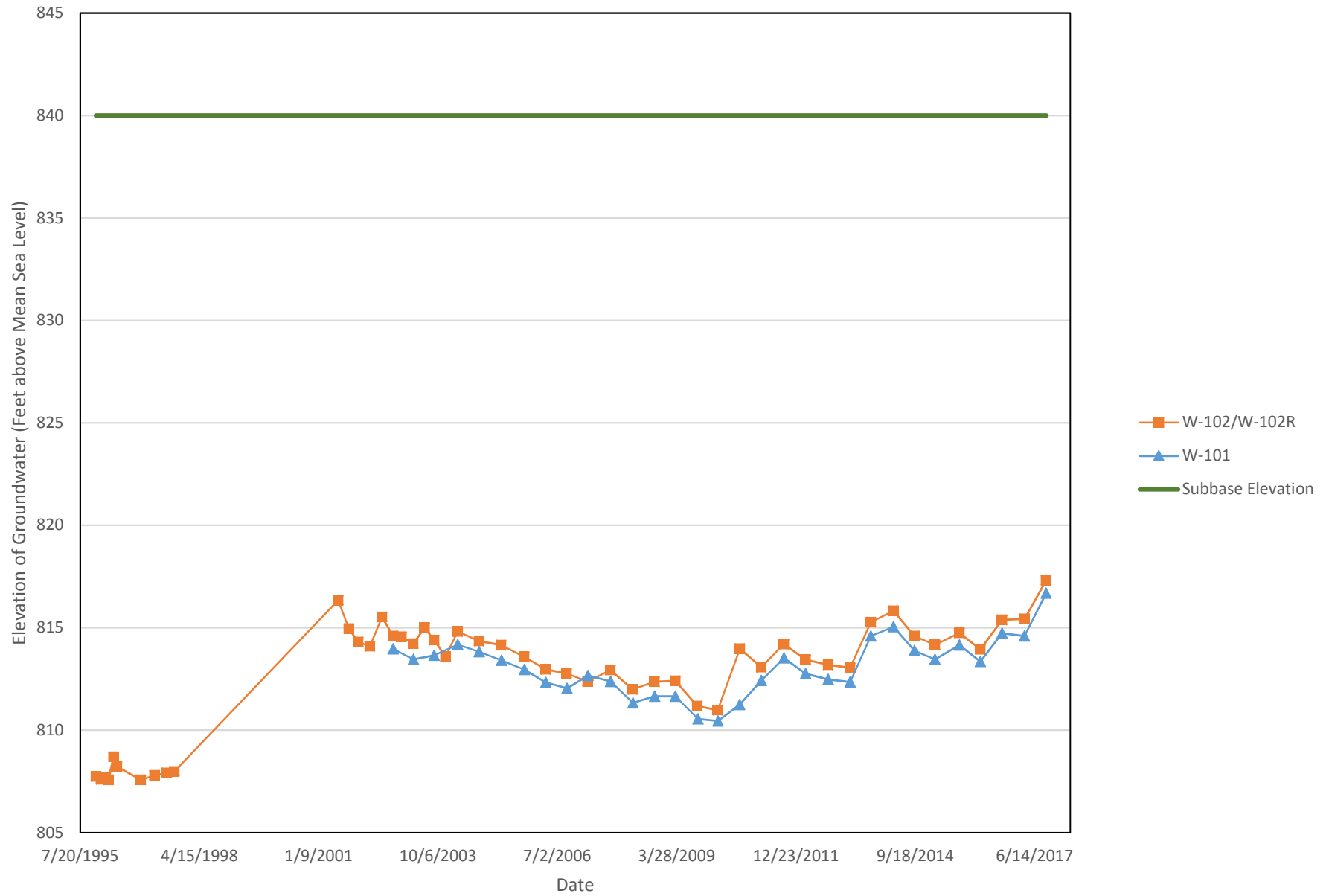
North Side of Landfill Groundwater Elevations (1995 - 2017)



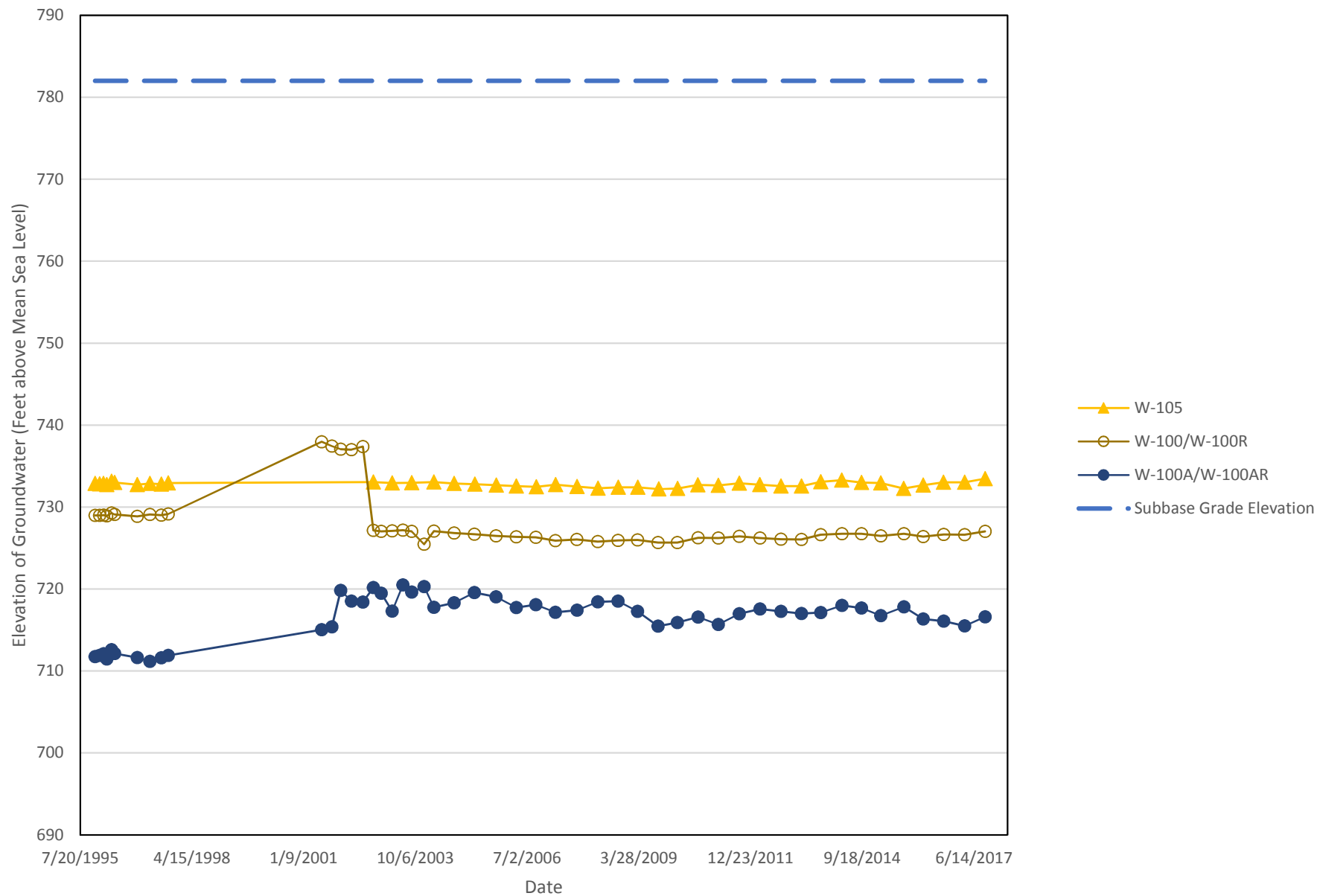
West Side of Landfill Groundwater Elevations (1995 - 2017)



East Side of Landfill Groundwater Elevations (1995 - 2017)



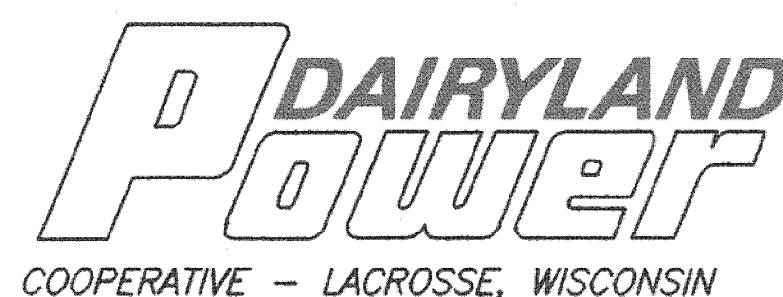
South Side of Landfill Groundwater Elevations (1995 - 2017)



## Appendix A-2

### Landfill Subbase Grades (RMT 2000)





# DAIRYLAND POWER COOPERATIVE

## PLAN OF OPERATION

### PHASE IV DISPOSAL AREA

### ALMA OFF-SITE ASH DISPOSAL FACILITY

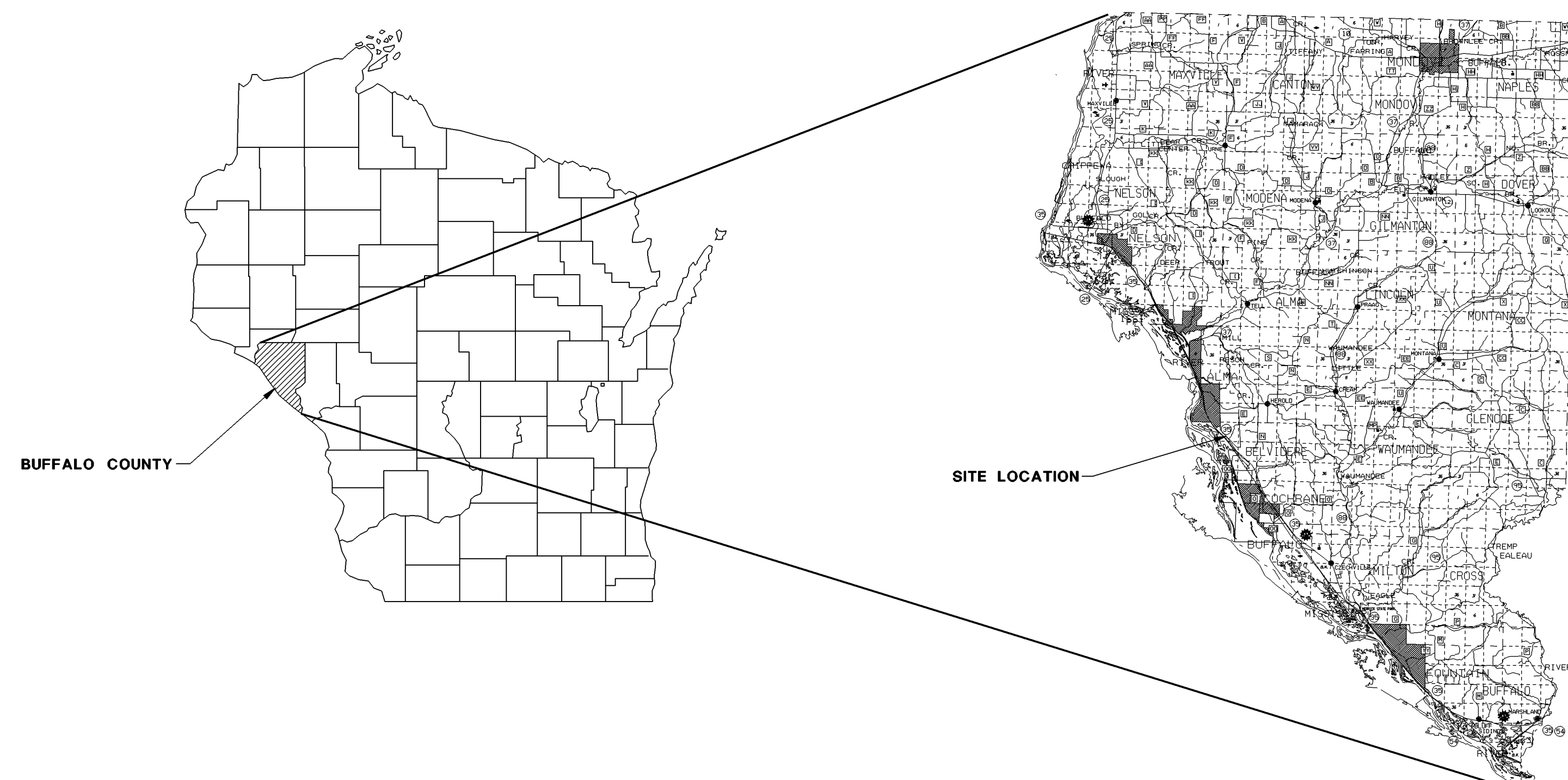
**PREPARED FOR: DAIRYLAND POWER COOPERATIVE**  
**LACROSSE, WISCONSIN**

**PREPARED BY: RMT, INC.**  
**MADISON, WISCONSIN**

**DATE: OCTOBER 2000**

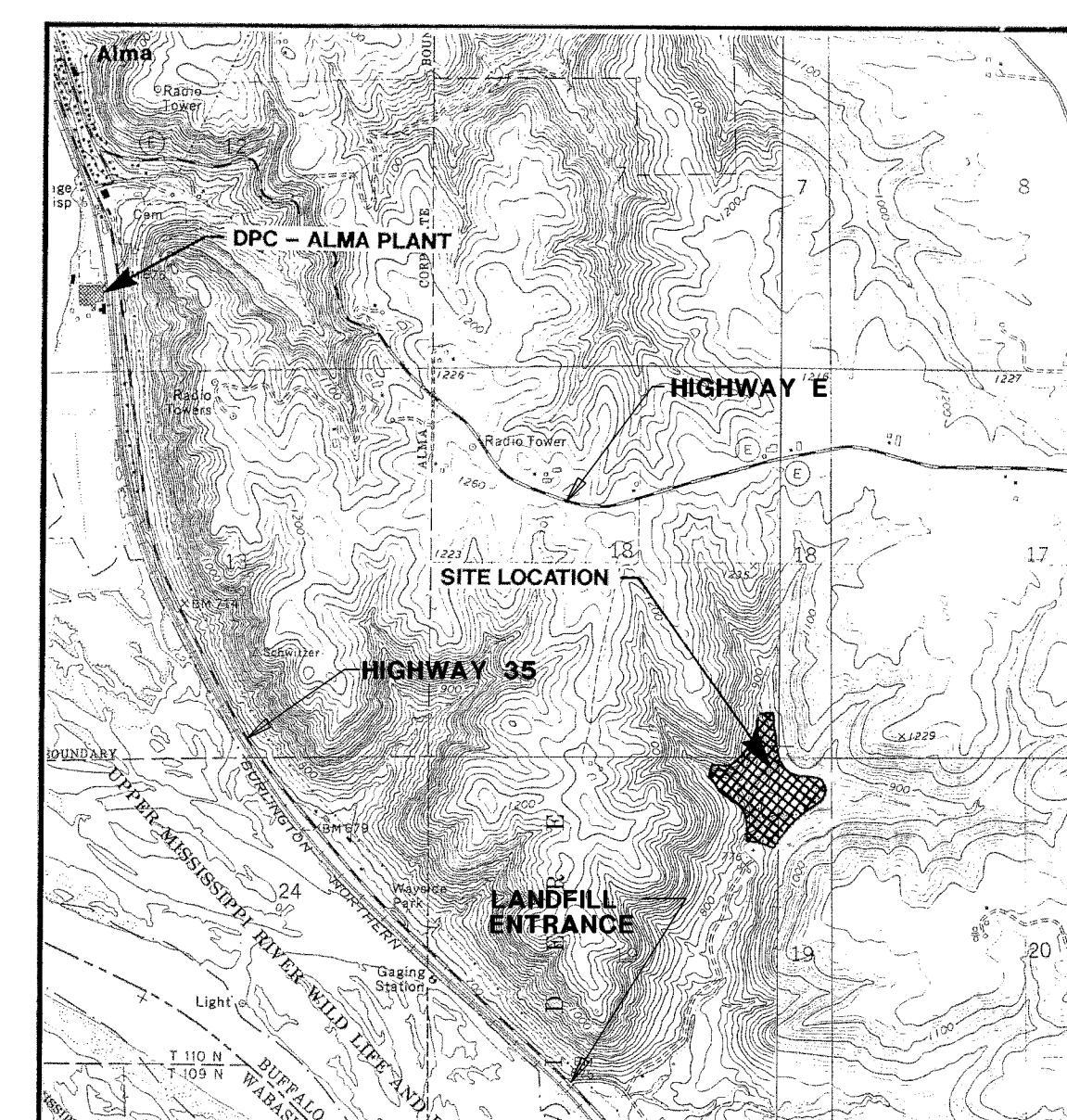
## INDEX

SHEET NUMBER	SHEET TITLE
1	TITLE SHEET/INDEX
2	STANDARD LEGEND AND NOTES
3	EXISTING CONDITIONS MAP
4	PROPOSED SUBBASE GRADES
5	PROPOSED BASE GRADES
6	PHASING PLAN- CELL 1 ACTIVE
7	PHASING PLAN- CELL 1 CLOSED CELL 2A ACTIVE
8	PHASING PLAN- CELL 1 AND 2A CLOSED CELL 2B ACTIVE
9	PHASING PLAN- CELL 1, 2A, AND 2B CLOSED CELL 3 ACTIVE
10	PHASING PLAN- CELL 1, 2A, 2B AND 3 CLOSED CELL 4A ACTIVE
11	PHASING PLAN- CELL 1, 2A, 2B, 3 AND 4A CLOSED CELL 4B ACTIVE
12	PROPOSED FINAL GRADES
13	PROPOSED ENVIRONMENTAL MONITORING PLAN
14	LONG TERM CARE PLAN
15	ENGINEERING CROSS SECTIONS 171700N AND 172200N
16	ENGINEERING CROSS SECTIONS 1477340E AND 1477710E
17	DETAILS- LINER AND COLLETION PIPES
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19	DETAILS- FINAL COVER
20	DETAILS- DOWNSLOPE FLUMES
21	DETAILS- DOWNSLOPE FLUMES
22	DETAILS- SEDIMENTATION BASINS
23	DETAILS- MISCELLANEOUS



WISCONSIN

BUFFALO COUNTY



SCALE: 1"=2000'

MAP SOURCE: U.S.G.S. CREAM AND ALMA 7.5' QUADRANGLES, DATE 1974.

