Run-On and Run-Off Control System Plan

Alma Offsite Disposal Facility
Phase IV Landfill
Alma, Wisconsin

October 2016
Revised October 2021
Revised January 2024

Prepared For:

Dairyland Power Cooperative
3200 East Avenue South
La Crosse, Wisconsin 54601

Prepared By:

TRC
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APPENDICES

REVISION HISTORY

Revision Number	Revision Date	Section Revised	Summary of Revisions
1	10/6/2021	1.2, 2.2, 2.3, 3.0, App. B	5-year periodic revision, revised text and Appendix B
2	10/11/2023	Inserted Section 3	Requirements to meet WDNR standards

1.0 Introduction

1.1 Purpose and Scope

This Run-On and Run-Off Control System Plan (Plan) was prepared by TRC Environmental Corporation (TRC) on behalf of Dairyland Power Cooperative (DPC) for the Alma Offsite Disposal Facility, Phase IV Landfill (Landfill) where coal combustion residuals (CCR) are disposed. The approximately 32.1 acre Landfill is located in Sections 18 and 19, T21N, R12W, Town of Belvidere, Buffalo County, Wisconsin.

This Plan meets the run-on and run-off control system requirements of the United States Environmental Protection Agency's (USEPA) CCR Rule (Title 40 Code of Federal Regulations (CFR) parts 257 Subpart D – "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments"). This text and its accompanying appendices and plan sheets present the plans and specifications of the run-off and run-on control systems of the Landfill. The plan sheets and the text, with its appendices, complement each other and should be reviewed and used as one document.

2.0 Engineering Design Concepts for Controlling Run-On and Run-Off

2.1 General

The Landfill design has been developed to provide environmentally sound CCR disposal. The storm water run-on and run-off control systems for the Landfill have been designed and meet the requirements of 40 CFR 257.81.

The supporting calculations for the run-on and run-off design are referenced throughout the text and are included in the appendices. Details and drawings illustrating design layout and specifications are referenced as applicable and presented on the plan sheets and figures. The majority of the calculations provided in the appendices were prepared during the initial permitting of the Phase IV Disposal Area and included in the October 2000 Plan of Operation (POO) in accordance with Wisconsin Administrative Code, Chapters 500 through 520, and conversations with the Wisconsin Department of Natural Resources (WDNR). Plan sheets included in Appendix C are the relevant plan sheets from the October 2000 POO drawing plan set. For the purposes of this Plan, the terms surface water and storm water have been used interchangeably and reflect precipitation routed over land or temporarily stored to manage run-on and run-off. No streams, wetlands, or bodies of water are located in areas that would impact run-on and run-off at the Landfill.

2.2 Run-On Control System

2.2.1 General

The run-on control system for the Landfill consists of perimeter berms, diversion berms, downslope flumes, ditching, sedimentation basins, and culverts, designed and constructed to control surface water during both the operational and post-closure periods of the Landfill. The design of the surface water controls have been performed for the operational periods when the combination of surface conditions and contributing acreage would result in the greatest run-off volume, and for the post-closure period. Given the location of the site, the surface water management system was designed utilizing the 100-year, 24-hour storm event at the time of the design, which exceeds the current 25-year, 24-hour storm event required by 40 CFR 257.81(a)(1). Calculations for the surface water run-on control designs are included in Appendix A.

The surface water control system design has been performed to meet the following requirements:

- Run-off curve numbers (RCNs) used in the analysis provide a conservative analysis of the potential land uses of the upland areas. Upland areas within the watershed primarily include wooded areas and agricultural lands. The wooded areas are located on the steeper-sloped areas of the valley and are unlikely to be affected by future land uses. High RCNs for the agricultural lands were selected to represent a conservative fallow condition with exposed bare soil. The RCNs selected for these areas were 86.
- Surface water run-on controls have been designed to divert off-site surface water away from the active fill areas. On-site surface water is routed to sedimentation basins, except surface water in contact with active fill areas, which is treated as leachate.

2.2.2 Control of Surrounding Run-On

Surface water from areas west, north, and east of the Landfill currently drain to existing drainage channels that have formed in the valleys near the Landfill. These drainage channels converge at the location of the Landfill, are conveyed around the Landfill by perimeter diversion ditches, and continue to the south in a single drainage ditch. The main drainage ditch then routes the water to the south for approximately 1.5 miles before discharging into the Mississippi River (see Plan Sheet 5 in Appendix C).

Diversion ditches are designed to route off-site surface water around the Landfill in a controlled manner. These ditches are constructed in phases as the Landfill is developed.

During previous construction events, the perimeter drainage ditch along the eastern, western, and northern sides of the Landfill were constructed to route storm water from the east, west, and north around the Landfill. Cells 1, 2, and 3 of the Landfill have been constructed (see Plan Sheet 9 in Appendix C). A temporary drainage ditch/diversion berm was constructed on the northwestern side of the Landfill to route surface water from areas northwest of the Landfill around the Landfill. During Cell 4, Module B development, the remaining surface water controls will be completed (see Plan Sheets 11 and 12 in Appendix C).

Temporary and permanent ditching and diversion berms were designed and constructed to manage the peak flows associated with the 100-year, 24-hour storm event.

2.2.3 Diversion Berms

Diversion berms are designed along the final cover system to collect and transfer surface water to the receiving downslope flume or sedimentation basin (see Detail 2 on Plan Sheet 19 in Appendix C). These diversion berms concentrate and control flow, and discharge the non-contact surface water (water that has not come into contact with the CCR) from the Landfill away from the final cover. The swales created by the diversion berms are designed at 2 percent typical slopes along the flow lines. The locations of the surface water diversion berms are shown on Plan Sheet 12 in Appendix C.