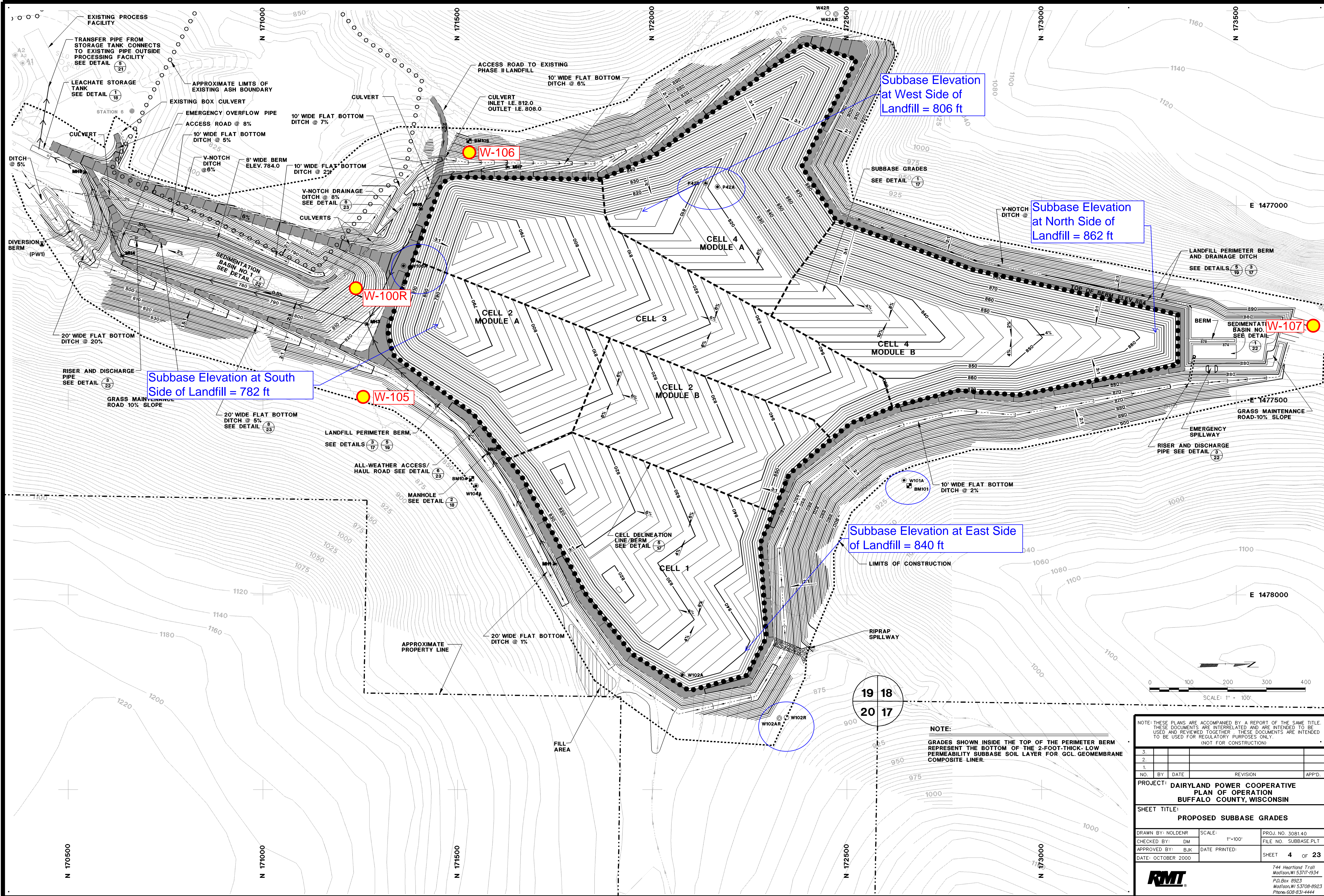
SITE LOCATION

NOTE: THESE PLANS ARE ACCOMPANIED BY A REPORT OF THE  
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ARE INTENDED TO BE USED AND REVIEWED TOGETHER.  
(NOT FOR CONSTRUCTION)



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Madison, WI 53717-1934  
P.O. Box 8923  
Madison, WI 53708-8923  
Phone: 608-831-4444





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

PROJECT: DAIRYLAND POWER COOPERATIVE  
PLAN OF OPERATION  
BUFFALO COUNTY, WISCONSIN

SHEET TITLE:  
**PROPOSED SUBBASE GRADES**

DRAWN BY: NOLDENR	SCALE:	PROJ. NO. 308140
CHECKED BY: BH	1"=100'	FILE NO. SUBFACE.DJT

CHECKED BY: DM	FILE NO. SUBBASE.PLT
APPROVED BY: BJK	DATE PRINTED:
DATE: OCTOBER 2000	SHEET <b>4</b> OF <b>23</b>

**BMT** 744 Heartland Trail  
Madison, WI 53717-1934

**NMI**<sup>®</sup> P.O. Box 8923  
Madison, WI 53708-8923  
Phone: 608-831-4444

\_\_\_\_\_

**Levels**

(1) 1,2,9  
(2) 4,6,7,9,10,12,21,23,24,26,29,32-34,39,40,43,45,54,55,57,61  
(3) 36,19  
(4) 5,8,21,22,27,29,33,34,45,57,58  
(5) 1,26,33,36  
(6) 1,8,10,11,12,14,15,17,57,58  
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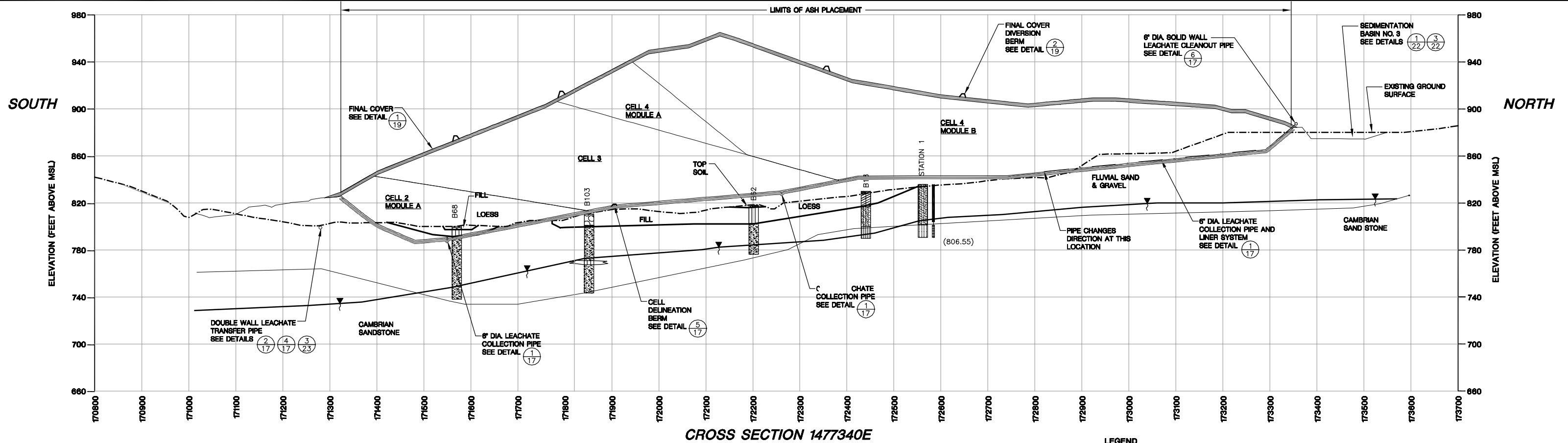
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**Pilot Data**

RMT COMPUTER AIDED DESIGN &amp; DRAFTING







#### LEGEND

- |  |   |  |   |
|--|---|--|---|
|  | PROPOSED FINAL COVER/BASE LINER                               |  | EXISTING GROUND SURFACE                       |
|  | 6\" DIA. PERFORATED GRADIENT CONTROL/LEACHATE COLLECTION PIPE |  | WATER TABLE LINE                              |
|  | APPROXIMATE DIVERSION BERM LOCATION                           |  | STRATIGRAPHIC BOUNDARY, DASHED WHERE INFERRED |
|  | MAIN GRADIENT CONTROL TRANSFER PIPE (745.03)                  |  |   |
|  | WATER TABLE OR PIEZOMETRIC ELEVATION                          |  |   |
|  | UNIT B AND C BOUNDARY   |  |   |
|  | B61 BORING OR WELL NUMBER                                     |  |   |

#### NOTES

- EXISTING GROUND SURFACE TAKEN FROM PLAN SHEET 3.
- ELEVATION REFERENCED TO USGS MEAN SEA LEVEL (MSL) DATUM, 1929.
- GROUNDWATER ELEVATIONS BASED ON MEASUREMENTS OBTAINED BY DPC ON APRIL 26, 1996.
- THE STRATUM LINES ARE BASED ON INTERPOLATION BETWEEN BORINGS AND ON INFORMATION CONTAINED IN THE HIGHWATER TABLE CONTOUR MAP (PLAN SHEET 12) AND THE TOP OF COMPETENT BEDROCK CONTOUR MAP (PLAN SHEET 13) IN THE FEASIBILITY REPORT, AND ON THE BOTTOM OF LOESS EXISTING CONDITIONS (FIGURE 2) SHEET INCLUDED IN THE APRIL 30, 1999, SUPPLEMENTAL INFORMATION TO SUPPORT FEASIBILITY DETERMINATION. ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS MAY VARY. CORRELATIONS ARE SHOWN IN MORE DETAIL IN FEASIBILITY REPORT PLAN SHEETS 4-10 (RMT, SEPTEMBER 1997).
- SOIL BORINGS AND WELLS HAVE BEEN PROJECTED ONTO THE CROSS SECTION.
- SEE SHEET 4 FOR SUBBASE GRADES, SHEET 5 FOR BASE GRADES AND SHEET 12 FOR FINAL GRADES.

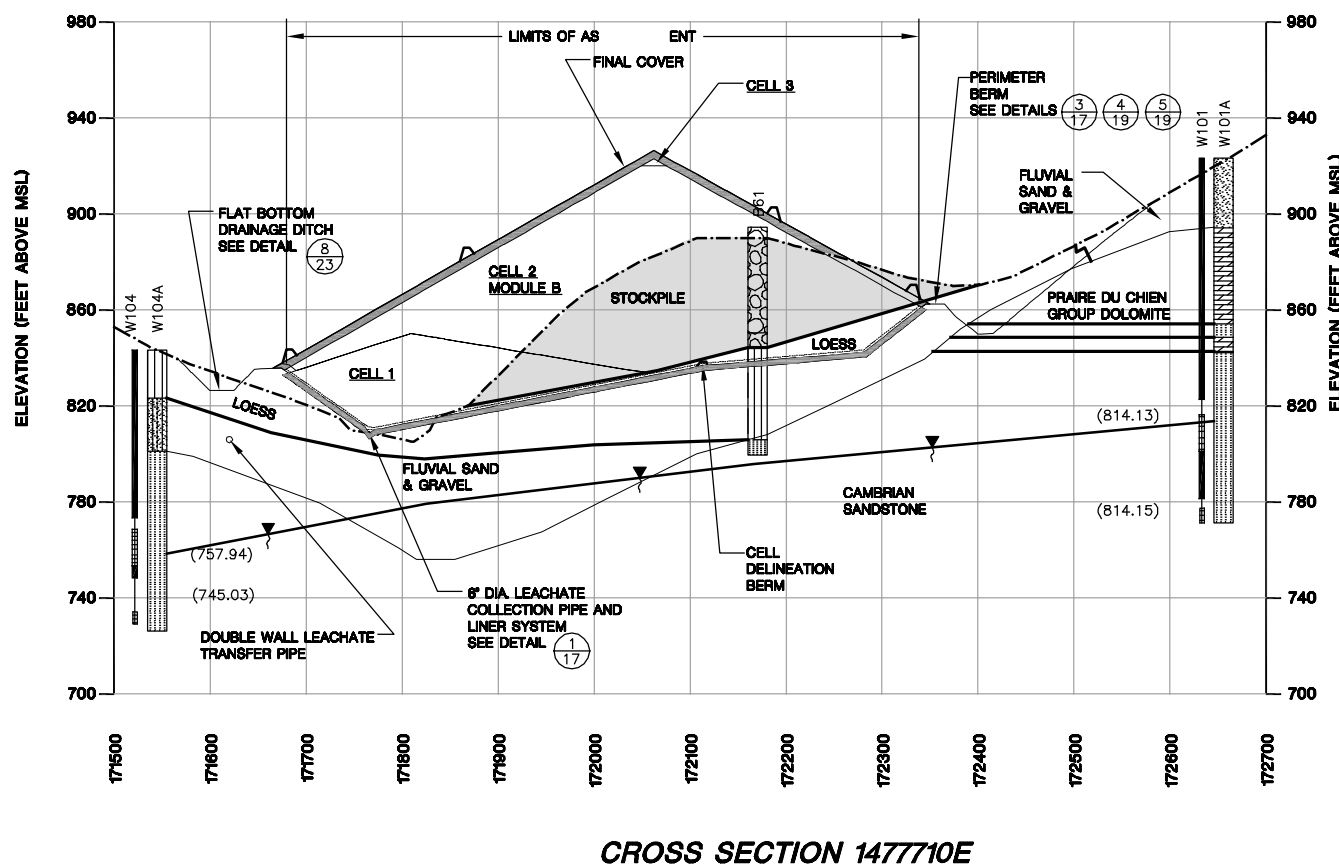
(SEE SHEET 2 FOR STANDARD NOTES AND LEGEND)

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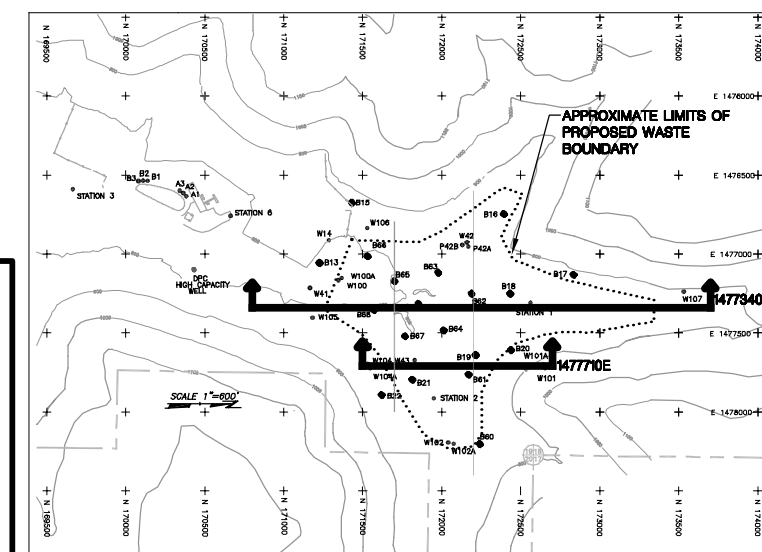
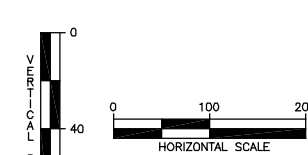
3.					
2.					
1.					
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CHECKED BY: DM		DATE PRINTED:		SHEET 16 OF 23	
APPROVED BY: BJL					
DATE: OCTOBER 2000					

744 Heartland Trail  
Madison, WI 53717-1934  
P.O. Box 8923  
Madison, WI 53708-8923  
Phone: 608/631-4444

**RMT**



VERTICAL SCALE EXAGGERATED 2.5X



CROSS SECTION LOCATOR MAP

# Appendix B

## Supporting Material for §257.61

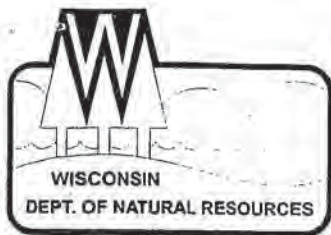
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## Appendix B-1

### Feasibility Determination (Lundberg, 1999)



## State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Tommy G. Thompson, Governor  
George E. Meyer, Secretary  
Scott A. Humrickhouse, Regional Director

West Central Region Headquarters  
1300 W. Clairemont Avenue  
PO Box 4001  
Eau Claire, Wisconsin 54702-4001  
Telephone 715-839-3700  
FAX 715-839-6076  
TDD 715-839-2786

September 10, 1999

Mr. George Johnston  
Dairyland Power Cooperative  
3200 East Avenue South, P.O. Box 817  
La Crosse, WI 54602-0817

FID# 606009360  
License #4126  
Buffalo County  
SW  
Approval

Subject: Feasibility Determination for the Proposed Dairyland Power Cooperative Phase IV Ash Disposal Facility, Town of Belvidere, Buffalo County, Wisconsin. License No. 4126

Dear Mr. Johnston:

We have determined that the proposed Phase IV disposal area, Alma Off-Site Ash Disposal Facility is feasible, subject to certain conditions; and that it should provide for satisfactory solid waste disposal. We have also determined that the Wisconsin Environmental Policy Act requirements have been met through the preparation of an Environmental Assessment. An Environmental Impact Statement is not needed for this project.

This favorable determination entitles you to submit a plan of operation, which meets the conditions set forth in the feasibility report and subsequent addenda, the attached determination and chapter NR 514, Wis. Adm. Code. This determination does not guarantee that we will approve a plan of operation, or license your proposed facility. When preparing your plan of operation, we advise you to carefully review the requirements of chs. NR 500 through 538, Wis. Adm. Codes.

Dairyland Power Cooperative requested an exemption to s. NR 504.04(3)(f), Wis. Adm. Code, for one (1) water supply well (PW-1) located downgradient and within 1,200 feet of the limits of filling for the proposed Phase IV development. This water supply well is approximately 410 feet deep and is cased to a depth of 113 feet below the ground surface. Due to its location downgradient of the proposed landfill no exemption will be granted for this well. This well must be abandoned in accordance with ch. NR 812.26, Wis. Adm. Code, prior to waste placement in the Phase IV development. If an exemption request is made to the Department outlining non-potable uses for this well which can be independently confirmed prior to waste placement in the Phase IV development, an exemption may be considered at that time.

Dairyland Power Cooperative requested an exemption to the locational criteria of s. NR 504.04(3)(f), Wis. Adm. Code, for a proposed high capacity well (PW-2). This well would be located a minimum of 250 feet from the limits of waste and situated hydraulically upgradient/sidegradient of the proposed Phase IV development. The well design would include steel casing down to an elevation of at least 650 M.S.L. which would place the bottom of casing approximately 170 feet below the top of bedrock. The remainder of the well would be constructed as an open borehole in the bedrock and would extend to between 450 and 500 feet below the ground surface. For these reasons the Department is granting this exemption to the separation distance in s. NR 812.08(4)(g)(1), and the locational criteria in s. NR 504.04(3)(f), Wis. Adm. Code.



Dairyland Power Cooperative – Off-Site Phase IV Ash Landfill  
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Dairyland Power Cooperative requested an exemption to s. NR 512.11(3), Wis. Adm. Code, regarding the submittal of a bedrock piezometric map. It has been shown that the groundwater flow direction is the same in the fluvial sand and gravel as it is in the underlying Cambrian Sandstone and the water table intersects both the unconsolidated sediment and bedrock. For these reasons the Department is granting this exemption.

Dairyland Power Cooperative requested an exemption under s. NR 140.28, Wis. Adm. Code, for a number of monitoring wells based on the background quality data. We have granted groundwater quality exemptions at specific monitoring wells where elevated concentrations of certain parameters have been detected during the four (4) rounds of background groundwater sampling. The following criteria as established in s. NR 507.18(2)(b), Wis. Adm. Code, were used to determine if granting groundwater quality exemptions were appropriate:

1. Any of the values from the background sampling exceed a parameter's enforcement standard (ES), or
2. Two or more of the values exceed a parameter's preventive action limit (PAL), or
3. The average of a parameter's value is greater than the PAL.

Landfill owners must perform baseline groundwater monitoring in accordance with s. NR 507.18, Wis. Adm. Code and report any exceedances to Wisconsin's groundwater standards. At sixteen (16) different monitoring locations the groundwater data indicated elevated concentrations above the ch. NR 140, Wis. Adm. Code, groundwater standards for the parameters listed in ch. NR 507, Table 3. We have granted exemptions to the State's groundwater quality standards for specific monitoring wells where elevated concentrations of certain parameters have been detected. Alternate concentration limits (ACLs) will need to be established in accordance with s. NR 705.29 for these wells and parameters. To determine what these ACLs shall be, this approval requires that more baseline data be collected in order to have at least eight (8) rounds of data for the calculations. Elevated concentrations of sulfate at Sta. 6 are related to filling and housekeeping activities of the now closed Phase II area. The Department will grant an exemption to the groundwater standard for sulfate at Sta. 6 for the proposed Phase IV development and allow an ACL to be calculated. However, no calculated ACL for sulfate may be applied to existing landfill phases 1, 2, and 3 (license number 2927, FID number 606009360). Dairyland Power Cooperative must continue to monitor the sulfate concentrations at this well location.

Dairyland Power Cooperative requested an exemption to s. NR 507.21, Wis. Adm. Code, for leachate quality monitoring since the leachate will be disposed at the Dairyland Power Cooperative waste water treatment plant in Alma, Wisconsin. Leachate analytical data provides pertinent information regarding conditions within the landfill. Further, in your October 7, 1998, "Additional Information requested for Feasibility Determination" report was a letter dated September 24, 1998 from the alternate leachate disposal facility – La Crosse Wastewater Utility. In this letter, the La Crosse Wastewater Utility specified that they be routinely provided with leachate analytical data. Therefore, an exemption for leachate quality monitoring will not be granted.

Dairyland Power Cooperative requested an exemption to s. NR 512.15(2)(b), Wis. Adm. Code, for the number of samples analyzed from each clay borrow source test pit. Due to the relatively thin nature of the clay deposit at the on-site borrow source, only one sample was collected and analyzed from most of the test pits. This clay will not be needed if the proposal for a geosynthetic clay liner (GCL) is approved for the liner and cover. For these reasons the Department is granting this exemption.



Dairyland Power Cooperative – Off-Site Phase IV Ash Landfill  
Feasibility Determination  
09/10/99

The proposed Phase IV development will be situated within a valley at the juncture of four surface water drainage ways. The bluff top land surrounding this landfill location is approximately 450 feet above the valley. In a heavy precipitation storm event, the amount and velocity of run-off water flowing from the uplands down into this valley can become quite significant. The landfill owner should be aware a potential exists for high velocity water flows from the higher elevations to erode and/or washout surface water controls during the different phases of construction. It will be imperative that the surface water structures are assessed and repaired, if necessary, as quickly as possible following any heavy storms.

If you have any questions regarding this determination, please contact Mark Stephenson, Hydrogeologist at (608) 785-9983; Marty Herrick, Environmental Engineer, at (608) 789-5518; or Jack Tritt, Waste Management Specialist from our Eau Claire office at (715) 839-3768.

Sincerely,



David R. Lundberg  
Waste Management Team Leader  
West Central Region

cc: Mark A. Osten, RMT Inc., 744 Heartland Trail, P.O. Box 8923, Madison, WI 53708-8923  
Paul Huebner – WA/3  
Dennis Mack – WA/3  
Chuck Leveque – LC/5  
Mark Stephenson – La Crosse  
Marty Herrick – La Crosse  
Jack Tritt – WCR  
Jack Connelly/Bureau File – WA/3  
Jim Pardee – EA/6  
Patti Cronin – Waste Facility Siting Board  
Sandra Ebert – Buffalo County Clerk, P.O. Box 58, Alma, WI 54610  
Lyle Hofer – Town of Belvidere Clerk, P.O. Box 216, Cochrane, WI 54622  
Nathan D. Sampson – Zoning Administrator, P.O. Box 492, Alma, WI 54610-0492

## PROJECT SUMMARY GENERAL SITE INFORMATION

Proposed Facility Name: Dairyland Power Cooperative Phase IV Ash Disposal Area

Authorized Contact: Mr. George Johnston  
Dairyland Power Cooperative  
P.O. Box 817  
3200 East Avenue South  
La Crosse, Wisconsin 54601  
(608) 787-1322

Site Location and Area: Dairyland Power Cooperative (DPC) is proposing to site and develop a noncontiguous coal ash disposal area (Phase IV) at their existing Alma off-site disposal facility. This disposal facility would be located in the NE1/4 of the NE1/4 of Section 19 and portions of Section 18 and 20, Township 21 North, Range 12 West, Town of Belvidere, Buffalo County, Wisconsin. The proposed limits of filling would cover 32.1 acres within a parcel of 1,113 acres owned by DPC. The proposed site is located adjacent, but not connected to, DPC's current off-site ash disposal facility. The site is located approximately 4,000 ft. east of State Trunk Highway (STH) "35" and 3,200 ft. south of County Road "E". The area surrounding the proposed disposal site is generally sparsely populated agricultural land. Access to the facility is along a private entrance road from STH 35.

One water supply well is located within 1200 feet of the proposed limits of fill. This well would be abandoned prior to waste placement in the Phase IV development.

Proposed Capacity and Site Life: The proposed Phase IV disposal area has a design capacity of approximately 3,011,000 cubic yards. The estimated site life is 13.9 years but may be influenced by the demand for both fly ash and bottom ash as beneficial reuse materials.

Proposed Service Area, Waste Types and Leachate Characteristics: The proposed site will be owned and operated as a private industrial solid waste disposal facility. Waste disposal will, for the most part, be limited to fly ash and bottom ash from the burning of coal. This material will be produced at the Alma Units 1 – 5, the John P. Madgett (JPM), and the Genoa Station No.3 generating facilities owned and operated by DPC. A small quantity (less than 1% of the total waste stream) of asbestos from power plant renovations and waste water treatment plant sludge from DPC's Alma power generating station will also be disposed at this site. The chemical characteristics of the leachate produced within the site are expected to be the same as for the existing Phase III.

Present Land Use and Zoning: DPC is currently using a portion of their property for coal ash disposal operations in Phases I through III. Phases I, II, and III are located 1,000 feet, 100 feet, and 1,400 feet respectively to the south/southwest of the proposed landfill footprint. Phase I was closed in 1993. Phase II was closed in October 1997. Phase III is approximately 7 acres in size and depending on ash generation rates and anticipated beneficial reuse demands, is expected to reach capacity by the year 2004. The 1,113 acre parcel is zoned as an agricultural district as is the surrounding land.



Topography and Hydrology: The site is located within the Mississippi River drainage basin in a valley, at the juncture of four surface water drainage-ways. The lower (southern) end of the valley is currently being used for ash disposal under previous approvals. The bluff top land surrounding this site is primarily used for agricultural purposes and extends roughly 450 feet above the valley floor where the landfill would be situated.

Ephemeral waterways, which flow only in direct response to precipitation, route surface water from the uplands and steep slopes into the central valley. These waters then flow through ditches and culverts toward the Mississippi River located approximately 1 mile south. The nearest wetlands are located approximately 1 mile south of the proposed site along the Mississippi River.

Regional and Site Specific Geology: The surficial soil at the proposed site generally consists of a sand and silty sand with lenses of gravel. Additionally, several borings contained layers of finer grained soil including silt and clay ranging from a few feet to as much as 40 feet in thickness. The sandy soil typically extends to bedrock at depths ranging from 15 to 60 feet below the existing ground surface. The sandy soil is primarily the result of fluvial deposition; however, some of the sand near the bedrock surface appears to be the result of *in situ* weathering of the sandstone bedrock.

Bedrock in the area is composed of the Prairie du Chien Group Dolomite, which acts as a cap rock overlying Cambrian Sandstone. In the proposed landfill footprint, however, the Prairie du Chien has been removed by erosion.

Cambrian Sandstone underlies the unconsolidated sediment in the landfill footprint. This bedrock type is fine-grained with interbedded lenses of dark brown sandstone and calcareous, shaley partings. The bedrock surface mimics the surface topography only at higher relief. The top of bedrock is substantially deeper in the central portion of the landfill footprint than along the valley slope area.

Hydrogeology: The groundwater table beneath the site is present both within the unconsolidated sandy sediment and within the sandstone bedrock. The overlying sand and gravel aquifer is hydraulically connected to the sandstone bedrock. The depth to groundwater varies from 27.5 feet in the northeastern portion of the site to 110 feet below ground surface on the northern end of the site. The minimum separation between the proposed subbase grades and the high water table is approximately 30 feet. Groundwater flows into the central portion of the valley and then toward the Mississippi River approximately 1 mile south/southwest of the site.

The *in situ* hydraulic conductivity of the fluvial sand and gravel across the site ranges from  $5.3 \times 10^{-3}$  to  $2.8 \times 10^{-4}$  cm/sec. The geometric mean horizontal hydraulic conductivity in this unit is approximately  $1.4 \times 10^{-3}$  cm/sec. The *in situ* hydraulic conductivity in the Cambrian Sandstone ranged from  $2.5 \times 10^{-5}$  to  $1.0 \times 10^{-2}$  cm/sec. The geometric mean horizontal hydraulic conductivity within the geologic unit is  $1.1 \times 10^{-3}$  cm/sec.

Baseline groundwater quality results, for indicator parameters and public health and welfare parameters for the proposed site were provided as part of the feasibility report. In one or more wells installed at the site the concentrations of lead, manganese, nitrogen (nitrate + nitrite), selenium and sulfate attained or exceeded the preventive action limit (PAL) or enforcement standard (ES) established in ch. NR 140, Wis. Adm. Code. The Department is granting an exemption under s. NR 140.28, Wis. Adm. Code for the baseline exceedances of the parameters



listed above at these monitoring wells. Calculations of PAL's for detection parameters and alternative concentration limits (ACLs) for wells granted exemptions to the groundwater standards, should be prepared in accordance with chs. NR 507.27 and NR 507.29, Wis. Adm. Code. As part of the plan of operation, Dairyland Power Cooperative should propose PALs for detection monitoring parameters and ACLs for the parameters granted exemption to the groundwater standards.

Proposed Design: The proposed Phase IV ash disposal facility would be developed in 4 phases with filling beginning in a 6 acre tract along the east central portion of the site and generally progressing westward. The proposed area of ash disposal would cover approximately 32 acres and provide 3,011,000 cubic yards of design capacity.

The proposed surface water control system is designed for a 100-year, 24-hour storm event. Surface water control will include the phased construction beginning prior to landfill construction of the permanent surface water controls around the site perimeter supplemented with temporary surface water controls where necessary.

The proposed design would include a geosynthetic clay liner (GCL) installed over a 2-foot thick, low permeability subbase and overlain by a 60-mil high density polyethylene (HDPE) geomembrane. The low permeability subbase soil would come from on-site material excavated within the Phase IV footprint.

An alternate liner design was included in the feasibility report. This alternate design included a 4-foot thick compacted clay liner in lieu of the GCL. The HDPE geomembrane would be installed over the clay liner and tested in accordance with ss. NR 504.06 (2) (a) and (f), Wis. Adm. Code.

Regardless of which liner type is installed, a leachate collection system would be constructed in an overlying coarse-grained drainage layer material. Leachate that would accumulate in a collection tank would be recycled for the purpose of sluicing ash waste into the disposal area. Excess leachate will be trucked to Dairyland Power's own wastewater treatment plant at the Alma, Wisconsin generation station or to the alternate treatment plant (La Crosse Wastewater Utility) in the City of La Crosse, Wisconsin. This landfill would not be classified as a zone of saturation landfill because the minimum separation between the subbase grades and the high water table is approximately 30 feet.

Final cover would consist of a 6-inch soil grading layer over the ash, followed by a GCL, a 40-mil very flexible polyethylene (VFPE) geomembrane, a 1-foot sand drainage layer, a 1-foot general soil cover layer and a 6-inch topsoil layer. Final grades are designed at a maximum of 4H:1V slope

An alternate final cover design was also included in the feasibility report. This alternate design consists of a 2-foot thick compacted clay layer in lieu of the grading layer, GCL and geomembrane in accordance with NR 504.07, Wis. Adm. Code. A 2.5-foot thick general soil cover layer would be placed over the clay followed by a 6-inch thick layer of topsoil.

The ash to be disposed at this site is biologically inert; thus, a gas management system was not included in the project design.

The planned final use for the Phase IV ash disposal area will be as open green space.

Environmental Monitoring: The proposed ash landfill would include an environmental monitoring program to measure groundwater levels and quality, surface water quality and leachate quantity and quality. Samples would be taken semi-annually from groundwater monitoring wells installed at various depths and locations around the site. Leachate head wells and the leachate collection tank will also be monitored on a regular basis. All environmental monitoring data including groundwater, leachate quality and leachate head measurements and surface water monitoring would be reported to the Department electronically on diskettes.

Groundwater analysis would include those parameters specified in NR 507, Appendix 1, Table 2, Wis. Adm. Code. Leachate analysis would include those parameters specified in NR 507, Appendix 1, Table 4, Wis. Adm. Code.



BEFORE THE STATE OF WISCONSIN  
DEPARTMENT OF NATURAL RESOURCES

DETERMINATION OF SITE FEASIBILITY  
DAIRYLAND POWER COOPERATIVE  
PHASE IV ASH DISPOSAL FACILITY  
TOWN OF BELVIDERE, BUFFALO COUNTY, WISCONSIN  
WDNR LICENSE # 4126

FINDINGS OF FACT

The Department finds that:

- 1) Dairyland Power Cooperative (DPC) has proposed to construct and operate an ash disposal landfill in the NE1/4 of the NE1/4 of Section 19 and portions of Sections 18 and 20, Township 21 North, Range 12 West, Town of Belvidere, Buffalo County, Wisconsin.
- 2) The proposed ash disposal facility is intended to serve the needs of DPC as a private industrial solid waste disposal facility. Waste disposal at this site will consist of fly and bottom ash which is produced at the Alma Units 1 – 5, the John P. Madgett (JPM), and the Genoa Station No. 3 (G-3) power generation facilities owned and operated by DPC.
- 3) The proposed ash disposal landfill would have a design capacity of 3,011,000 cubic yards with an approximate operational life of 13.9 years.
- 4) The Department made an initial site inspection of the proposed site on August 24, 1994.
- 5) On April 25, 1995, the Department received an Initial Site Report (ISR) dated April 1995, and submitted by RMT, Inc., on behalf of DPC.
- 6) On July 17, 1995, the Department determined that the ISR was complete and issued an opinion that the proposed site may have potential for development as an industrial solid waste disposal facility.
- 7) The Department considered the following documents in its review of the feasibility of the proposed ash disposal landfill:
  - (a) A Feasibility Report, dated September 19, 1997, and received by the Department on September 19, 1997, prepared by RMT, Inc., on behalf of DPC.
  - (b) A DPC Feasibility Report Clarification dated November 25, 1997, and received by the Department on November 26, 1997, prepared by RMT, Inc., on behalf of DPC.
  - (c) A Feasibility Report Addendum – Geotechnical Testing Results dated December 15, 1997, and received by the Department on December 16, 1997, prepared by RMT, Inc., on behalf of DPC.

- (d) An Additional Information Requested for Feasibility Determination report dated October 7, 1998, and received by the Department on October 8, 1998, prepared by RMT, Inc., on behalf of DPC.
  - (e) A Supplemental Information to Support Feasibility Determination report dated April 30, 1999 and received by the Department on May 3, 1999, prepared by RMT, Inc., on behalf of DPC.
  - (f) A Request for Approval of High Capacity Well Location report dated August 19, 1999, and received by the Department on August 20, 1999, prepared by RMT, Inc., on behalf of DPC.
- 8) The Feasibility Report review fee of \$20,000 was received by the Department on October 28, 1997.
  - 9) On June 22, 1998, the Department determined that the Feasibility Report was complete; however, additional information was requested to aid in the feasibility determination.
  - 10) On January 5, 1999 and January 27, 1999, the Department requested additional information to aid in the feasibility determination.
  - 11) A public notice under s. 289.25 (3) Stats., was published in The Buffalo County Journal on July 2, 1998. The Department did not receive any responses to the public notice.
  - 12) The proposed landfill expansion would not be located within:
    - (a) 1,000 feet of any navigable lake, pond, or flowage;
    - (b) 300 feet of a navigable river or stream;
    - (c) a floodplain;
    - (d) 1,000 feet of the nearest edge of the right-of-way of any state trunk highway, interstate, federal aid primary highway, or the boundary of any public park;
    - (e) 10,000 feet of any airport runway end used or planned to be used by turbojet aircraft or within 5,000 feet of any airport runway end used by piston type aircraft or within an area where the design or operation of the landfill would pose a significant bird hazard to aircraft;
    - (f) within 200 feet of a fault that has had displacement in Holocene time;
    - (g) within a seismic impact zone; or
    - (h) within an unstable area.
  - 13) The proposed limits of fill of the ash disposal landfill would be located within 1,200 feet of the DPC high-capacity water supply well (PW-1) for which an exemption to s. NR 504.04 (3) (f), Wis. Adm. Code, was requested. The Department has determined that the exemption is



not warranted and that this well must be abandoned prior to waste placement in the Phase IV disposal area.