Drainage areas for the Landfill are defined by the proposed surface water diversion berms at the site. Run-off computations were performed for the site with the proposed diversion berms in-place and are contained in Appendix A. Figure K-2 in Appendix A shows the post-closure drainage areas for the Landfill.

2.2.4 Downslope Flumes

Downslope flumes are included in the design to collect and transfer surface water from the diversion berms on the final cover to the sedimentation basins. Plan Sheet 12 shows the location of the downslope flumes. The downslope flumes have been designed as enclosed pipe flumes to limit erosion and to control the flow as it crosses roads. Downslope flume calculations are included in the culvert design subsection of Appendix A.

2.2.5 Ditching

Surface water ditching has been designed to minimize velocities and depths of flow. Velocities for the grass-lined ditching have been limited to 4 feet per second (fps). In areas where velocities exceed 4 fps, permanent erosion matting, or grouted riprap are used to limit erosion and reduce velocities. Ditch sizing calculations are contained in Appendix A. Designed ditch locations are shown on Figure K-3 in Appendix A. The ditching to route surface water around the Landfill and away from the active areas of the Landfill are designed at a minimum 2-foot depth as shown on Detail 8 on Plan Sheet 23 in Appendix A. Ditch sizing calculations for operational and post-closure conditions show that a minimum freeboard of 0.4 feet occurs as the worst case condition in the ditches for the 100-year 24-hour storm event. Therefore, the calculations indicate that run-on to the active areas of the Landfill should not occur for the 25-year 24-hour storm event as required by 40 CFR 257.81(a)(1).

2.2.6 Sedimentation Basins

Two permanent sedimentation basins are designed to capture and treat non-contact run-off from the Landfill final cover system. The locations of the permanent sedimentation basins are shown on Plan Sheet 5 in Appendix C. The basins have been designed with a minimum surface area that exceeds the surface area required to settle 0.015 mm particles. The sedimentation basins are designed to accommodate the surface water run-off from a 100-year, 24-hour storm event. The emergency spillways are designed to control the run-off from a storm greater than the 100-year, 24-hour storm event.

2.2.7 Culverts

Several culverts are designed to transport non-contact run-off from the Landfill final cover and surrounding areas. The locations of the permanent culverts are shown on Plan Sheet 12 in Appendix C. The culverts have been designed to allow the peak run-off associated with a 100-year, 24-hour storm to pass through it without creating surface water breaching (i.e., berm overflow and run-on into active areas of the Landfill) or excessive backwater levels. Culvert sizing was performed using design charts developed by the U.S. Department of Transportation Federal Highway Administration. Culvert sizing calculations are provided in Appendix A.

2.2.8 Temporary Surface Water Controls

In addition to the permanent surface water management features discussed above, temporary surface water controls are also implemented during operation of the Landfill to control surface water from entering the active disposal area and to limit erosion of the final cover. These temporary control features include diversion berms, downslope discharge structure, and culverts. Temporary diversion berms will be constructed as needed along the transition from an active area to an area that has reached final grade, or that has intermediate cover, in order to control surface water from entering the active area. Temporary downslope discharge structures will be used to route non-contact run-off from diversion berms (either temporary or permanent) to the perimeter ditches.

2.3 Run-Off Control System

2.3.1 General

The leachate collection and handling system in conjunction with cell delineation berms (see detail 5 on Plan Sheet 17 in Appendix C) and perimeter berms comprise the control system for preventing contact surface water run-off from the active portions of the Landfill. Contact surface water is managed as leachate. The leachate collection system for the Landfill has been designed to provide effective drainage, collection, and removal of leachate from the Landfill.

2.3.2 Leachate Collection System

The primary components of the leachate collection system consist of a drainage layer, leachate collection and transfer piping, cleanouts, manholes, a storage tank, and a load-out facility. The leachate collection system layout is shown on Plan Sheet 5 in Appendix C. The drainage layer is placed over the geomembrane on the base and sidewalls. The drainage layer promotes the efficient transmission of leachate to the leachate collection trenches and pipes. The drainage layer is a minimum of 12 inches thick and has a minimum hydraulic conductivity of 1.0×10^{-2} centimeters per second (cm/s).

The leachate collection piping is placed in vee-shaped trenches and consists of 6-inch–diameter perforated high density polyethylene (HDPE) pipe. Pipe bedding material is placed around the perforated pipe and mounded as shown on Plan Sheet 17 in Appendix C.

Leachate collection pipes in each cell are placed parallel to each other in valleys over the herringbone design across the base. These lines drain at a 4 to 6 percent slope to the leachate removal and transfer system.

Temporary cell delineation berms are used along the cell boundaries to control surface water run-off from exiting the active areas of the Landfill. Refer to Detail 5 on Plan Sheet 17 for further details on the temporary cell delineation berm design.

2.3.3 Leachate Removal and Transfer System

The perforated leachate collection piping will transition to 6-inch–diameter nonperforated leachate transfer piping within the Landfill just prior to where the transfer piping penetrates the liner system at the southern toe-of-slope of each cell. The horizontal pipe penetration has been designed to prevent leachate from leaving the Landfill liner system through the liner penetration.

Outside of the limits of CCR, concrete manholes provide a location for transfer piping to manifold into a single perimeter transfer pipe around the southern end of the Landfill, and to provide a location for cleanout access piping.

The combined transfer piping then extends to the leachate storage tank located near the ash processing facility. Leachate collected in the tank is pumped into tanker trucks and transported to a nearby wastewater treatment plan for treatment which complies with 40 CFR 257.81(b). Plan Sheet 5 illustrates the location of the transfer piping, manholes, and the storage tank.

2.3.4 Leachate Storage Capacity From a 25-Year 24-Hour Storm Event

The proposed phasing plans and existing conditions were reviewed to determine the worst-case scenario for leachate generation. This worst-case scenario was used to show that run-off from the active area of the Landfill would not occur from a 25-year 24-hour storm event. Calculations contained in Appendix B show that there is approximately 14,700 cubic feet of leachate storage capacity remaining in the leachate collection system after a 25-year 24-hour storm event. Therefore, sufficient infrastructure is provided to prevent run-off from the active area of the Landfill as required by 40 CFR 257.81(a)(2).

2.3.5 Conclusions

This Plan has demonstrated that the Landfill has a run-on control system and a run-off control system sufficient to prevent flow onto or off of the active portion during a 24-hour 25-year storm event. The Landfill is in compliance with the requirements of 40 CFR 257.81.

3.0 Construction of Run-on and Run-off Control System

3.1 Run-on Control Systems

As noted in Section 2.2, the run-on control system consists of perimeter berms, diversion berms, downslope flumes, ditching, sedimentation basins, and culverts. Run-on controls have been designed to divert off-site surface water away from the active fill areas. On-site water is routed to sedimentation basins, except surface water in contact with active fill areas which is treated as leachate.

As summarized in Section 2.2.2, the run-on features are constructed incrementally during both the liner construction and final cover construction events. The previously constructed features were constructed per the site specifications with construction oversight directed by a professional engineer licensed in the State of Wisconsin. Documentation reports for construction events at the Landfill were prepared, submitted to the WDNR, and approved by the WDNR.

Temporary systems are used at the limits of the construction event to assist in the run-on control system until the remainder of the components are completed. The remainder of the run-on control system components will be completed during development of Cell 4B and following its closure. Specific schedules of exactly when features will be developed is not practicable, as the development and closure of the Landfill is dependent on filling activities, which are highly variable. Future construction will meet the previously approved design and specifications as noted in the October 2000 Plan of Operation, and construction oversight will be directed by a professional engineer licensed in the State of Wisconsin.

3.2 Run-off Control Systems

As noted in Section 2.3, the run-off control system consists of the leachate collection system in conjunction with cell delineation berms and perimeter berms. The previously constructed features for the active area were constructed during the liner installation of the associated module/cell. The remaining portions of the run-off control system will be constructed during the construction events for Cells 4A and 4B. The general placement of the leachate collection system is summarized in Section 2.3.2 and is detailed in the approved October 2000 Plan of Operation.

Previous and future construction have been/will be completed in accordance with the site specifications and design, as shown in Appendix C. Construction oversight has/will be directed by a professional engineer licensed in the State of Wisconsin. Documentation reports for previous construction events have been prepared, submitted to the WDNR, and previously approved by the WDNR. Following construction of future landfill cells/modules, reports documenting construction will be prepared and submitted to the WDNR as required by ch. NR 516.

4.0 Amendment of the Plan and Notification

This Plan was been completed in compliance with the requirements set forth in 40 CFR 257.81. This document has been placed in the operating record, posted to the publicly accessible website, and government notifications have been provided.

A Run-On and Run-Off Control System Plan must be prepared every 5 years from the completion date of this Plan.

The Plan must be amended whenever the periodic review period is reached or if changes in site conditions, either intentionally or unintentionally, occur that will sustainably impact the current written plan in effect.

5.0 Engineer's Certification

Pursuant to 40 CFR 257.81 and by means of this certification I attest that:

(i) I am familiar with the requirements of the federal CCR rule (40 CFR 257);

(ii) this Run-On and Run-Off Control System Plan has been prepared in accordance with good engineering practice; and

(iii) this Run-On and Run-Off Control System Plan meets the requirements of 40 CFR 257.81(c).

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.

Breanne N. Kahnk

Signature of Registered Professional Engineer

Registration No. E-46825 State: Wisconsin

BREANNE N. KAHNK
E-46825
MIDDLETON, WI
1/17/24

Appendix A: Surface Water Run-On Control System Calculations

Note: For clarification purposes, these run-on calculations estimate "run-off" quantities from areas in and surrounding the Landfill that develop non-contact surface water that is managed to prevent run-on to the active Landfill areas.

- Surface Water Run-off Calculations
  - Purpose/Methodology/Assumptions/Results/References
  - Post-closure Run-off Calculations
  - Operational Run-off Calculations
  - Reference Information
- Diversion Berm, Perimeter Ditch, and Spillway Design Calculations
  - Purpose/Methodology/Assumptions/Results/References
  - Calculations – Post-closure Landfill Conditions
  - Calculations – Operational Landfill Conditions
  - Reference Information
- Culvert/Downslope Flume Design Calculations
  - Purpose/Methodology/Assumptions/Results/References
  - Calculations – Post-closure Landfill Conditions
  - Calculations – Temporary Culverts, Operational Conditions
- Vegetation Information

Surface Water Run-off Calculations

Purpose/Methodology/Assumptions/Results/References

PROJECT/PROPOSAL NAME	PREPARED		CHECKED		PROJECT/PROPOSAL NO.
	By:	Date:	By:	Date:	
Dairyland Power Cooperative	BJK	5/97	BLP	6/97	3081.40

SURFACE WATER RUNOFF CALCULATIONS

Purpose

The purpose of the surface water runoff calculations was to estimate the amount of surface water runoff and the peak discharge for the 25-year, 24-hour and 100-year, 24-hour storms at the proposed Dairyland Power Landfill. Calculations were performed for the pre- and post-development conditions. Calculations were also performed for operational conditions for the 25-year, 24-hour storm. Once determined, the surface water runoff quantities were compared to determine the effect of the proposed landfill on the existing drainage patterns. The runoff calculations were also used to size diversion ditches, sedimentation basins, culverts, and downslope flumes.

Methodologies

Surface water runoff calculations consist of delineating drainage areas (watersheds), as shown on the attached figures, estimating runoff characteristics, and calculating the peak and total runoff rate and volume for each drainage area. The methods for computing surface water runoff were based on the methodologies presented in the Technical Release No. 55 - "Urban Hydrology for Small Watersheds" by the United States Soil Conservation Service.