- 14) A new well (PW-2) is proposed for construction and would be located a minimum of 250 feet hydraulically upgradient/sidegradient to the Phase IV disposal area. An exemption to s. NR 504.04 (3) (f), Wis. Adm. Code is requested for this well. The Department has determined that the exemption is warranted because of the proposed design and location.
- 15) The proposed ash disposal landfill, if designed, constructed, and operated in accordance with the feasibility report and the conditions set forth below, would not be within an area where there is a reasonable probability that the facility will cause:
  - (a) a significant adverse impact on wetlands as provided in ch. NR 103, Wis. Adm. Code;
  - (b) a significant adverse impact on critical habitat areas;
  - (c) a detrimental effect on any surface water;
  - (d) a detrimental effect on groundwater quality;
  - (e) the migration of explosive concentrations of gases in any facility structure or in the soil or air beyond the facility boundary; or
  - (f) the emission of any hazardous air contaminants in excess of standards contained in s. NR 445.03, Wis. Adm. Code.
- 16) The Department considered the following information while reviewing the need for exemptions to groundwater standards at this facility:
  - (a) baseline groundwater monitoring data provided in the Feasibility Report and Addenda to the Feasibility Report;
  - (b) well construction details and boring logs provided in the Feasibility Report;
  - (c) well location plan sheets and water table maps provided in the Feasibility Report and Addenda to the Feasibility Report;
  - (d) the landfill design specifications provided in the Feasibility Report and Addenda to the Feasibility Report as conditioned herein.
- 17) Based on an examination of site conditions, the Department finds the following:
  - (a) Groundwater concentrations of arsenic, lead, manganese, nitrogen (nitrate + nitrite), selenium, silver and sulfate at the site area are found at concentrations exceeding the ch. NR 140, Wis. Adm. Code, groundwater standards. These exceedances are due to baseline groundwater quality associated with natural hydrogeologic conditions or substances released by other human activities on, or near, the proposed facility.



- (b) The elevated concentrations of sulfate at Station 6 reflects groundwater quality related to the Phase II ash disposal area.

18) Based on an examination of the groundwater quality data for the proposed facility for substances of public health concern, and the information listed in Findings of Fact 16 and 17, the Department finds the following:

- (a) Mean baseline concentrations above the preventive action limit (PAL) but below the enforcement standard (ES) established for the following substances of public health concern were observed in groundwater samples from the monitoring wells listed below:

<u>SUBSTANCE</u>	<u>WELL NUMBER</u>
lead	W-100A, W-101
nitrogen (nitrate + nitrite)	W-100, W-100A, W-107
selenium	Sta. 6, W-100, W-100A, W-102A, W-104A

- (b) The mean concentration of samples analyzed for arsenic in well W-107 does not attain the PAL established in NR 140, Wis. Adm. Code.
- (c) The mean concentration of samples analyzed for manganese in monitoring wells W-42, W-100A, W-104A, and W-107 do not attain the PAL established in NR 140, Wis. Adm. Code. Therefore, the requested exemption to the groundwater standard for manganese is not necessary.
- (d) The concentration of silver in the duplicate sample obtained from Station 1, on February 14, 1996, was not detected in the regular sample obtained from Station 1, on the same date and was not detected more than once during the sampling period. Therefore, an exemption to the groundwater standard for this well is not necessary.
- (e) The proposed facility will not cause the concentration of lead, nitrogen (nitrate + nitrite) and selenium to exceed the ES for these substances at a point of standards application because of the landfill design.
- (f) The proposed facility is designed to achieve the lowest possible concentrations for lead, nitrogen (nitrate + nitrite) and selenium which are technically and economically feasible.

19) Based on an examination of the groundwater quality data for the proposed facility for substances of public welfare concern and Findings of Fact 16 and 17 above, the Department finds the following:

- (a) Mean baseline concentrations above the ES established for the following substance of public welfare concern was observed in groundwater samples from the monitoring well listed below:

<u>SUBSTANCE</u>	<u>WELL NUMBER</u>
sulfate	Sta. 6

- (b) The proposed facility is designed to achieve the lowest possible concentration of sulfate, which is technically and economically feasible.
  - (c) The anticipated increase in the concentration of sulfate does not present a threat to public health or welfare because of the landfill design.
- 20) Granting the exemptions that are set forth below will not inhibit compliance with the Wisconsin solid waste management standards in chs. NR 500 through 538, Wis. Adm. Code.
- 21) Neither the applicant, nor any person owning a 10% or greater legal or equitable interest in the applicant or in the assets of the applicant:
- (a) is in noncompliance with a plan approval or order issued by the Department for a solid or hazardous waste facility in Wisconsin;
  - (b) owns or previously owned a 10% or greater legal or equitable interest in a person, or in the assets of a person, who is not in compliance with a plan approval or order issued by the Department for a solid or hazardous waste facility in Wisconsin.
- 22) The Department has complied with the requirements of chs. NR 150, Wis. Adm. Code, and s. 1.11, Stats., and has adopted all practical means to avoid or minimize environmental harm consistent with social, economic and other essential considerations.
- 23) The special conditions set forth below are needed to assure that the facility will not pose a substantial hazard to public health or welfare.

#### CONCLUSIONS OF LAW

1. The proposal will comply with the applicable requirements of chs. NR 500 through 538, Wis. Adm. Code, provided that the conditions of the feasibility determination set forth below are met.
2. The procedural requirements of ss. 1.11 and 289.21 to 289.29, Stats., have been complied with.
3. The Department has the authority to determine that a site is feasible with special conditions, if the conditions are needed to ensure compliance with chs. NR 500 through 538, Wis. Adm. Code.
4. The Department has the authority to deny a landfill design that does not meet the requirements of s. NR 140.28 and s. NR 504.06 (1), Wis. Adm. Code.
5. The Department has the authority under s. NR 140.28, Wis. Adm. Code, and ss. 160.19 (8) and (9), Stats., to grant exemptions to the groundwater standards for lead, nitrogen (nitrate + nitrite), selenium and sulfate.



6. The Department has the authority under s. NR 504.04 (2), Wis. Adm. Code, to grant exemptions to the location criterion of s. NR 504.04 (3) (f), Wis. Adm. Code, regarding the siting of a solid waste land disposal facility within 1,200 feet of any private water supply well.
7. The Department has the authority under s. NR 812.43 (1), Wis. Adm. Code, to grant variances to the location criterion of s. NR 812.08 (4) (g) (1), Wis. Adm. Code, regarding private water supply wells located within 1,200 feet of a proposed landfill.
8. As provided for under s. 289.28 (1), Stats., sufficient need for the proposed ash disposal facility has been established.
9. In accordance with the foregoing, the Department has the authority under s. 289, Stats., to issue the following grant of exemptions, determination of need and design capacity, and conditional feasibility determination.

#### GRANT OF EXEMPTIONS

1. Dairyland Power Cooperative (DPC) has demonstrated circumstances which warrant an exemption to the groundwater standards for lead, nitrogen (nitrate + nitrite), selenium and sulfate in ch. NR 140, Wis. Adm. Code as specified in s. NR 140.28, Wis. Adm. Code. Therefore, the Department grants an exemption to allow the landfill expansion to be developed in an area where a preventive action limit or enforcement standard has been attained or exceeded. Exemptions are, therefore, granted for these parameters and the wells listed in Findings of Facts 18 and 19. DPC must establish alternative concentration limits (ACLs) for the wells and substances listed in Findings of Facts 18 and 19 when sufficient rounds of baseline groundwater quality samples have been collected. These alternative concentration limit calculations must be presented to the Department for approval prior to waste placement in the Phase IV ash disposal area. The sulfate concentration found in Sta. 6 is related to filling activities associated with the now close Phase II area. An ACL may be calculated and applied for sulfate concentrations at Sta. 6 associated only with the proposed Phase IV development. The calculated ACL for Sta. 6 may not be applied to the other ash disposal landfills (Phases I, II, or III, License No. 2927, FID No. 606009360) at the Alma, Wisconsin off-site facility.
2. Dairyland Power Cooperative has demonstrated circumstances which warrant an exemption from s. NR 504.04 (3) (f), Wis. Adm. Code and a variance from s. NR 812.08 (4) (g) (1), Wis. Adm. Code, to allow construction of a solid waste landfill where the proposed limits of filling are within 1,200 feet of any private water supply well. An exemption is hereby granted for the proposed well (PW-2) provided that the conditions set forth in the August 27, 1999 variance approval letter from the Department of Natural Resources, Bureau of Drinking Water and Groundwater are met.
3. Dairyland Power Cooperative has demonstrated circumstances which warrant an exemption from s. NR 512.11 (3), Wis. Adm. Code, regarding the submittal of a bedrock piezometric map. An exemption is hereby granted.



4. Dairyland Power Cooperative has demonstrated circumstances which warrant an exemption from s. NR 512.15 (2) (b), Wis. Adm. Code, for the number of samples analyzed from each clay borrow source test pit. An exemption is hereby granted.

#### DETERMINATION OF NEED AND DESIGN CAPACITY

The Department hereby determines as follows:

1. There is sufficient need within the anticipated service area for the proposed Dairyland Power Cooperative, Phase IV Ash Disposal Area in the Town of Belvidere, Buffalo County, Wisconsin.
2. A design capacity of 3,011,000 cubic yards for the proposed Phase IV Ash Disposal Facility will provide for an expected operational life of approximately 13.9 years.

#### CONDITIONAL FEASIBILITY DETERMINATION

The Department hereby determines that the proposed Dairyland Power Cooperative, Phase IV Disposal Area, Alma Off-Site Ash Disposal Facility, Town of Belvidere, Buffalo County, Wisconsin is environmentally feasible and has the potential for use as an industrial solid waste disposal landfill. This determination is contingent on the fact that the following conditions are complied with and the Plan of Operation is prepared in accordance with chs. NR 500 through NR 538, Wis. Adm. Codes.

##### GENERAL:

1. The maximum design capacity of the proposed Dairyland Power Cooperative, Phase IV Ash Disposal Area shall not exceed 3,011,000 cubic yards.
2. The Plan of Operation, at a minimum, shall comply with the requirements of chs. NR 500 through 538, Wis. Adm. Code, the Feasibility Report, and conditions of this approval. Additionally, supporting justification shall be provided if the plan differs from the provisions of the Administrative Code.

##### FACILITY DESIGN:

3. This Feasibility Determination is in part based on the use of a geosynthetic clay liner (GCL). The GCL is a new technology and installation, quality assurance (QA) and quality control (QC) standards have not been codified in the NR 500 series, Wis. Adm. Code. Consequently the Bureau of Waste Management's "Guidance for the Use of Geosynthetic Clay Liners (GCLs) at Solid Waste Facilities" should be followed as well as the manufacturers recommendations when submitting final design for the GCL in the Plan of Operation. The compatibility of the anticipated waste stream with respect to the GCL has been addressed in the Feasibility Report. If waste stream characteristics change from those presented in the Feasibility Report then the compatibility of those changes may have to be readdressed.



ENVIRONMENTAL MONITORING:

4. A minimum of 8 rounds of baseline groundwater sampling data, which represent background groundwater conditions, shall be provided for the substances and wells requiring an exemption from the groundwater standards of ch. NR 140, Wis. Adm. Code. The results of this monitoring, justification for use or removal of any baseline monitoring results in the calculation of alternative concentration limits (ACL) and the ACL calculations shall be submitted with the Plan of Operation.
5. The facility environmental monitoring plan, including groundwater, leachate, and surface water shall be included in the Plan of Operation and shall be consistent with that outlined in the environmental monitoring section of the attached feasibility summary. Detection monitoring shall comply with ch. NR 507, Wis. Adm. Code, including using the analytical methods specified in Appendix II.
6. A revised sampling plan shall be included in the Plan of Operation. The plan shall comply with ch. NR 507.16, Wis. Adm. Code. The months of sampling and order of sampling wells shall be defined in the sampling plan.
7. Detection leachate monitoring shall be conducted in accordance with ch. NR 507, Appendix I, Table 4. The months of sampling shall be defined in the sampling plan.
8. The environmental monitoring program shall meet the requirements of NR 507, Wis. Adm. Code, or provide justification for not doing so. The monitoring points assigned to the Phase IV ash disposal area are detailed in Attachment A, Tables 1, 2 and 3.
9. As part of the Plan of Operation, Dairyland Power Cooperative shall provide a plan to protect existing monitoring devices during construction of the Phase IV ash disposal area.
10. Dairyland Power Cooperative shall propose inspection of erosion control measures on a regular basis and/or following major precipitation events. Include a timeline for making any necessary repairs.
11. As part of the Plan of Operation, Dairyland Power Cooperative shall specify the sequencing of erosion control and stormwater control structures with regard to landfill sequencing.
12. As part of the Plan of Operation, Dairyland Power Cooperative shall include a timeline for proper abandonment of water supply well PW-1, or justification for continued use of this well. If the Department does not approve continued use as a non-potable water supply, the well shall be abandoned on accordance with ch. NR 812.26, Wis. Adm. Code prior to waste placement in the Phase IV development.

The Department retains the jurisdiction either to require the submittal of additional information or to modify this approval at any time if, in the Department's opinion, conditions warrant further modifications.

### NOTICE OF APPEAL RIGHTS

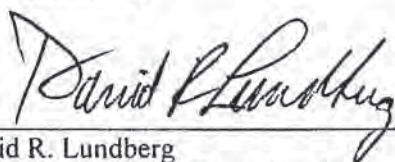
If you believe you have a right to challenge this decision, you should know that Wisconsin statutes and administrative rules establish time periods within which requests to review Department decisions must be filed.

For judicial review of a decision pursuant to sections 227.52 and 227.53, Stats., you have 30 days after the decision is mailed, or otherwise served by the Department, to file your petition with the appropriate circuit court and serve the petition on the Department. Such a petition for judicial review shall name the Department of Natural Resources as the respondent.

This notice is provided pursuant to section 227.48(2), Stats.

Dated Sept. 10, 1999

DEPARTMENT OF NATURAL RESOURCES  
For the Secretary



David R. Lundberg  
Waste Management Team Leader  
West Central Region



Mark Stephenson  
Plan Review Hydrogeologist



**ATTACHMENT "A"**

**TABLE 1**

ENVIRONMENTAL MONITORING SUMMARY  
DAIRYLAND POWER COOPERATIVE PHASE IV ASH DISPOSAL AREA

ASH DISPOSAL LANDFILL DETECTION MONITORING, FILTERED SAMPLES:

WELL NAME	DNR I.D. #	WUWN	Selenium Dissolved 1145	Alkalinity Total 39036	Boron Dissolved 1020	COD 341	Specific Conduct. 94	Field pH 400	Ground- water Temp. 10	Ground- water Elevation 72020	Hardness Total 22413	Sulfate Dissolved 946
Station 1	1	BX385	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
Station 2	2	BX386	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
Station 6	16	IM717	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
W-42	17	LO914	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
P-42A	18	LO915	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
P-42B	19	LO916	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
W-43	20	LO917	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
W-100	21	LO918	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
W-100A	22	LO919	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
W-101	23	LO920	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
W-101A	24	LO921	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
W-102	25	LO922	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
W-102A	26	LO923	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
W-104	27	LO924	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
W-104A	28	LO925	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
W-105	29	LO926	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
W-106	30	LO927	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
W-107	31	LO928	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA

WUWN = Wisconsin Unique Well Number  
SA = Semi-Annual Sampling

**TABLE 2**

HIGH CAPACITY WATER SUPPLY WELL  
MONITORING SUMMARY

WELL NAME	DNR I.D. #	WUWN	Selenium Total 1147	Alkalinity Unfilter 410	Boron Total 1022	COD Unfiltered 340	Specific Conduct. 94	Field pH 400	Ground- water Temp. 10	Hardness Unfiltered 900	Sulfate Total 945
PW-2	*	NG834**	SA	SA	SA	SA	SA	SA	SA	SA	SA

WUWN = Wisconsin Unique Well Number  
\* - To be assigned upon completion of well installation

9/10/1999

\*\* - Well number assigned by Dept. of Natural Resources, Bureau of Drinking Water and Groundwater in a letter dated August 27, 1999 to Dairyland Power Cooperative.

SA = Semi-Annual Sampling

**TABLE 3**

LEACHATE MONITORING SUMMARY

LEACHATE COLLECTION SYSTEM, UNFILTERED SAMPLES

PARAMETER	PARAMETER #	FREQUENCY
BOD <sub>5</sub>	310	SA
Field Conductivity	94	SA
Field pH	400	SA
Alkalinity, Total	410	SA
Boron, Total	1022	SA
Cadmium, Total	1027	SA
Chloride	940	SA
COD, Total	340	SA
Hardness, Total	900	SA
Iron, Total	74010	SA
Lead, Total	1051	SA
Manganese, Total	1055	SA
Mercury, Total	71900	SA
Selenium, Total	1147	SA
Sulfate	945	SA
Total Suspended Solids	150	SA
*Leachate Volume Pumped	32	MONTHLY

SA = Semi-Annually

\* = The volume of the leachate removed shall be recorded at least monthly (reported semi-annually).



## Appendix B-2

### Excerpts from Feasibility Report (RMT, 1997)

# FEASIBILITY REPORT

## DAIRYLAND POWER COOPERATIVE PHASE IV DISPOSAL AREA ALMA OFF-SITE ASH DISPOSAL FACILITY TOWN OF BELVIDERE BUFFALO COUNTY, WISCONSIN

Prepared For  
Dairyland Power Cooperative

Prepared By  
RMT, Inc.  
Madison, Wisconsin

September 1997



Peter D. Creamer, P.E.  
Senior Project Engineer



Mark A. Osten, P.G., C.P.G.  
Project Manager



RMT, INC. — MADISON, WI  
744 HEARTLAND TRAIL ☎ 53717-1934  
P.O. Box 8923 ☎ 53708-8923  
608/831-4444 ☎ 608/831-3334 FAX



## Section 7

# Ecological Assessment

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### 7.1 Wetlands

The proposed site is located in an upland area with no perennial streams, and is located approximately 2 miles north of the Mississippi River. No wetlands are known to be present on or near the site. The nearest wetlands are located adjacent to the Mississippi River. The WDNR was approached on the need to conduct a wetlands inventory. On February 20, 1997, Brad Wolbert (WDNR) indicated that he had spoken with the wetlands staff and that no wetlands inventory would be required (Appendix A).