The calculations were performed using the QUICK TR-55 computer program developed by Haestad Methods (Haestad 1989). The program incorporates rainfall quantities, storm distributions, surface runoff characteristics, drainage areas, times of concentration, and travel times to generate a hydrograph from which the volume of surface water runoff and the peak discharge are obtained.

It is noted that the storm water control structures have been designed using a 100-year, 24-hour storm event and a TR-55 Type II storm distribution to determine peak flow rates. Rainfall distributions for the Type II storm event include "nested" higher intensity storm events within those needed for longer durations at the same probability. The resulting peak flows using this design method meet or exceed the peak flows obtained using a 25-year, time of concentration storm event (required by NR 504.09).

PROJECT/PROPOSAL NAME	PREPARED		CHECKED		PROJECT/PROPOSAL NO.
	By:	Date:	By:	Date:	
Dairyland Power Cooperative	BJK	5/97	BLP	6/97	3081.40

Assumptions

The following assumptions were made in developing the hydrographs (Note: The figures and values referenced in these assumptions have been included in the references portion of this appendix):

- A 2-year, 24-hour storm event in the vicinity of the landfill is 2.8 inches based on rainfall maps prepared by the U.S. Weather Bureau.
- A 25-year, 24-hour storm event in the vicinity of the landfill equates to 4.9 inches based on rainfall maps prepared by the U.S. Weather Bureau.
- A 100-year, 24-hour storm event in the vicinity of the landfill equates to 6.1 inches based on rainfall maps prepared by the U.S. Weather Bureau.
- A Type II rainfall distribution was used, based on SCS storm distribution maps provided in the TR-55 manual.
- Cover types for the pre-development conditions, from which runoff curve numbers were determined, were based on USGS topographic maps and an aerial photograph.
- For the post-development landfill conditions, a runoff curve number of 74 was assumed, based on values provided in the TR-55 manual.
- Based on the USDA-SCS General Soil Map for Buffalo County, Wisconsin, the primary soil formations present include the Dubuque silt loam and the Fayette silt loam. These soils are a Type B soil, based on tables provided in the TR-55 manual.
- Runoff curve numbers for the non-landfill areas ranged from 55 to 86, based on values provided in the TR-55 manual. Refer to the attached calculations for the breakdown and description of each of the curve numbers used for the various drainage areas.

Results

The table below summarizes the results of the surface water runoff analyses and provides a comparison of the pre- and post-development conditions:

STORM	TOTAL RUNOFF (acre-ft)			PEAK DISCHARGE (cfs)		
	PRE-	POST-	Δ	PRE-	POST-	Δ
25-year	153	148	(5)	1,170	1,028	(142)
100-year	232	225	(7)	1,895	1,622	(273)

Based on the results of the surface water runoff calculations, the proposed landfill is not anticipated to have an adverse impact on the existing surface water at the site. Total runoff volumes to the existing drainageways are not anticipated to change in the pre- and post-development conditions. Peak runoff volumes to the existing drainageways for post-

PROJECT/PROPOSAL NAME	PREPARED		CHECKED		PROJECT/PROPOSAL NO.
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development conditions are slightly lower than the pre-development conditions. This is primarily due to the use of sedimentation basins to dissipate peak flows from the landfill to the surrounding areas. The reduced peak flows will result in reduced sediment transport from the site.

The results of these surface water runoff calculations have also been used in the attached diversion berm, perimeter ditch, spillway, and sedimentation basin calculations. These structures have been designed to handle the peak runoff from the 100-year, 24-hour storm event.