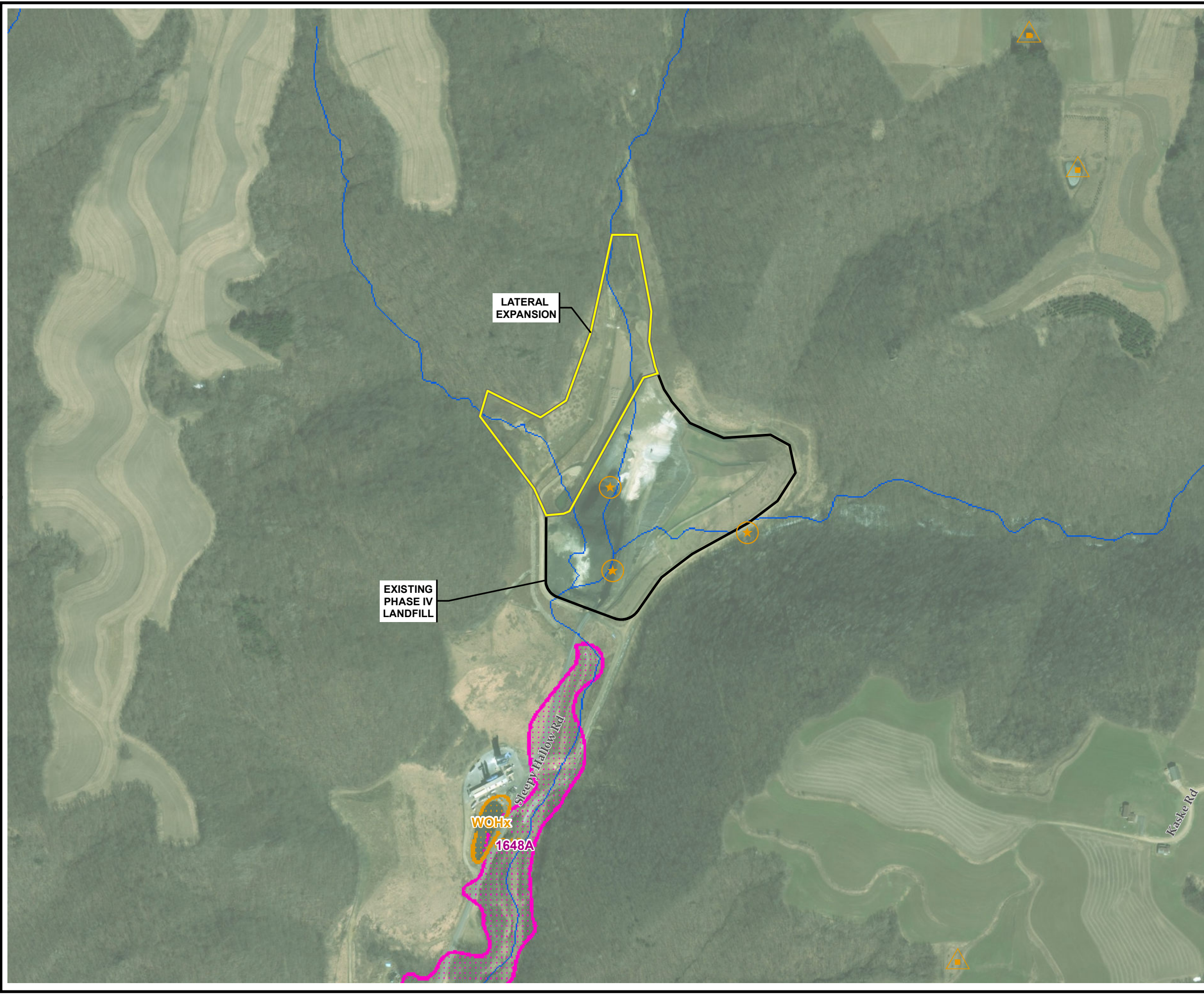
### 7.2 Critical Habitat

In letters dated September 22, 1994, and August 20, 1997 (Appendix A), the WDNR Bureau of Endangered Resources (BER) indicated that their "Natural Heritage Inventory" data files contain no occurrence records of Endangered, Threatened, or Special concern species or natural communities, nor any State Natural Areas for the proposed landfill site or clay borrow area.

## Appendix B-3

### WDNR Surface Water Data Viewer Map





**LEGEND**

EXISTING LANDFILL LIMITS

LATERAL EXPANSION BOUNDARY

WETLAND CLASS AREAS

WETLAND INDICATORS

FILLED/DRAINED WETLAND

WETLAND TOO SMALL TO DELINEATE

WDNR STREAM/RIVER

**NOTES**

1. BASE MAP IMAGERY FROM ESRI/DIGITAL GLOBE, 2017.

2. WWI WETLANDS FROM WDNR SURFACE WATER DATA VIEWER.

3. NHD FLOWLINE DATA ACQUIRED FROM USGS.

05001,000

Feet

1" = 500'

1:6,000

PROJECT:DAIRYLAND POWER COOPERATIVE  
ALMA OFF-SITE DISPOSAL FACILITY, PHASE IV LANDFILL  
LOCATIONS RESTRICTIONS DEMONSTRATIONS  
BUFFALO COUNTY, WISCONSIN

TITLE:

WATERBODY MAP

DRAWN BY:B. DEEGAN

CHECKED BY:J. HOTSTREAM

APPROVED BY:T. MARTIN

DATE:MAY 2018

PROJ. NO.:243332.0004

FIGURE 1

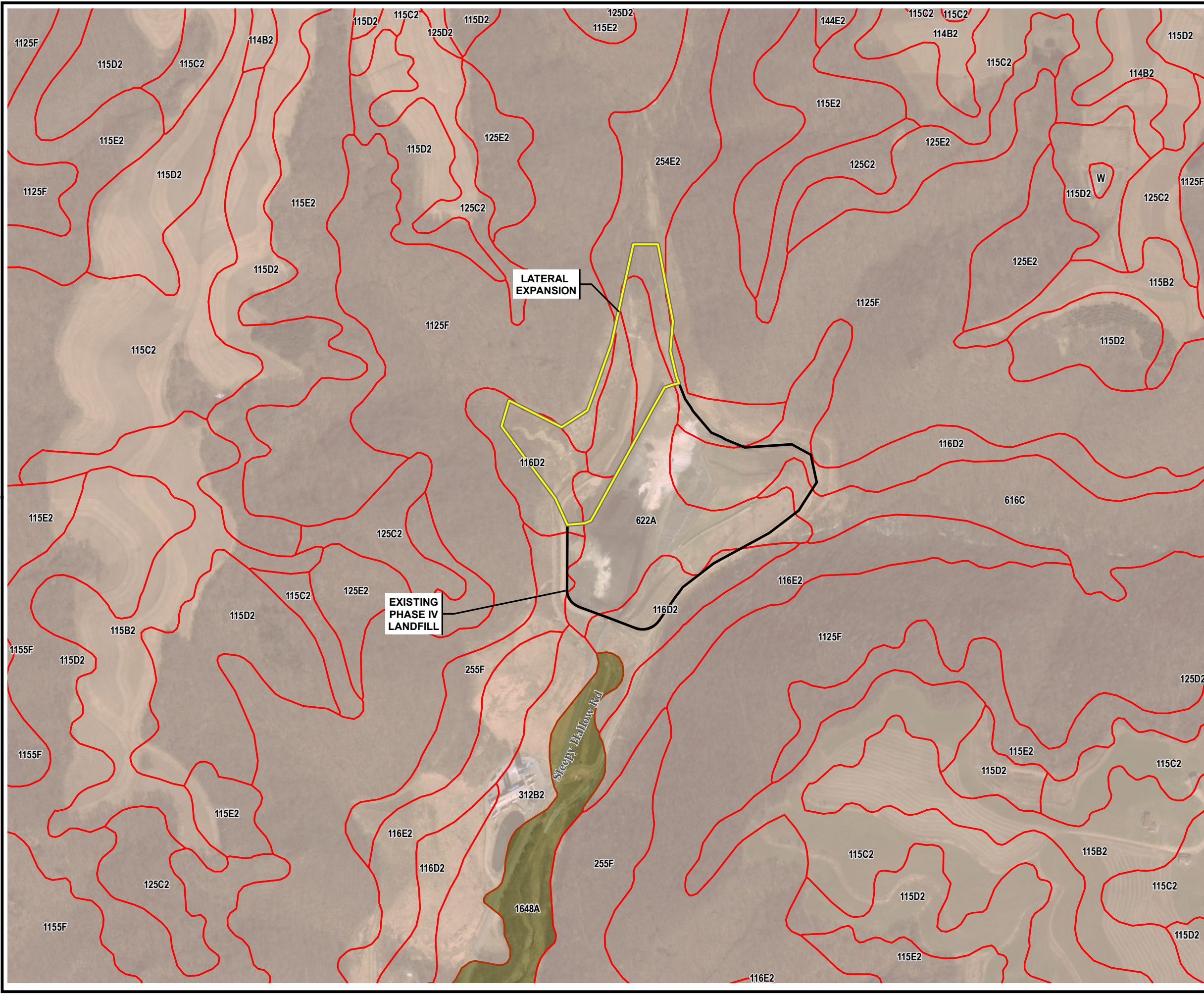
TRC

708 Heartland Trail  
Suite 3000  
Madison, WI 53717  
Phone: 608.826.3600

FILE NO.:243332-002.mxd



## Appendix B-4 USDA Hydric Rating Map



**LEGEND**

EXISTING LANDFILL LIMITS

LATERAL EXPANSION BOUNDARY

**HYDRIC SOIL PERCENTAGE**

0 %

96 %

**NOTES**

1. BASE MAP IMAGERY FROM ESRI/DIGITAL GLOBE, 2017.

2. SOILS DATA ACQUIRED FROM USDA/NRCS SSURGO SOILS DATABASE.

05001,000

Feet

1" = 500'

1:6,000

PROJECT: DAIRYLAND POWER COOPERATIVE ALMA OFF-SITE DISPOSAL FACILITY, PHASE IV LANDFILL LOCATIONS RESTRICTIONS DEMONSTRATIONS BUFFALO COUNTY, WISCONSIN	
TITLE: SOILS MAP	
DRAWN BY: B. DEEGAN	PROJ. NO.: 243332.0004
CHECKED BY: J. HOTSTREAM	FIGURE 2
APPROVED BY: T. MARTIN	
DATE: MAY 2018	
<div><div></div><div>708 Heartland Trail Suite 3000 Madison, WI 53717 Phone: 608.826.3600</div></div>	
FILE NO.: 243332-003.mxd	

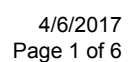


91° 52' 2" W



91° 52' 57" W


Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84











## MAP LEGEND

### Area of Interest (AOI)







 Area of Interest (AOI)

### Soils







#### Soil Rating Polygons

-  Hydric (100%)
-  Hydric (66 to 99%)
-  Hydric (33 to 65%)
-  Hydric (1 to 32%)
-  Not Hydric (0%)
-  Not rated or not available


#### Soil Rating Lines

-  Hydric (100%)
-  Hydric (66 to 99%)
-  Hydric (33 to 65%)
-  Hydric (1 to 32%)
-  Not Hydric (0%)
-  Not rated or not available






#### Soil Rating Points

-  Hydric (100%)
-  Hydric (66 to 99%)
-  Hydric (33 to 65%)
-  Hydric (1 to 32%)
-  Not Hydric (0%)
-  Not rated or not available


### Water Features

 Streams and Canals

### Transportation

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

### Background

 Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service  
Web Soil Survey URL:  
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Buffalo County, Wisconsin  
Survey Area Data: Version 10, Sep 28, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Nov 1, 2010—Nov 2, 2010

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Hydric Rating by Map Unit

Hydric Rating by Map Unit— Summary by Map Unit — Buffalo County, Wisconsin (WI011)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
115B2	Seaton silt loam, ridge phase, 2 to 6 percent slopes	0	6.8	2.6%
115C2	Seaton silt loam, driftless ridge, 6 to 12 percent slopes, moderately eroded	0	18.0	6.8%
115D2	Seaton silt loam, driftless ridge, 12 to 20 percent slopes, moderately eroded	0	8.2	3.1%
115E2	Seaton silt loam, driftless valley, 20 to 30 percent slopes, moderately eroded	0	6.9	2.6%
116D2	Churchtown silt loam, 12 to 20 percent slopes, moderately eroded	0	27.6	10.5%
116E2	Churchtown silt loam, 20 to 30 percent slopes, moderately eroded	0	21.7	8.3%
125C2	Pepin silt loam, 6 to 12 percent slopes, moderately eroded	0	4.8	1.8%
125E2	Pepin silt loam, 20 to 30 percent slopes, moderately eroded	0	5.0	1.9%
254E2	Norden silt loam, 20 to 30 percent slopes, moderately eroded	0	7.2	2.7%
255F	Urne fine sandy loam, 30 to 45 percent slopes	0	16.2	6.2%
312B2	Festina silt loam, 2 to 6 percent slopes, moderately eroded	0	8.5	3.2%
616C	Chaseburg silt loam, 4 to 12 percent slopes, occasionally flooded	0	6.3	2.4%
622A	Worthen silt loam, 0 to 2 percent slopes, occasionally flooded	0	16.4	6.2%
1125F	Dorerton, very stony-Elbaville complex, 30 to 60 percent slopes	0	101.0	38.4%

Hydric Rating by Map Unit— Summary by Map Unit — Buffalo County, Wisconsin (WI011)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1648A	Northbend-Ettrick silt loams, 0 to 3 percent slopes, frequently flooded	96	8.1	3.1%
Totals for Area of Interest			262.8	100.0%

## Description

This rating indicates the percentage of map units that meets the criteria for hydric soils. Map units are composed of one or more map unit components or soil types, each of which is rated as hydric soil or not hydric. Map units that are made up dominantly of hydric soils may have small areas of minor nonhydric components in the higher positions on the landform, and map units that are made up dominantly of nonhydric soils may have small areas of minor hydric components in the lower positions on the landform. Each map unit is rated based on its respective components and the percentage of each component within the map unit.

The thematic map is color coded based on the composition of hydric components. The five color classes are separated as 100 percent hydric components, 66 to 99 percent hydric components, 33 to 65 percent hydric components, 1 to 32 percent hydric components, and less than one percent hydric components.

In Web Soil Survey, the Summary by Map Unit table that is displayed below the map pane contains a column named 'Rating'. In this column the percentage of each map unit that is classified as hydric is displayed.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). Under natural conditions, these soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 2002). These criteria are used to identify map unit components that normally are associated with wetlands. The criteria used are selected estimated soil properties that are described in "Soil Taxonomy" (Soil Survey Staff, 1999) and "Keys to Soil Taxonomy" (Soil Survey Staff, 2006) and in the "Soil Survey Manual" (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in "Field Indicators of Hydric Soils in the United States" (Hurt and Vasilas, 2006).

### References:

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.



Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18.

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.

Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service.

## Rating Options

*Aggregation Method:* Percent Present

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Lower

# Appendix C

## Supporting Material for §257.62

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### Table of Contents

- Appendix C-1: Excerpts from Feasibility Report (RMT 1997)
- Appendix C-2: USGS Quaternary Earthquake Fault Map (USGS 2015)

## Appendix C-1

### Excerpts from Feasibility Report (RMT 1997)



# FEASIBILITY REPORT

## DAIRYLAND POWER COOPERATIVE PHASE IV DISPOSAL AREA ALMA OFF-SITE ASH DISPOSAL FACILITY TOWN OF BELVIDERE BUFFALO COUNTY, WISCONSIN

Prepared For  
Dairyland Power Cooperative

Prepared By  
RMT, Inc.  
Madison, Wisconsin

September 1997



Peter D. Creamer, P.E.  
Senior Project Engineer



Mark A. Osten, P.G., C.P.G.  
Project Manager





## Section 8

# Hydrogeologic Investigation

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### 8.1 Site Field Investigation

#### 8.1.1 Soil Borings

The subsurface exploration program was designed to fulfill the requirements for submittal of a Feasibility Report as specified in NR 512. For the proposed 32.1-acre landfill, NR 512.09 (1) requires that 22 borings be sampled to a depth 25 feet below the proposed subbase grade. Prior to the Feasibility Report investigation, 23 soil borings had been completed at the site. Of these 23 soil borings, three borings (B15, B16, and B17) were located greater than the 300-foot distance requirement of NR 512.09, and five borings (B18, B19, B20, B21, and B22) did not meet the depth requirement. Station 6 (not one of the 23 borings noted above) was drilled as part of a separate evaluation during the October/November 1994 field activities to document groundwater conditions downgradient (south) of the existing Phase II disposal area. To supplement these data and provide data from across the proposed Phase IV disposal area, borings at 15 additional locations were drilled (B60, B61, B62, B63, B64, B65, B66, B67, B68, W100A, W101A, W104/104A, W105, W106, and W107). Test pits TP36, TP37, TP38, TP41, and TP42, excavated for previous investigations, were also used in the evaluation.

The borings used in the Feasibility Report, their installation dates, their distances from limits of fill, and the reasons for their installation are listed in Table 8-1. The locations of the soil borings are shown on Plan Sheet 2. Appendix A contains correspondence from the WDNR approving modification to the standard NR 512 geotechnical program.

The soil borings were extended using hollow-stemmed auger drilling or mud rotary drilling techniques. Rock drilling was conducted using air-rotary and coring techniques. Soil boring logs are included in Appendix E. Water used in drilling and decontamination of drilling equipment was obtained from the DPC on-site production well. A sample of this water was tested. Analytical results are included in Appendix F. An experienced geologist was on-site to observe and direct drilling, sampling, and related activities.



### **8.1.6 Inventory of Water Supply Wells**

An inventory of public and private water supply wells within 1,200 feet of the proposed site was conducted. The only water supply well located within 1,200 feet of the proposed limits of fill is the DPC on-site supply well located approximately 1,000 feet downgradient of the proposed site (Plan Sheet 3). The well log, construction data, and pumping information for this well are contained in Appendix E.

## **8.2 Site Conditions**

### **8.2.1 Topography and Hydrology**

Plan Sheet 3 presents an existing conditions map that shows the topography of the area within a minimum of 1,500 feet of the proposed limits of fill. The map was prepared from portions of the Cream and Alma, Wisconsin, USGS topographic maps and an aerial survey flown by Aero-Metric Engineering, Inc., of Sheboygan, Wisconsin, on April 3, 1993. The aerial survey covered the proposed landfill area. The USGS topographic maps covered the surrounding areas.

A significant amount of topographic relief occurs across the site. The topographic map (Plan Sheet 3) reveals that the topography slopes steeply into a central valley. Surface water runoff from the uplands and slopes surrounding the site drains into ditches within the central valley that extend from the site area to the Mississippi River. Culverts along the path of the ditches within the central valley aid in controlling surface water runoff. The nearest wetlands are located approximately 1 mile south of the site along the Mississippi River.

The site is located within the Mississippi River drainage basin. There are no navigable streams located within approximately 1 mile of the site. The nearest navigable stream is the Mississippi River.

### **8.2.2 Soil and Geology**

Evaluation of soil boring logs indicates that sand and silty sand are the predominant soil types on site. However, several borings contain a layer of finer grained soil, including silt and clay above the sandy soil, ranging from a few feet to as much as 40 feet thick at boring B20 and abandoned well W14. The sandy soil typically extends to bedrock, at depths ranging between 15 and 60 feet below the ground surface. There are also a few isolated areas where fill is present. The fill is associated with the existing landfill footprints at Phases I, II, and III, located south of the proposed disposal area, and with the soil stockpile (in the center of the proposed Phase IV disposal area footprint near



boring B19). Except at the existing landfill phases and the soil stockpile, the fill is generally less than 10 feet deep.