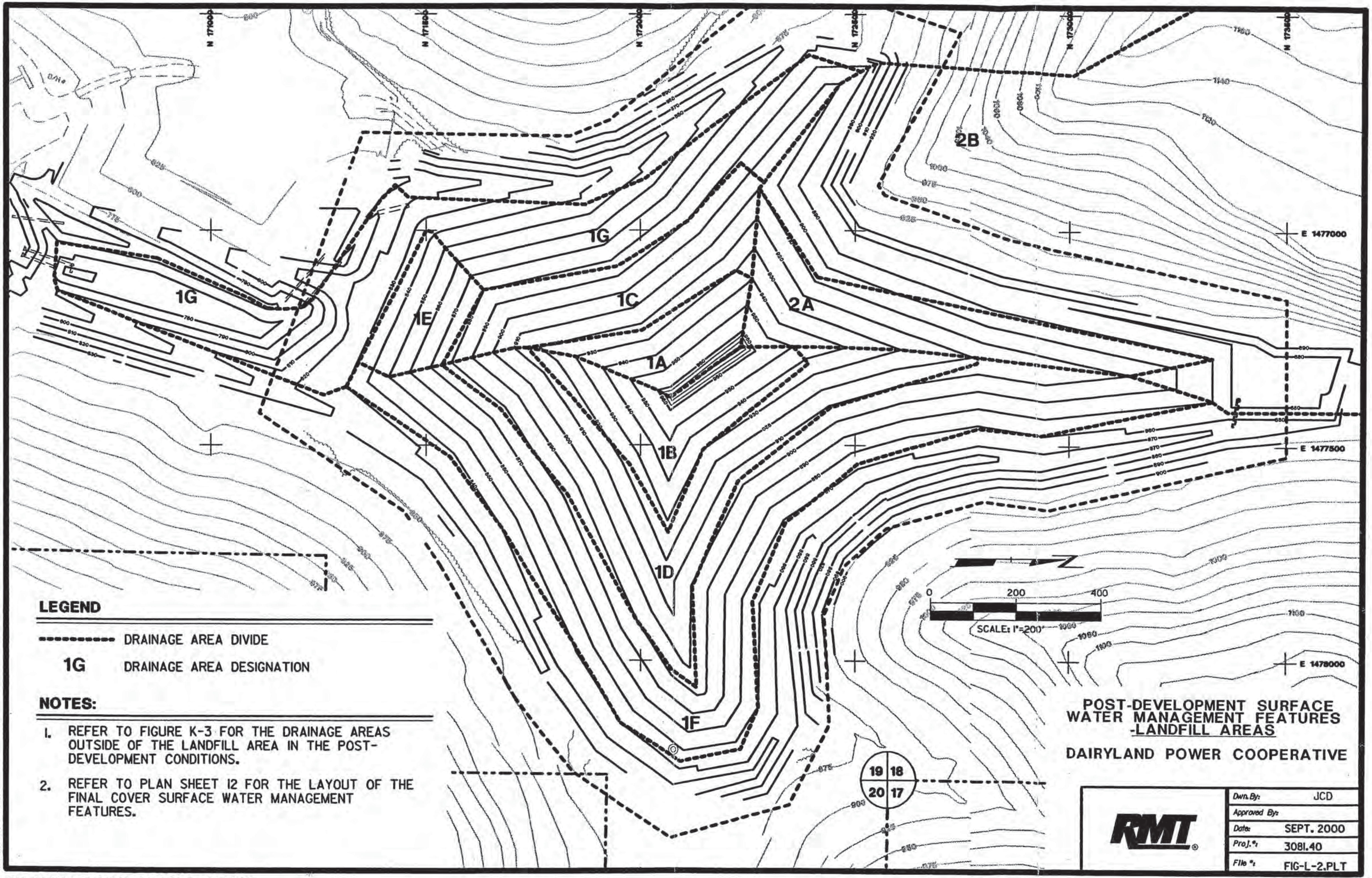
References

US Department of Agriculture, Soil Conservation Service. Urban Hydrology for Small Watersheds. Technical Release No. 55. 2nd Edition. June 1986.

US Department of Agriculture, Soil Conservation Service. 1986. Engineering Field Manual for Conservation Practices. November 1986.

Haestad Methods. Pond Pack, QUICK TR-55. Hydrology for Small Watersheds. December 1989.

Post-closure Run-off Calculations



LEGEND

DRAINAGE AREA DIVIDE

1G DRAINAGE AREA DESIGNATION

NOTES:

1. REFER TO FIGURE K-3 FOR THE DRAINAGE AREAS OUTSIDE OF THE LANDFILL AREA IN THE POST-DEVELOPMENT CONDITIONS.
2. REFER TO PLAN SHEET 12 FOR THE LAYOUT OF THE FINAL COVER SURFACE WATER MANAGEMENT FEATURES.

POST-DEVELOPMENT SURFACE WATER MANAGEMENT FEATURES -LANDFILL AREAS

DAIRYLAND POWER COOPERATIVE

RMT

Dwn. By:	JCD
Approved By:	
Date:	SEPT. 2000
Proj.#:	3081.40
File #:	FIG-L-2.PLT

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Pen Table = DNET\TBL\default.tbl
Levels On = 1-63

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Ref. File 2 = bmrmt.dgn
Ref. File 3 = proposed.dgn
Ref. File 4 = surface.dgn

(1) 4-6,9,10,12,21,23,24,26-28,32,34,40,43,45,54,55,57,61
(2) 1-16
(3) 33,45-50
(4) 2,3,14-16

RMT COMPUTER AIDED DESIGN & DRAFTING

FIGURE K-2

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Quick TR-55 Ver.5.46   S/N:
Executed: 09:52:46   04-09-1997



                     Dairyland Power Coop.
                      Feasibility Report
                       Landfill Runoff
                           BJK 3/97


                   RUNOFF CURVE NUMBER SUMMARY
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::


              Subarea           Area          CN
            Description        (acres)    (weighted)
           -------------      ---------  ------------
           1A                      1.40       74
           1B                      2.20       74
           1C                      2.90       74
           1D                      5.30       74
           1E                      1.20       74
           1F                      9.50       74
           1G                      7.40       84
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✓ BJB
6/13/97

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Quick TR-55 Ver.5.46   S/N:
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                     Dairyland Power Coop.
                      Feasibility Report
                       Landfill Runoff
                          BJK 3/97


                   RUNOFF CURVE NUMBER DATA
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::


Composite Area: 1A


                                          AREA      CN
       SURFACE DESCRIPTION               (acres)
    --------------------------------    ---------  ----
    Landfill Cover                          1.40    74  ✓

             COMPOSITE AREA --->            1.40    74.0  ( 74 )
    ::::::::::::::::::::::::::::::::::::::::::::::::::::::


Composite Area: 1B


                                          AREA      CN
       SURFACE DESCRIPTION               (acres)
    --------------------------------    ---------  ----
    Landfill Cover                          2.20    74  ✓

             COMPOSITE AREA --->            2.20    74.0  ( 74 )
    ::::::::::::::::::::::::::::::::::::::::::::::::::::::


Composite Area: 1C


                                          AREA      CN
       SURFACE DESCRIPTION               (acres)
    --------------------------------    ---------  ----
    Landfill Cover                          2.90    74  ✓

             COMPOSITE AREA --->            2.90    74.0  ( 74 )
    ::::::::::::::::::::::::::::::::::::::::::::::::::::::
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✓ BLG 6/13/97

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Composite Area: 1D


                                        AREA       CN
      SURFACE DESCRIPTION             (acres)
--------------------------------     ---------    ----
Landfill Cover                            5.30     74  ✓

            COMPOSITE AREA --->           5.30     74.0   ( 74 )
:::::::::::::::::::::::::::::::::::::::::::::::::::::


Composite Area: 1E


                                        AREA       CN
      SURFACE DESCRIPTION             (acres)
--------------------------------     ---------    ----
Landfill Cover                            1.20     74  ✓

            COMPOSITE AREA --->           1.20     74.0   ( 74 )
:::::::::::::::::::::::::::::::::::::::::::::::::::::


Composite Area: 1F


                                        AREA       CN
      SURFACE DESCRIPTION             (acres)
--------------------------------     ---------    ----
Landfill Cover                            9.50     74  ✓

            COMPOSITE AREA --->           9.50     74.0   ( 74 )
:::::::::::::::::::::::::::::::::::::::::::::::::::::


Composite Area: 1G


                                        AREA       CN
      SURFACE DESCRIPTION             (acres)
--------------------------------     ---------    ----
Landfill Cover                            4.40     74 ✓
Sedimentation Basin                       3.00     98 ✓

            COMPOSITE AREA --->           7.40     83.7   ( 84 )
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Quick TR-55 Ver.5.46   S/N:
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                   Dairyland Power Coop.
                    Feasibility Report
                     Landfill Runoff
                        BJK 3/97


                RUNOFF CURVE NUMBER SUMMARY
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::


            Subarea          Area        CN
          Description      (acres)   (weighted)
          -------------    ---------  ------------
          2A                  2.70        74
          2B                 21.50        69
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Quick TR-55 Ver.5.46   S/N:
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✓ BLG
6/13/97

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                    Dairyland Power Coop.
                     Feasibility Report
                      Landfill Runoff
                         BJK 3/97


                  RUNOFF CURVE NUMBER DATA
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::


Composite Area: 2A


                                              AREA      CN
          SURFACE DESCRIPTION               (acres)
      -------------------------------     ---------    ----
      Landfill Cover                           2.70     74  ✓

                COMPOSITE AREA --->            2.70     74.0   ( 74 )
      ::::::::::::::::::::::::::::::::::::::::::::::::::::::


Composite Area: 2B


                                              AREA      CN
          SURFACE DESCRIPTION               (acres)
      -------------------------------     ---------    ----
      Landfill Cover                           2.70     74 ✓
      Graded/Grassed Area                      2.00     61 ✓
      Woods/Brush                             15.80     67 ✓
      Sedimentation Basin                      1.00     98 ✓

                COMPOSITE AREA --->           21.50     68.8   ( 69 )
      ::::::::::::::::::::::::::::::::::::::::::::::::::::::
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Quick TR-55 Ver.5.46   S/N:
Executed: 08:55:25   06-18-1997    a:COVER1.TCT



                  SUMMARY SHEET FOR Tc or Tt COMPUTATIONS
                   (Solved for Time using TR-55 Methods)


                          Dairyland Power Coop.
                           Feasibility Report
                          Landfill Final Cover
                               BJK 3/97


                 Subarea descr.  Tc or Tt   Time (hrs)
                 --------------  --------   ----------
                 1A                 Tc         0.18
                 1B                 Tc         0.23
                 1C                 Tc         0.23
                 1D                 Tc         0.35
                 1E                 Tc         0.18
                 1F                 Tc         0.45
                 1G                 Tc         0.22
```

✓ BAG
6/13/97

```
Quick TR-55 Ver.5.46   S/N:
Executed: 09:48:41   04-09-1997    a:COVER1.TCT

                          Dairyland Power Coop.
                           Feasibility Report
                          Landfill Final Cover
                               BJK 3/97

                     Tc COMPUTATIONS FOR: 1A

 SHEET FLOW (Applicable to Tc only)
    Segment ID                                    1
    Surface description                     Dense Grass
    Manning's roughness coeff., n                0.2400 ✓
    Flow length, L (total < or = 300)    ft     150.0 ✓
    Two-yr 24-hr rainfall, P2            in     2.800
    Land slope, s                       ft/ft   0.2500 ✓
                    0.8
        .007 * (n*L)
    T = --------------                  hrs      0.13              = 0.13
           0.5    0.4
         P2    *  s

 SHALLOW CONCENTRATED FLOW
    Segment ID                                    2
    Surface (paved or unpaved)?                 Unpaved
    Flow length, L                       ft     420.0 ✓
    Watercourse slope, s                ft/ft   0.0200 ✓

                     0.5
    Avg.V =  Csf *  (s)                 ft/s   2.2818
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                    hrs      0.05              = 0.05


 CHANNEL FLOW
    Segment ID
    Cross Sectional Flow Area, a      sq.ft     0.00
    Wetted perimeter, Pw                 ft     0.00
    Hydraulic radius, r = a/Pw           ft     0.000
    Channel slope, s                   ft/ft   0.0000
    Manning's roughness coeff., n              0.0000

                 2/3    1/2
        1.49  *  r   *  s
    V = --------------------           ft/s   0.0000
                 n

    Flow length, L                       ft        0

    T = L / (3600*V)                    hrs      0.00              = 0.00

  ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                          TOTAL TIME (hrs)          0.18
```

✓ BLG
6/13/97

```
Quick TR-55 Ver.5.46   S/N:
Executed: 09:48:41   04-09-1997    a:COVER1.TCT

                         Dairyland Power Coop.
                          Feasibility Report
                         Landfill Final Cover
                               BJK 3/97

                     Tc COMPUTATIONS FOR: 1B

 SHEET FLOW (Applicable to Tc only)
    Segment ID                                     1
    Surface description                      Dense Grass
    Manning's roughness coeff., n                0.2400
    Flow length, L (total < or = 300)   ft      125.0
    Two-yr 24-hr rainfall, P2           in      2.800
    Land slope, s                      ft/ft   0.2500
                        0.8
        .007 * (n*L)
    T = --------------                  hrs     0.11              = 0.11
            0.5    0.4
          P2   *  s

 SHALLOW CONCENTRATED FLOW
    Segment ID                                    2
    Surface (paved or unpaved)?                 Unpaved
    Flow length, L                       ft     960.0
    Watercourse slope, s               ft/ft   0.0200