The sandy soil is primarily the result of fluvial deposition. However, some of the sand, near the bedrock surface, appears to have resulted from *in situ* weathering of the sandstone bedrock present beneath most of the site. This soil generally consists of fine- to coarse-grained silty sand, poorly graded sand with gravel, and/or poorly graded gravel with sand; is typically very dense, and is brownish-yellow (10 YR 6/6) in color. The silty and clayey soil overlying the sandy deposits appears to be the result of a combination of loess deposits and, to a lesser degree, isolated lacustrine deposition. This soil is generally described as soft to medium stiff, dark yellowish-brown (10 YR 4/6) to brown (7.5 YR 4/2) silt or silty clay. Rust-colored mottling is common within this unit.

The results of the laboratory testing of selected soil samples (from both the loess/lacustrine silt and clay and the fluvial sand and gravel) for grain-size distribution, Atterberg limits, and laboratory hydraulic conductivity are summarized in Table 8-2. The soil test data sheets are contained in Appendix G.

Bedrock in the site area is composed of the Prairie du Chien Group Dolomite, that acts as a cap rock overlying the Cambrian Sandstones. Prairie du Chien Group Dolomite was observed in W101 on the ridge top in the northern portion of the site (Plan Sheets 7 and 8). The contact between the dolomite and Cambrian Sandstones was observed in well W101 at approximately 844 feet M.S.L. The Prairie du Chien Group Dolomite at W101 was found to be highly fractured and weathered. In the proposed landfill footprint, the Prairie du Chien has been removed by erosion.

Cambrian Sandstones underlie the unconsolidated sediment in this area. The Cambrian Sandstones include the Jordan Sandstone; the St. Lawrence Formation; the Franconia, Galesville, Eau Claire, and Mount Simon Sandstones; and the Dresbach Formation. The Cambrian Sandstone beneath the site was found to be fine grained, fissile, friable, and glauconitic with interbedded lenses of dark-brown sandstone and calcareous shaley partings. Bedrock cores of this formation were obtained from W101A, W106, and W107.

Plan Sheet 12 is a map of the top of the competent bedrock surface in the site area. This surface is also depicted on Geologic Cross Sections A-A' through L-L' shown on Plan Sheets 4 through 10. The surface mimics the topography, only at higher relief. The top of bedrock is substantially deeper in the central part of the valley, beneath the proposed disposal area footprint, than the valley slope areas.



Facility/Project Name <b>Dairyland Power 3081.23</b>		License/Permit/Monitoring Number <b>2927</b>		Boring Number <b>W101A</b>	
Boring Drilled By (Firm name and name of crew chief) <b>Boart Longyear, Crew Chief: Eric Shoenberg</b>		Date Drilling Started <b>10/23/95</b>		Date Drilling Completed <b>10/30/95</b>	
DNR Facility Well No.		WI Unique Well No.		Common Well Name	
				Final Static Water Level <b>813.0 Feet MSL</b>	
				Surface Elevation <b>923.1 Feet MSL</b>	
				Borehole Diameter <b>6.0 Inches</b>	
Boring Location State Plane <b>172652.00 N, 1477729.00 E</b>		Lat <b>0 0 "</b>		Local Grid Location (If applicable) <input type="checkbox"/> N <input type="checkbox"/> E <input type="checkbox"/> S <input type="checkbox"/> W	
NE 1/4 of NE 1/4 of Section 19 T 21 N, R 12W		Long <b>0 0 "</b>			
County <b>Buffalo County</b>		DNR County Code <b>06</b>		Civil Town/City/ or Village <b>Belvidere</b>	

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties					Comments
									Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	
			30	Blind drilled to 30.0 feet. See log of W101 for sample descriptions.										
			31											
			32											
			33											
			34											
			35											
			36											
			37											
			38											
			39											
			40											
			41											
			42											
			43											
			44											
			45											
			46											
			47											
			48											
			49											
			50											
			51											
			52											
			53											
			54											

**DOLOMITE/LIMESTONE**, hard, fractured, highly weathered, fractures filled with silt/sand.

As above.

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature






*Daniel G. Reid*

Firm

**RMT**

744 Heartland Trail, Madison Wisconsin  
Tel: 608-831-4444, Fax: 608-831-3334

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Sample		Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties					Comments	
Number	Length (In) Recovered								Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200		
1			55												
		56													
57															
58															
59															
60															
61															
62															
63															
64															
65															
66															
67															
68															
69															
70															
71															
72															
73	SANDSTONE, olive green,														
74	glauconitic, soft, fissile, friable,														
75	fine to medium grained.														
76															
77															
78	DOLOMITE/LIMESTONE, hard,														
79	dense, highly weathered.														
80	SANDSTONE, olive green,														
81	glauconitic, interbedded with														
82	dark brown-black sandstone and														
83	white lenses, fine grained, fissile,														
84	medium friable, recovery=94%,														
85	RQD=50%, FF=3.														
86															
87															
88															
89															
90															
91	Recovery=99%, RQD=55%, FF=6.														
92															
93	As above, but also contains tan														
94	sandstone, very fine with lenses														
95	of shaley consistency, bottom 3.5														
96	feet well cemented.														



Boring Number **W101A** Use only as an attachment to Form 4400-122. Page **3** of **4**

Sample		Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties					P 200	Comments
Number	Length (In) Recovered								Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit			
3			97	<p>Recovery=40%, RQD=0%.</p> <p>Core barrel locks up at 104.0 feet.</p> <p style="text-align: center;">▽</p> <p>As above, SANDSTONE, olive green, glauconitic, interbedded with dark brown to black sandstone and white calcareous shaley lenses, fine-grained, fissile, medium friable.</p>										RC	
			98												
			99												
			100												
			101												
			102												
			103												
			104												
			105												
			106												
			107												
			108												
			109												
			110												
			111												
			112												
			113												
			114												
			115												
			116												
			117												
		118													
		119													
		120													
		121													
		122													
		123													
		124													
		125													
		126													
		127													
		128													
		129													
		130													
		131													
		132													
		133													
		134													
		135													
		136													
		137													

Boring Number

**W101A**

Use only as an attachment to Form 4400-122.



Page 4 of 4

Sample		Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties					Comments	
Number	Length (In) Recovered								Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200		
			138												
			139												
			140												
			141												
			142												
			143												
			144												
			145												
			146												
			147												
			148												
			149												
			150												
			151												
			152												
				End of boring at 152.0 feet.											

KH =  
1X10-2  
cm/sec



Facility/Project Name <b>Dairyland Power 3081.23</b>			License/Permit/Monitoring Number <b>2927</b>		Boring Number <b>W106</b>	
Boring Drilled By (Firm name and name of crew chief) <b>Boart Longyear, Crew Chief: Paul Dickinson</b>			Date Drilling Started <b>11/2/95</b>		Date Drilling Completed <b>11/7/95</b>	
					Drilling Method <b>8" MUD ROTARY</b>	
DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level <b>773.6 Feet MSL</b>		Surface Elevation <b>848.3 Feet MSL</b>	
					Borehole Diameter <b>8.0 Inches</b>	
Boring Location State Plane <b>171530.00 N, 1476837.00 E</b>			Lat <b>0 0 "</b>		Local Grid Location (If applicable)	
<b>NE 1/4 of NE 1/4 of Section 19 T 21 N, R 12W</b>			Long <b>0 0 "</b>		<input type="checkbox"/> N <input type="checkbox"/> E <input type="checkbox"/> S <input type="checkbox"/> W	
County <b>Buffalo County</b>			DNR County Code <b>06</b>		Civil Town/City/ or Village <b>Belvidere</b>	

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S S	Graphic Log	Well Diagram	PID/FID	Soil Properties					Comments
									Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	
1	20	12	1-5	<b>SILTY SAND WITH GRAVEL (SM), fine to coarse, 15-30% silt, 10YR 6/6 yellowish brown, medium dense, (Fill).</b>	SM					M				SS
2	18	19	6-10	As above.										SS
3	14	38	11-15	As above.										SS
4	14	20	16-20	As above.										SS

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm

RMT

744 Heartland Trail, Madison Wisconsin  
Tel: 608-831-4444, Fax: 608-831-3334

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Page 2 of 3

[illegible]

Page 3 of 3

[illegible]



Facility/Project Name <b>Dairyland Power 3081.30</b>			License/Permit/Monitoring Number <b>2927</b>		Boring Number <b>W107</b>	
Boring Drilled By (Firm name and name of crew chief) <b>Boart Longyear, Crew Chief: T. Schmalfeldt</b>			Date Drilling Started <b>4/29/97</b>		Date Drilling Completed <b>5/1/97</b>	
					Drilling Method <b>6 1/4 HSA</b>	
DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level Feet MSL <b>906.2</b>		Surface Elevation Feet MSL <b>906.2</b>	
					Borehole Diameter <b>6.0</b> Inches	
Boring Location State Plane <b>173527.44 N, 1477214.99 E</b>			Lat <b>0 3 N</b>		Local Grid Location (If applicable) <input type="checkbox"/> N <input type="checkbox"/> E	
<b>NE 1/4 of NE 1/4 of Section 19 T 21 N, R 12W</b>			Long <b>0 3 W</b>		Feet <input type="checkbox"/> S Feet <input type="checkbox"/> W	
County <b>Buffalo County</b>			DNR County Code <b>06</b>		Civil Town/City/ or Village <b>Belvidere</b>	

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties					Comments
									Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	
1	8	26	1-4	SILT (ML), 5% fine to coarse sand, 5% fine gravel, 10-15% clay, slightly plastic, stiff, 7.5YR 4/4 brown.						M				
			5-9	POORLY GRADED SAND WITH GRAVEL (SP) to SILTY SAND WITH GRAVEL (SM), fine to coarse, 10-20% silt, 15-20% fine to coarse gravel, 5% cobbles, 10YR 6/6 brownish yellow, medium dense.	SP					M				SS
2	24	56	10-12	As above.										SS
3	15	36	13-16	As above, but with boulder at ~ 12.0-13.5 feet.										SS
4	18	26	17-20	POORLY GRADED SAND WITH SILT (SP/SM), 10% silt, 10% fine to medium gravel (angular fragments), 10YR 6/6 brownish yellow, medium dense.	SP/SM					M				SS

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature <i>David R. Leed</i>	Firm <b>RMT</b> 744 Heartland Trail, Madison Wisconsin Tel: 608-831-4444, Fax: 608-831-3334
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Boring Number

W107



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Page 2 of 3

Sample		Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties					Comments
Number	Length (In) Recovered								Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	
5	14	44	26	As above, except ~20% silt.										SS
RC1	6	15	30	<b>WEATHERED DOLOMITE BEDROCK</b> , becomes competent at ~31.0 feet.										SS
			31											RQD=0
	24	NA	32											FF=0
			33											Rec=40%
			34											
			35											
			36											
			37											GRAB
			38											
			39											
8		40	Alternating layers (1-2 feet thick) of light brown dolomite and olive brown to olive green silty sandstone.											GRAB
		41												
		42												
		43												
		44												
		45												
		46												GRAB
		47												
9		48	Olive brown to olive green <b>SILTY SANDSTONE</b> , glauconitic, fine to medium grained.											
		49												
		50												
		51												GRAB
		52												
		53												
		54												
		55												
10		56	Driller notes large fractures at ~53.0 feet, loose air circulation. <b>DOLOMITE</b> , light brown to gray, highly weathered with alternating layers of olive brown to olive green silty sandstone.  Air circulation returns at ~60.0 feet.  Olive brown to olive green Glauconitic <b>SANDSTONE</b> , fine-grained with many silty lenses.											
		57												
		58												
		59												
		60												
		61												
		62												
		63												
64														
65														
66														



Boring Number **W107** Use only as an attachment to Form 4400-122. Page **3** of **3**

Sample		Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties					Comments
Number	Length (In) Recovered								Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	
RC2	18	NA	67	Olive green glauconitic SANDSTONE, fine grained with many silty lenses.  Water at 74.5 feet while drilling.  End of boring at 86.0 feet.										
			68											
			69											
			70											
			71											
			72											
			73											
			74											
			75											
			76											
			77											
			78											
			79											
			80											
			81											
			82											
			83											
			84											
85														
86														

RQD=0  
FF=0  
Rec=38%

## Appendix C-2

### USGS Quaternary Earthquake Fault Map (USGS, 2015)





# Appendix D

## Supporting Material for §257.63

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U.S. Geological Survey - Earthquake Hazards Program

# Alma Offsite Facility, Phase IV Landfill

Latitude = 44.290°N, Longitude = 91.876°W

Location



Reference Document

2015 NEHRP Provisions

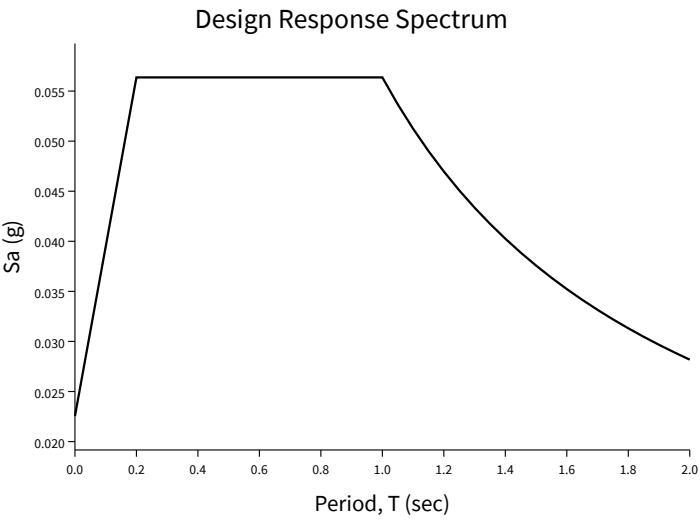
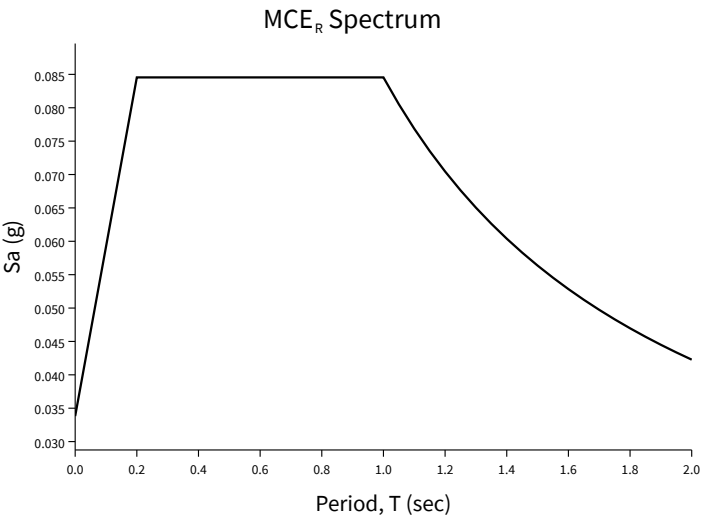
Site Class

D (determined): Stiff Soil

Risk Category

IV e.g. (Essential Facilities)

<b>S<sub>S</sub></b> =	0.047 g	<b>S<sub>MS</sub></b> =	0.075 g	<b>S<sub>DS</sub></b> =	0.050 g
<b>S<sub>1</sub></b> =	0.035 g	<b>S<sub>M1</sub></b> =	0.085 g	<b>S<sub>D1</sub></b> =	0.056 g



Since  $S_{MS} < S_{M1}$ , for this response spectrum  $S_{MS}$  has been set equal to  $S_{M1}$  in accordance with Section 11.4.3.

Since  $S_{MS} < S_{M1}$ , for this response spectrum  $S_{MS}$  has been set equal to  $S_{M1}$  (and hence  $S_{DS}$  has been set equal to  $S_{D1}$ ), in accordance with Section 11.4.3.



## Mapped Acceleration Parameters, Long-Period Transition Periods, and Risk Coefficients

Note: The  $S_S$  and  $S_1$  ground motion maps provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain  $S_S$ ) 1.3 (to obtain  $S_1$ ).

- [FIGURE 22-1  \$S\_S\$  Risk-Targeted Maximum Considered Earthquake \( \$MCE\_R\$ \) Ground Motion Parameter for the Conterminous United States for 0.2 s Spectral Response Acceleration \(5% of Critical Damping\), Site Class B](#)
- [FIGURE 22-2  \$S\_1\$  Risk-Targeted Maximum Considered Earthquake \( \$MCE\_R\$ \) Ground Motion Parameter for the Conterminous United States for 1.0 s Spectral Response Acceleration \(5% of Critical Damping\), Site Class B](#)
- [FIGURE 22-9 Maximum Considered Earthquake Geometric Mean \( \$MCE\_G\$ \) PGA, %g, Site Class B for the Conterminous United States](#)
- [FIGURE 22-14 Mapped Long-Period Transition Period,  \$T\_L\$  \(s\), for the Conterminous United States](#)
- [FIGURE 22-18 Mapped Risk Coefficient at 0.2 s Spectral Response Period,  \$C\_{RS}\$](#)
- [FIGURE 22-19 Mapped Risk Coefficient at 1.0 s Spectral Response Period,  \$C\_{R1}\$](#)

## Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site class as Site Class , based on the site soil properties in accordance with Chapter 20.

**Table 20.3-1 Site Classification**

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: <ul style="list-style-type: none"><li>• Plasticity index <math>PI &gt; 20</math></li><li>• Moisture content <math>w \geq 40\%</math>, and</li><li>• Undrained shear strength <math>\bar{s}_u &lt; 500</math> psf</li></ul>		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		
For SI: 1ft/s = 0.3048 m/s 1lb/ft <sup>2</sup> = 0.0479 kN/m <sup>2</sup>			

## Site Coefficients and Risk-Targeted Maximum Considered Earthquake (MCE<sub>R</sub>) Spectral Response Acceleration Parameters

Risk-targeted Ground Motion (0.2 s)

$$C_{RS}S_{SUH} = 0.942 \times 0.050 = 0.047 \text{ g}$$

Deterministic Ground Motion (0.2 s)

$$S_{SD} = 1.500 \text{ g}$$

$$S_S \equiv \text{"Lesser of } C_{RS}S_{SUH} \text{ and } S_{SD} \text{"} = 0.047 \text{ g}$$

Risk-targeted Ground Motion (1.0 s)

$$C_{R1}S_{1UH} = 0.877 \times 0.040 = 0.035 \text{ g}$$

Deterministic Ground Motion (1.0 s)

$$S_{1D} = 0.600 \text{ g}$$

$$S_1 \equiv \text{"Lesser of } C_{R1}S_{1UH} \text{ and } S_{1D} \text{"} = 0.035 \text{ g}$$

**Table 11.4-1: Site Coefficient  $F_a$**

Site Class	Spectral Reponse Acceleration Parameter at Short Period					
	$S_S \leq 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S = 1.25$	$S_S \geq 1.50$
A	0.8	0.8	0.8	0.8	0.8	0.8
B (measured)	0.9	0.9	0.9	0.9	0.9	0.9
B (unmeasured)	1.0	1.0	1.0	1.0	1.0	1.0
C	1.3	1.3	1.2	1.2	1.2	1.2
D (determined)	1.6	1.4	1.2	1.1	1.0	1.0
D (default)	1.6	1.4	1.2	1.2	1.2	1.2
E	2.4	1.7	1.3	1.2 *	1.2 *	1.2 *
F	See Section 11.4.7					

\* For Site Class E and  $S_S \geq 1.0$  g, see the requirements for site-specific ground motions in Section 11.4.7 of the 2015 NEHRP Provisions. Here the exception to those requirements allowing  $F_a$  to be taken as equal to that of Site Class C has been invoked.