                         0.5
    Avg.V =  Csf *  (s)                ft/s   2.2818
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                    hrs     0.12              = 0.12


 CHANNEL FLOW
    Segment ID
    Cross Sectional Flow Area, a      sq.ft     0.00
    Wetted perimeter, Pw                 ft     0.00
    Hydraulic radius, r = a/Pw           ft    0.000
    Channel slope, s                   ft/ft   0.0000
    Manning's roughness coeff., n              0.0000

                   2/3    1/2
         1.49  *  r   *  s
    V = --------------------           ft/s   0.0000
                   n

    Flow length, L                       ft        0

    T = L / (3600*V)                    hrs     0.00              = 0.00

   ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                             TOTAL TIME (hrs)       0.23
```

✓ 6/13/97

```
Quick TR-55 Ver.5.46   S/N:
Executed: 09:48:41   04-09-1997    a:COVER1.TCT

                              Dairyland Power Coop.
                               Feasibility Report
                              Landfill Final Cover
                                    BJK 3/97

                         Tc COMPUTATIONS FOR: 1C

 SHEET FLOW (Applicable to Tc only)
    Segment ID                                      1
    Surface description                        Dense Grass
    Manning's roughness coeff., n                  0.2400
    Flow length, L (total < or = 300)     ft      165.0
    Two-yr 24-hr rainfall, P2             in      2.800
    Land slope, s                       ft/ft     0.2500
                     0.8
        .007 * (n*L)
    T =  ------------                   hrs       0.14              =  0.14
            0.5    0.4
          P2    *  s

 SHALLOW CONCENTRATED FLOW
    Segment ID                                     2
    Surface (paved or unpaved)?                    Unpaved
    Flow length, L                        ft      720.0
    Watercourse slope, s                ft/ft     0.0200

                      0.5
    Avg.V =  Csf *  (s)                 ft/s    2.2818
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                    hrs       0.09              =  0.09


 CHANNEL FLOW
    Segment ID
    Cross Sectional Flow Area, a       sq.ft      0.00
    Wetted perimeter, Pw                  ft      0.00
    Hydraulic radius, r = a/Pw            ft      0.000
    Channel slope, s                    ft/ft     0.0000
    Manning's roughness coeff., n                 0.0000

                   2/3    1/2
        1.49  *  r    *  s
    V =  -------------------            ft/s    0.0000
                   n

    Flow length, L                        ft         0

    T = L / (3600*V)                    hrs       0.00              =  0.00

 ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                             TOTAL TIME (hrs)        0.23
```

✓
6/13/97

```
Quick TR-55 Ver.5.46   S/N:
Executed: 08:55:25   06-18-1997    a:COVER1.TCT

                         Dairyland Power Coop.
                          Feasibility Report
                         Landfill Final Cover
                              BJK 3/97

                     Tc COMPUTATIONS FOR: 1D

 SHEET FLOW (Applicable to Tc only)
    Segment ID                                    1
    Surface description                    Dense Grass
    Manning's roughness coeff., n               0.2400
    Flow length, L (total < or = 300)   ft     160.0 ✓
    Two-yr 24-hr rainfall, P2            in     2.800
    Land slope, s                      ft/ft   0.2500 ✓
                     0.8
        .007 * (n*L)
    T = --------------                  hrs      0.13          = 0.13
            0.5   0.4
         P2   *  s

 SHALLOW CONCENTRATED FLOW
    Segment ID                                    2
    Surface (paved or unpaved)?                Unpaved
    Flow length, L                       ft     1770.0 ✓
    Watercourse slope, s               ft/ft   0.0200 ✓

                      0.5
    Avg.V =  Csf *  (s)                ft/s   2.2818
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                    hrs      0.22          = 0.22


 CHANNEL FLOW
    Segment ID
    Cross Sectional Flow Area, a       sq.ft     0.00
    Wetted perimeter, Pw                  ft     0.00
    Hydraulic radius, r = a/Pw            ft    0.000
    Channel slope, s                   ft/ft   0.0000
    Manning's roughness coeff., n              0.0000

                   2/3    1/2
        1.49  *  r   *  s
    V = --------------------           ft/s   0.0000
                   n

    Flow length, L                        ft        0

    T = L / (3600*V)                    hrs      0.00          = 0.00

  ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                        TOTAL TIME (hrs)        0.35
```

✓ BLB
6/13/97

```
Quick TR-55 Ver.5.46   S/N:
Executed: 08:55:25   06-18-1997    a:COVER1.TCT

                              Dairyland Power Coop.
                               Feasibility Report
                              Landfill Final Cover
                                   BJK 3/97

                         Tc COMPUTATIONS FOR: 1E

 SHEET FLOW (Applicable to Tc only)
    Segment ID                                     1
    Surface description                      Dense Grass
    Manning's roughness coeff., n                 0.2400
    Flow length, L (total < or = 300)   ft       175.0 ✓
    Two-yr 24-hr rainfall, P2           in        2.800
    Land slope, s                     ft/ft      0.2500 ✓
                        0.8
       .007 * (n*L)
    T = --------------                 hrs        0.14              = 0.14
          0.5    0.4
        P2   *  s

 SHALLOW CONCENTRATED FLOW
    Segment ID                                     2
    Surface (paved or unpaved)?                Unpaved
    Flow length, L                      ft       250.0 ✓
    Watercourse slope, s              ft/ft      0.0200 ✓

                        0.5
    Avg.V =  Csf *  (s)               ft/s      2.2818
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                  hrs        0.03               = 0.03


 CHANNEL FLOW
    Segment ID
    Cross Sectional Flow Area, a     sq.ft      0.00
    Wetted perimeter, Pw               ft       0.00
    Hydraulic radius, r = a/Pw         ft      0.000
    Channel slope, s                 ft/ft     0.0000
    Manning's roughness coeff., n              0.0000