Note: Use straight-line interpolation for intermediate values of  $S_S$ .



Note: Where Site Class B is selected, but site-specific velocity measurements are not made, the value of  $F_a$  shall be taken as 1.0 per Section 11.4.2.

Note: Where Site Class D is selected as the default site class per Section 11.4.2, the value of  $F_a$  shall not be less than 1.2 per Section 11.4.3.

**For Site Class = D (determined) and  $S_S = 0.047$  g,  $F_a = 1.600$**

**Table 11.4-2: Site Coefficient  $F_v$** 

Site Class	Spectral Response Acceleration Parameter at 1-Second Period					
	$S_1 \leq 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 = 0.50$	$S_1 \geq 0.60$
A	0.8	0.8	0.8	0.8	0.8	0.8
B (measured)	0.8	0.8	0.8	0.8	0.8	0.8
B (unmeasured)	1.0	1.0	1.0	1.0	1.0	1.0
C	1.5	1.5	1.5	1.5	1.5	1.4
D (determined)	2.4	2.2 <sup>1</sup>	2.0 <sup>1</sup>	1.9 <sup>1</sup>	1.8 <sup>1</sup>	1.7 <sup>1</sup>
D (default)	2.4	2.2 <sup>1</sup>	2.0 <sup>1</sup>	1.9 <sup>1</sup>	1.8 <sup>1</sup>	1.7 <sup>1</sup>
E	4.2	3.3 <sup>1</sup>	2.8 <sup>1</sup>	2.4 <sup>1</sup>	2.2 <sup>1</sup>	2.0 <sup>1</sup>
F	See Section 11.4.7					

<sup>1</sup> For Site Class D or E and  $S_1 \geq 0.2$  g, site-specific ground motions might be required. See Section 11.4.7 of the 2015 NEHRP Provisions.

Note: Use straight-line interpolation for intermediate values of  $S_1$ .

Note: Where Site Class B is selected, but site-specific velocity measurements are not made, the value of  $F_v$  shall be taken as 1.0 per Section 11.4.2.

**For Site Class = D (determined) and  $S_1 = 0.035$  g,  $F_v = 2.400$**

Site-adjusted  $MCE_R$  (0.2 s)

$$S_{MS} = F_a S_S = 1.600 \times 0.047 = 0.075 \text{ g}$$

Site-adjusted  $MCE_R$  (1.0 s)

$$S_{M1} = F_v S_1 = 2.400 \times 0.035 = 0.085 \text{ g}$$

Design Spectral Acceleration Parameters

Design Ground Motion (0.2 s)

$$S_{DS} = \frac{2}{3} S_{MS} = \frac{2}{3} \times 0.075 = 0.050 \text{ g}$$

---

Design Ground Motion (1.0 s)

$$S_{D1} = \frac{2}{3} S_{M1} = \frac{2}{3} \times 0.085 = 0.056 \text{ g}$$

---



## Design Response Spectrum

Long-Period Transition Period =  $T_L = 12$  s

---

### Figure 11.4-1: Design Response Spectrum

Since  $S_{MS} < S_{M1}$ , for this response spectrum  $S_{MS}$  has been set equal to  $S_{M1}$  (and hence  $S_{DS}$  has been set equal to  $S_{D1}$ ), in accordance with Section 11.4.3.

Spectral Response Acceleration,  $S_a$  (g)

Period,  $T$  (sec)

## **MCE<sub>R</sub> Response Spectrum**

The MCE<sub>R</sub> response spectrum is determined by multiplying the design response spectrum above by 1.5.  
Since  $S_{MS} < S_{M1}$ , for this response spectrum  $S_{MS}$  has been set equal to  $S_{M1}$  in accordance with Section 11.4.3.



## Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

**Table 11.8-1: Site Coefficient for  $F_{PGA}$**

Site Class	Mapped MCE Geometric Mean ( $MCE_G$ ) Peak Ground Acceleration					
	$PGA \leq 0.10$	$PGA = 0.20$	$PGA = 0.30$	$PGA = 0.40$	$PGA = 0.50$	$PGA \geq 0.60$
A	0.8	0.8	0.8	0.8	0.8	0.8
B (measured)	0.9	0.9	0.9	0.9	0.9	0.9
B (unmeasured)	1.0	1.0	1.0	1.0	1.0	1.0
C	1.3	1.2	1.2	1.2	1.2	1.2
D (determined)	1.6	1.4	1.3	1.2	1.1	1.1
D (default)	1.6	1.4	1.3	1.2	1.2	1.2
E	2.4	1.9	1.6	1.4	1.2	1.1
F	See Section 11.4.7					

Note: Use straight-line interpolation for intermediate values of PGA

Note: Where Site Class D is selected as the default site class per Section 11.4.2, the value of  $F_{pga}$  shall not be less than 1.2.

**For Site Class = D (determined) and  $PGA = 0.023$  g,  $F_{PGA} = 1.600$**

Mapped  $MCE_G$

$PGA = 0.023$  g

Site-adjusted  $MCE_G$

$$PGA_M = F_{PGA} PGA = 1.600 \times 0.023 = 0.036 \text{ g}$$

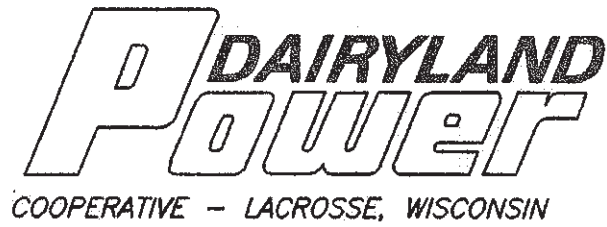


# Appendix E

## Supporting Material for §257.64

---





## **PLAN OF OPERATION**

### **PHASE IV DISPOSAL AREA ALMA OFF-SITE ASH DISPOSAL FACILITY TOWN OF BELVIDERE BUFFALO COUNTY, WISCONSIN**

**PREPARED FOR  
DAIRYLAND POWER COOPERATIVE**

**PREPARED BY  
RMT, INC.  
MADISON, WISCONSIN**

October 2000

**Purpose/Approach/Methodologies/Assumptions/  
Results/References**



## COMPUTATION SHEET

744 Heartland Trail (537)7-8923 P. O. Box 8923 (537)8-8923 Madison, WI (608) 831-4444 FAX: (608) 831-3334 VOICE: (608) 831-1989

PROJECT/PROPOSAL NAME	PREPARED		CHECKED		PROJECT/PROPOSAL NO.
	By:	Date:	By:	Date:	
Dairyland Power Cooperative	JDH	9/97	PDC	9/97	3081.40
	Rev. BJK	9/00			

### GLOBAL SLOPE STABILITY

#### Purpose

To evaluate the global slope stability of the liner and final slopes.

#### Approach

The global stability analysis was performed by evaluating the following worst-case slope conditions:

#### Liner Slope

The worst-case slope of the liner consists of an 83-foot-high 3H:1V slope with a 2-foot-thick low-permeability soil layer, a GCL, a geomembrane, and a 1-foot-thick granular drainage layer (approximately Coordinate N172500, E147700, west slope [see Figure J-1]).

#### Final Cover Slope

The worst-case slope of the final cover consists of a 36-foot-high, 4H:1V slope (approximately Coordinate N172000, E1477000, west slope [see Figure J-2]). Conditions are modeled for ash waste.

#### Methodologies

- The analyses have been performed using the computer program XSTABL, which was developed at Purdue University and subsequently modified by Interactive Software Designs, Inc., of Moscow, Idaho (1994). XSTABL is used to perform the iterative task of identifying the worst-case failure scenario for each case using the Modified Bishops Method. XSTABL uses a two-dimensional static equilibrium method to determine a factor of safety against failure.
- The failure mode considered for the stability analysis was the circular or rotational failure of the waste, subgrade, natural formations, and compacted embankments (*i.e.*, perimeter berm, liner, and cover).
- The circular trial failure surface generator performs a search for the critical failure surface based on failure initiation and termination points established by the user, and is often used when no well-defined weak zone exists in the profile being evaluated. This failure mode is used in evaluating the stability of the liner and final slopes.
- The worst-case (lowest factor of safety) is identified by varying the limits of the failure generation locations. In cases where both types of failure are used to analyze the stability, the failure mode resulting in the most critical (lowest) factor of safety is presented in the results.



# DPC Liner Slope

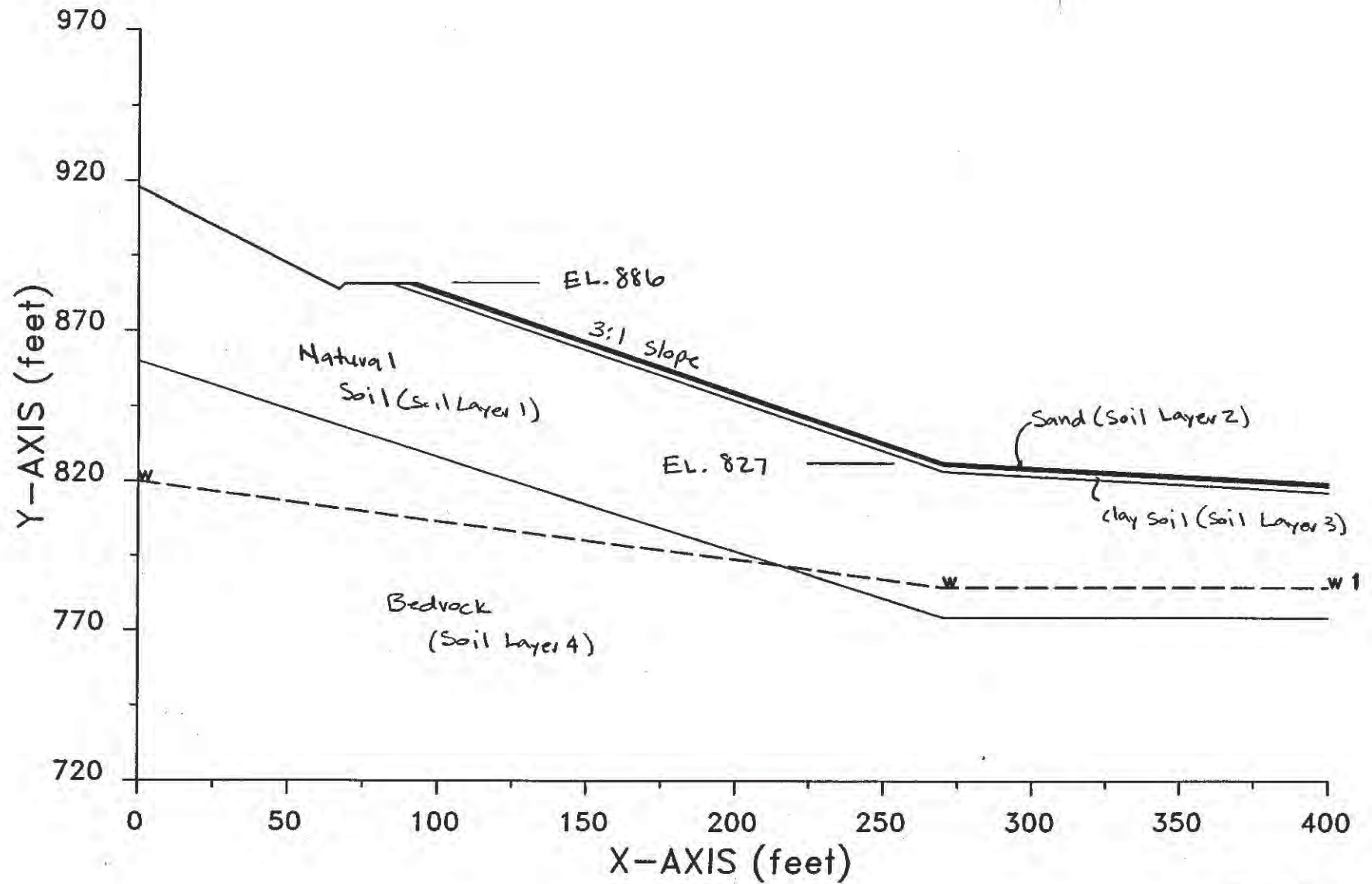


FIGURE J-1  
DPL 3081.28

# DPC Final Cover Slope

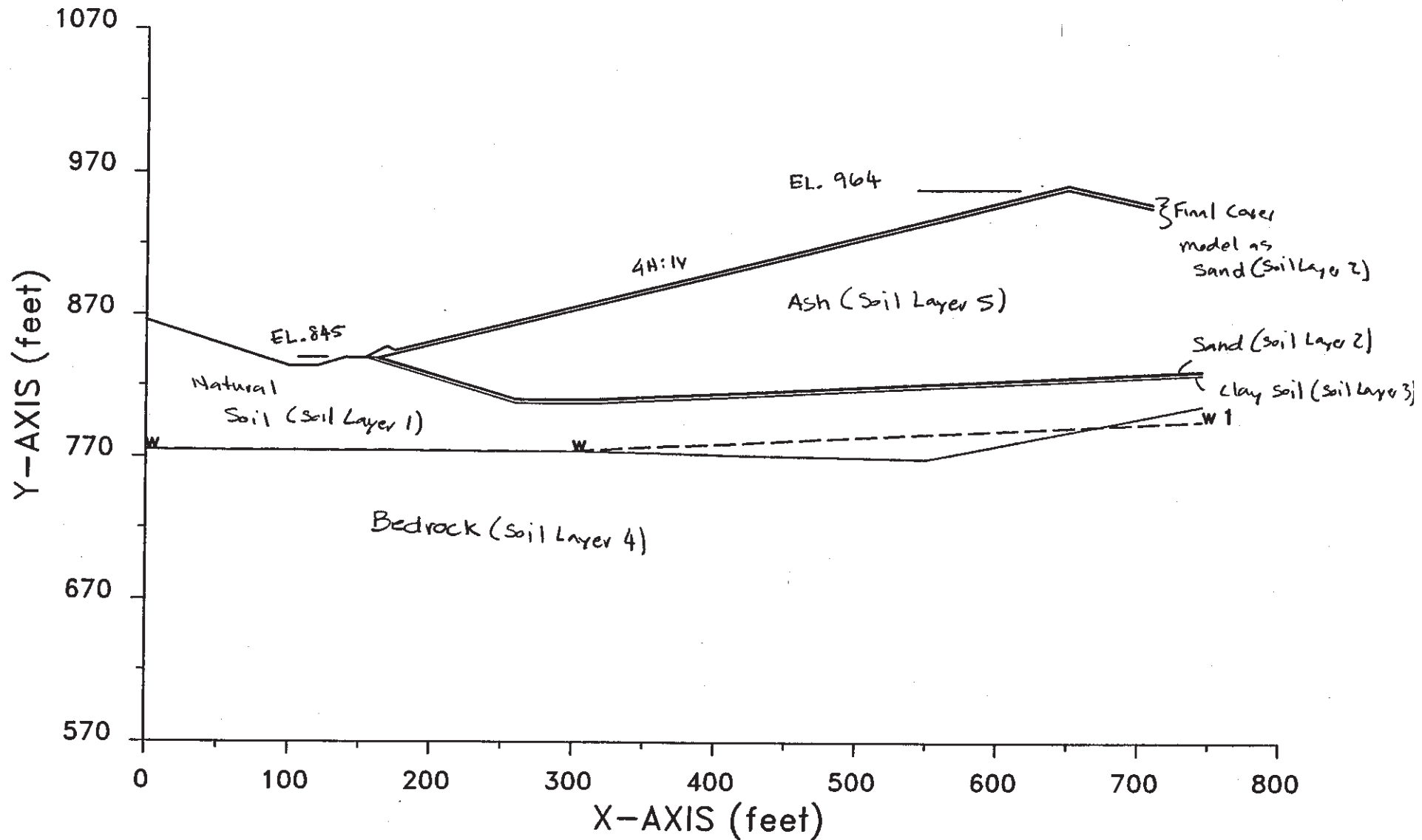


FIGURE J-2  
DPC 3081.28



## COMPUTATION SHEET

SHEET 4 OF 5

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	By:	Date:	By:	Date:	
Dairyland Power Cooperative	JDH	9/97	PDC	9/97	3081.40
	Rev. BJK	9/00			

### Assumptions

- Profile - The cross sections selected to be analyzed are representative of worst-case profiles with regard to slope stability. The longest and highest slopes were selected for modeling. The geologic setting and subgrade information was based on the information found on the geologic cross sections contained in this report.
- To simplify the analysis, the final cover is modeled as a single layer of soil, using sand soil characteristics. This assumption is minor due to the small thickness of the final cover relative to the thickness of waste.
- Groundwater - The water table is estimated to be at varying elevations of 775 to 799 feet through the cross section based on the groundwater elevation maps found in this report.
- A factor of safety of at least 1.3 is acceptable against global slope failures.
- The shear strength of the ash is based on published results of fly ash materials (Oweis, 1990). The results of these tests are as follows:

MATERIAL	MC (%)	$\gamma_d$ (pcf)	c (psf)	$\phi$ (degrees)
DPC ash waste	40	50	130	20

Notes:

MC = moisture content.

 $\gamma_d$  = dry unit weight.

c = cohesion (psf).

 $\phi$  = friction angle.

- Soil Parameters - Unit weight, friction angles, and cohesive strength parameters were estimated based on information gathered from boring logs contained in Appendix C of Addendum 3 for the Initial Site Report (RMT, 1995) and on geologic cross sections. Parameters were chosen based on their correlation with pocket penetration numbers and Plasticity Indices. Published values and engineering judgment were also considered to conservatively estimate the clay, soil, and waste characteristics, as presented in the following table:

MATERIAL	$\gamma$ (pcf)	$\gamma_{Sat}$ (pcf)	$\phi$ (degrees)	c (psf)
Natural soil	120	120	20	200
Sand	110	110	30	0
Clay soil	125	125	25	400
Bedrock	145	145	45	10000
Ash waste	80	80	20	130





## COMPUTATION SHEET

SHEET 5 OF 5  
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	By:	Date:	By:	Date:	
Dairyland Power Cooperative	JDH	9/97	PDC	9/97	3081.40
	Rev. BJK	9/00			

### Results

- The results of the slope stability analysis are summarized below.

#### Factors of Safety Against Circular Failure

	FACTOR OF SAFETY
Liner slope	1.6
Final cover slope	1.8

- Based on the assumed soil strength parameters and slope conditions, the slopes of the liner and final cover will be stable under the specified modeled conditions.

### References

Oweis, I. S. and R.P. Khera. 1990. Geotechnology of waste management. Butterworths, London.

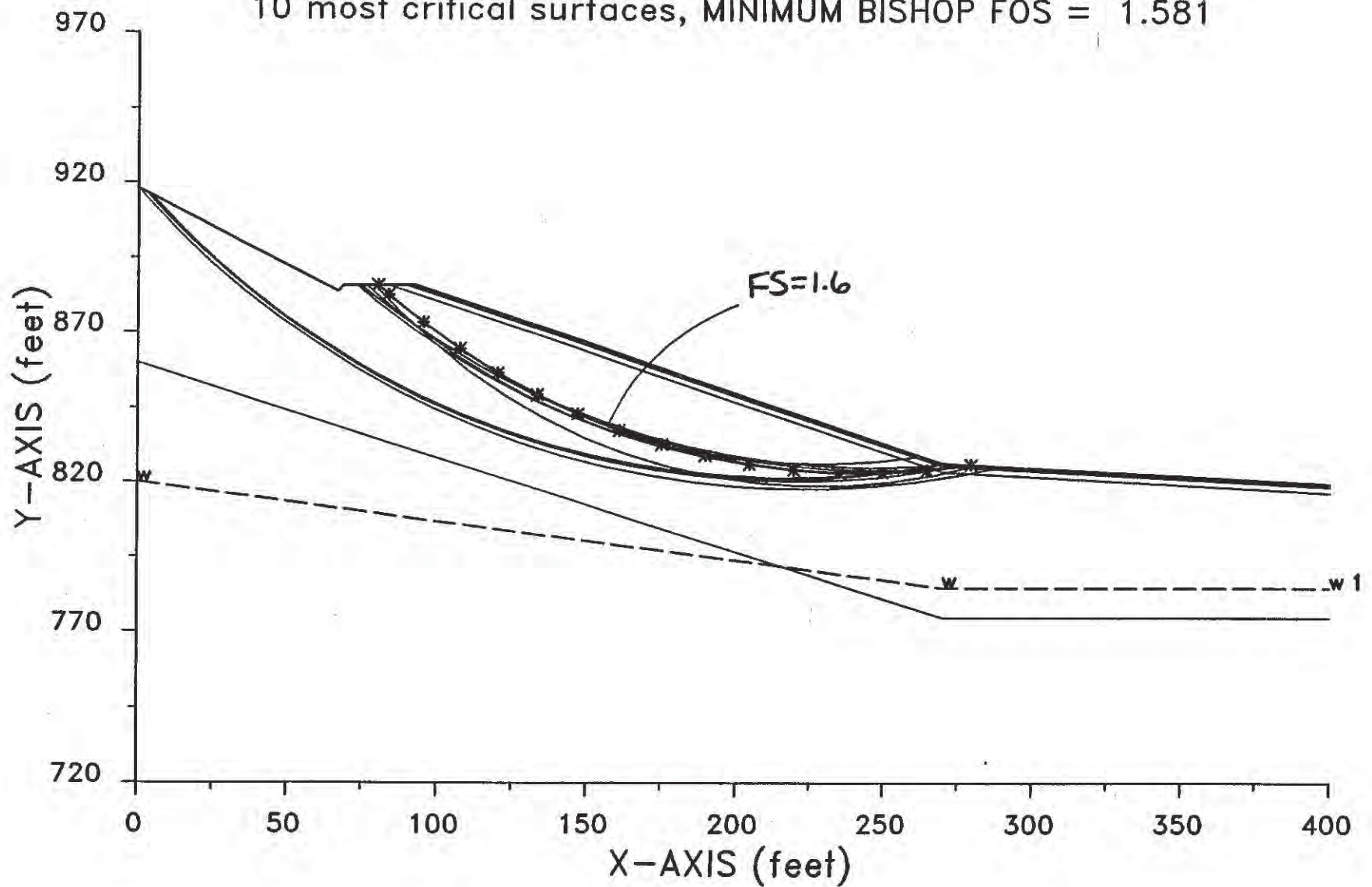
RMT, Inc. 4/1995. Initial site report for Dairyland Power Cooperative.

Interactive Software Designs. 1994. XSTABL Slope Stability Computer Program. Moscow, Idaho.

## XSTABL Outputs

# DPC Liner Slope

10 most critical surfaces, MINIMUM BISHOP FOS = 1.581





```

*****
*           X S T A B L           *
*                               *
*      Slope Stability Analysis   *
*      using the                 *
*      Method of Slices          *
*                               *
*      Copyright (C) 1992 - 96   *
*      Interactive Software Designs, Inc. *
*      Moscow, ID 83843, U.S.A.  *
*                               *
*      All Rights Reserved       *
*                               *
*      Ver. 5.200                96 - 1460 *
*****

```

Problem Description : DPC Liner Slope

-----  
SEGMENT BOUNDARY COORDINATES  
-----

7 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	918.0	67.0	884.0	1 ✓
2	67.0	884.0	69.0	886.0	1 ✓
3	69.0	886.0	84.0	886.0	1 ✓
4	84.0	886.0	90.0	886.0	3
5	90.0	886.0	93.0	886.0	2 ✓
6	93.0	886.0	270.0	827.0	2 ✓
7	270.0	827.0	400.0	820.0	2 ✓

6 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	90.0	886.0	270.0	826.0	3 ✓
2	270.0	826.0	400.0	819.0	3 ✓
3	84.0	886.0	270.0	824.0	1 ✓
4	270.0	824.0	400.0	817.0	1 ✓
5	.0	860.0	270.0	775.0	4 ✓
6	270.0	775.0	400.0	775.0	4 ✓

-----  
ISOTROPIC Soil Parameters  
-----

#### 4 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Cohesion Sat. (pcf)	Friction Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pressure Constant (psf)	Water Surface No.
1	120.0	120.0	200.0	20.00	.000	.0	1 - Natural Soil
2	110.0	110.0	.0	30.00	.000	.0	1 - Sand
3	125.0	125.0	400.0	25.00	.000	.0	1 - Clay Soil
4	145.0	145.0	10000.0	45.00	.000	.0	1 - Bedrock

1 Water surface(s) have been specified

Unit weight of water = 62.40 (pcf)

Water Surface No. 1 specified by 3 coordinate points

\*\*\*\*\*  
PHREATIC SURFACE,  
\*\*\*\*\*

Point No.	x-water (ft)	y-water (ft)
1	.00	820.00
2	270.00	785.00
3	400.00	785.00

A critical failure surface searching method, using a random technique for generating CIRCULAR surfaces has been specified.

400 trial surfaces will be generated and analyzed.

20 Surfaces initiate from each of 20 points equally spaced along the ground surface between x = 250.0 ft and x = 290.0 ft

Each surface terminates between x = .0 ft and x = 90.0 ft

Unless further limitations were imposed, the minimum elevation at which a surface extends is y = .0 ft

15.0 ft line segments define each trial failure surface.

-----  
ANGULAR RESTRICTIONS  
-----

The first segment of each failure surface will be inclined within the angular range defined by :

Lower angular limit := -45.0 degrees  
Upper angular limit := (slope angle - 5.0) degrees

Factors of safety have been calculated by the :

\*\*\*\*\* SIMPLIFIED BISHOP METHOD \*\*\*\*\*

The most critical circular failure surface is specified by 16 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	279.47	826.49
2	264.59	824.66
3	249.61	823.77
4	234.61	823.79
5	219.64	824.75
6	204.76	826.63
7	190.02	829.43
8	175.49	833.14
9	161.21	837.74
10	147.25	843.21
11	133.65	849.54
12	120.46	856.70
13	107.75	864.66
14	95.55	873.39
15	83.92	882.86
16	80.52	886.00

\*\*\*\* Simplified BISHOP FOS = 1.581 \*\*\*\*

The following is a summary of the TEN most critical surfaces

Problem Description : DPC Liner Slope

	FOS (BISHOP)	Circle Center		Radius	Initial	Terminal	Resisting
		x-coord (ft)	y-coord (ft)	(ft)	x-coord (ft)	x-coord (ft)	Moment (ft-lb)
1.	1.581	242.58	1065.87	242.21	279.47	80.52	4.571E+07
2.	1.583	240.37	1080.10	256.18	277.37	73.34	5.172E+07
3.	1.588	217.22	1112.22	290.31	271.05	2.88	9.804E+07
4.	1.588	222.43	1115.96	297.80	290.00	.10	1.125E+08
5.	1.589	245.92	1099.38	273.91	273.16	74.27	5.033E+07

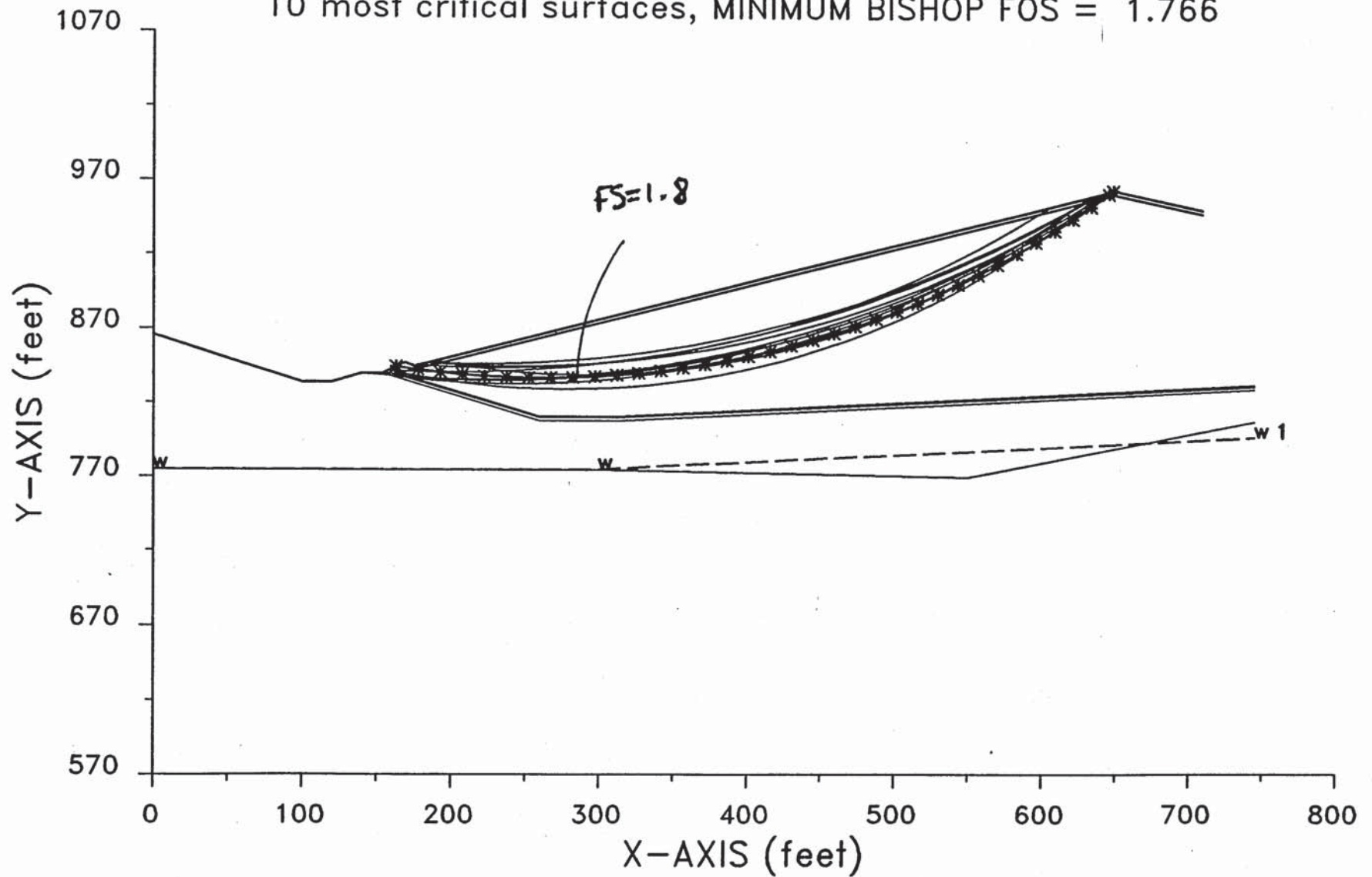


6.	1.590	228.19	1018.10	199.02	281.58	79.45	4.717E+07
7.	1.590	246.76	1096.56	272.04	279.47	74.66	5.171E+07
8.	1.590	219.48	1112.23	291.43	277.37	4.12	1.004E+08
9.	1.592	215.31	1104.38	282.98	271.05	4.55	9.690E+07
10.	1.592	227.51	1048.57	221.91	262.63	76.64	4.135E+07

\*\*\* END OF FILE \*\*\*

# DPC Final Cover Slope

10 most critical surfaces, MINIMUM BISHOP FOS = 1.766



```

*****
*           X S T A B L           *
*                               *
*      Slope Stability Analysis    *
*      using the                  *
*      Method of Slices           *
*                               *
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*                               *
*      Ver. 5.200                 96 - 1460 *
*****

```

Problem Description : DPC Final Cover Slope

-----  
SEGMENT BOUNDARY COORDINATES  
-----

✓ 2014  
8/97

9 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	866.0	100.0	834.0	1-
2	100.0	834.0	120.0	834.0	1-
3	120.0	834.0	140.0	840.0	1-
4	140.0	840.0	154.0	840.0	1-
5	154.0	840.0	168.0	847.0	2-
6	168.0	847.0	170.0	847.0	2-
7	170.0	847.0	175.0	845.0	2-
8	175.0	845.0	650.0	964.0	2-
9	650.0	964.0	710.0	951.0	2

17 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	162.0	839.4	650.0	961.5	2-
2	650.0	961.5	710.0	948.5	2-
3	164.5	839.6	650.0	961.0	5-
4	650.0	961.0	710.0	948.0	5-
5	164.5	839.6	260.0	811.0	2-
6	260.0	811.0	315.0	811.0	2-
7	315.0	811.0	745.0	833.0	2-
8	154.0	840.0	160.0	840.0	3-
9	160.0	840.0	260.0	810.0	3-
10	260.0	810.0	315.0	810.0	3-



11	315.0	810.0	745.0	832.0	3 ✓
12	154.0	840.0	260.0	808.0	1 ✓
13	260.0	808.0	315.0	808.0	1 ✓
14	315.0	808.0	745.0	830.0	1 ✓
15	.0	775.0	300.0	775.0	4 ✓
16	300.0	775.0	550.0	770.0	4 ✓
17	550.0	770.0	745.0	808.0	4 ✓

-----  
ISOTROPIC Soil Parameters  
-----

5 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Cohesion Sat. Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Water Surface Constant (psf)	Water Surface No.	
1	120.0	120.0	200.0	20.00	.000	.0	1 Natural Soil
2	110.0	110.0	.0	30.00	.000	.0	1 Sand
3	125.0	125.0	400.0	25.00	.000	.0	1 Clay Soil
4	145.0	145.0	10000.0	45.00	.000	.0	1 Bedrock
5	80.0	80.0	130.0	20.00	.000	.0	1 Ash

1 Water surface(s) have been specified

Unit weight of water = 62.40 (pcf)

Water Surface No. 1 specified by 3 coordinate points

\*\*\*\*\*  
PHREATIC SURFACE,  
\*\*\*\*\*

Point No.	x-water (ft)	y-water (ft)
1	.00	775.00
2	300.00	775.00
3	745.00	797.00

A critical failure surface searching method, using a random technique for generating CIRCULAR surfaces has been specified.

400 trial surfaces will be generated and analyzed.

20 Surfaces initiate from each of 20 points equally spaced along the ground surface between x = 100.0 ft and x = 200.0 ft

Each surface terminates between x = 550.0 ft

and  $x = 650.0$  ft

Unless further limitations were imposed, the minimum elevation  
at which a surface extends is  $y = .0$  ft

15.0 ft line segments define each trial failure surface.

-----  
ANGULAR RESTRICTIONS  
-----

The first segment of each failure surface will be inclined  
within the angular range defined by :

Lower angular limit := -45.0 degrees

Upper angular limit := (slope angle - 5.0) degrees

Factors of safety have been calculated by the :

\*\*\*\*\* SIMPLIFIED BISHOP METHOD \*\*\*\*\*

The most critical circular failure surface  
is specified by 36 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	163.16	844.58
2	178.01	842.44
3	192.90	840.65
4	207.83	839.20
5	222.79	838.10
6	237.77	837.34
7	252.76	836.93
8	267.76	836.86
9	282.76	837.14
10	297.75	837.77
11	312.72	838.74
12	327.66	840.06
13	342.57	841.72
14	357.43	843.72
15	372.25	846.06
16	387.00	848.75
17	401.70	851.78
18	416.31	855.14
19	430.85	858.84
20	445.30	862.87
21	459.65	867.24
22	473.89	871.94
23	488.03	876.96

24	502.04	882.31
25	515.93	887.98
26	529.68	893.97
27	543.29	900.27
28	556.75	906.89
29	570.06	913.81
30	583.20	921.04
31	596.17	928.57
32	608.97	936.40
33	621.58	944.52
34	634.00	952.93
35	646.23	961.63
36	649.10	963.77

\*\*\*\* Simplified BISHOP FOS = 1.766 \*\*\*\*

The following is a summary of the TEN most critical surfaces

Problem Description : DPC Final Cover Slope

	FOS (BISHOP)	Circle Center x-coord (ft)	Circle Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	1.766	263.14	1487.27	650.42	163.16	649.10	3.560E+08
2.	1.772	245.10	1579.89	735.11	184.21	644.14	3.177E+08
3.	1.781	291.69	1377.57	538.73	189.47	631.14	2.805E+08
4.	1.782	277.11	1389.77	560.64	157.89	638.35	3.532E+08
5.	1.786	228.21	1584.42	749.38	142.11	647.53	4.003E+08
6.	1.786	201.38	1697.08	856.23	157.89	639.17	3.588E+08
7.	1.790	222.48	1597.73	761.99	142.11	642.84	3.896E+08
8.	1.790	219.39	1665.49	818.94	184.21	636.06	3.063E+08
9.	1.791	244.31	1492.11	659.28	147.37	633.16	3.638E+08
10.	1.791	233.61	1533.39	689.57	178.95	605.85	2.576E+08

\*\*\* END OF FILE \*\*\*