                  2/3   1/2
       1.49  *  r   *  s
    V = --------------------          ft/s     0.0000
                  n

    Flow length, L                     ft          0

    T = L / (3600*V)                  hrs       0.00               = 0.00

 :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                         TOTAL TIME (hrs)          0.18
```

√ 6/13/97

```
Quick TR-55 Ver.5.46   S/N:
Executed: 09:48:41   04-09-1997    a:COVER1.TCT

                              Dairyland Power Coop.
                               Feasibility Report
                              Landfill Final Cover
                                   BJK 3/97

                         Tc COMPUTATIONS FOR: 1F

SHEET FLOW (Applicable to Tc only)
    Segment ID                                      1
    Surface description                     Dense Grass
    Manning's roughness coeff., n                0.2400
    Flow length, L (total < or = 300)     ft    150.0  ✓
    Two-yr 24-hr rainfall, P2             in    2.800
    Land slope, s                       ft/ft  0.2500  ✓
                          0.8
         .007 * (n*L)
    T = --------------                    hrs     0.13              = 0.13
            0.5    0.4
         P2   *   s

SHALLOW CONCENTRATED FLOW
    Segment ID                                     2
    Surface (paved or unpaved)?                   Unpaved
    Flow length, L                         ft    2650.0  ✓
    Watercourse slope, s                 ft/ft   0.0200  ✓

                           0.5
   Avg.V =  Csf *  (s)                   ft/s   2.2818
   where:   Unpaved Csf = 16.1345
            Paved   Csf = 20.3282

   T = L / (3600*V)                      hrs     0.32               = 0.32


CHANNEL FLOW
    Segment ID
    Cross Sectional Flow Area, a       sq.ft     0.00
    Wetted perimeter, Pw                  ft     0.00
    Hydraulic radius, r = a/Pw            ft     0.000
    Channel slope, s                    ft/ft    0.0000
    Manning's roughness coeff., n               0.0000

                  2/3    1/2
       1.49  *  r   *  s
   V = --------------------              ft/s   0.0000
                  n

   Flow length, L                         ft        0

   T = L / (3600*V)                      hrs     0.00               = 0.00

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                           TOTAL TIME (hrs)         0.45
```

✓BLG
6/13/97

```
Quick TR-55 Ver.5.46   S/N:
Executed: 09:48:41   04-09-1997    a:COVER1.TCT

                        Dairyland Power Coop.
                         Feasibility Report
                        Landfill Final Cover
                              BJK 3/97

                    Tc COMPUTATIONS FOR: 1G

 SHEET FLOW (Applicable to Tc only)
    Segment ID                                    1
    Surface description                     Dense Grass
    Manning's roughness coeff., n               0.2400
    Flow length, L (total < or = 300)    ft     170.0
    Two-yr 24-hr rainfall, P2            in     2.800
    Land slope, s                       ft/ft   0.2500
                    0.8
        .007 * (n*L)
    T = --------------                  hrs      0.14             = 0.14
           0.5    0.4
         P2   *  s

SHALLOW CONCENTRATED FLOW
    Segment ID                                  2         3
    Surface (paved or unpaved)?              Unpaved   Unpaved
    Flow length, L                       ft    780.0     370.0
    Watercourse slope, s                ft/ft  0.0600    0.0800

                         0.5
    Avg.V =  Csf *  (s)                 ft/s  3.9521    4.5635
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                    hrs     0.05  +   0.02    = 0.08


CHANNEL FLOW
    Segment ID
    Cross Sectional Flow Area, a       sq.ft     0.00
    Wetted perimeter, Pw                  ft     0.00
    Hydraulic radius, r = a/Pw            ft    0.000
    Channel slope, s                   ft/ft   0.0000
    Manning's roughness coeff., n              0.0000

                   2/3    1/2
        1.49  *  r    *  s
    V = --------------------           ft/s   0.0000
                  n

    Flow length, L                        ft        0

    T = L / (3600*V)                     hrs     0.00             = 0.00

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                           TOTAL TIME (hrs)        0.22
```

```
Quick TR-55 Ver.5.46   S/N:
Executed: 08:57:44   06-18-1997    a:COVER2.TCT


                SUMMARY SHEET FOR Tc or Tt COMPUTATIONS
                 (Solved for Time using TR-55 Methods)


                        Dairyland Power Coop.
                         Feasibility Report
                        Landfill Final Cover
                              BJK 3/97


                Subarea descr.  Tc or Tt   Time (hrs)
                --------------  --------   ----------
                2A                 Tc         0.28
                2B                 Tc         0.18
```

✓ 6/13/97

```
Quick TR-55 Ver.5.46   S/N:
Executed: 08:57:44   06-18-1997    a:COVER2.TCT

                       Dairyland Power Coop.
                        Feasibility Report
                       Landfill Final Cover
                            BJK 3/97

                   Tc COMPUTATIONS FOR: 2A

SHEET FLOW (Applicable to Tc only)
    Segment ID                                  1
    Surface description                    Dense Grass
    Manning's roughness coeff., n              0.2400
    Flow length, L (total < or = 300)   ft    200.0  ✓
    Two-yr 24-hr rainfall, P2           in    2.800
    Land slope, s                     ft/ft   0.2500  ✓
                     0.8
        .007 * (n*L)
    T = --------------                 hrs     0.16              = 0.16
           0.5    0.4
         P2   *  s

SHALLOW CONCENTRATED FLOW
    Segment ID                                  2
    Surface (paved or unpaved)?               Unpaved
    Flow length, L                       ft    940.0  ✓
    Watercourse slope, s               ft/ft   0.0200  ✓

                      0.5
    Avg.V =  Csf *  (s)                ft/s   2.2818
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                   hrs     0.11              = 0.11


CHANNEL FLOW
    Segment ID
    Cross Sectional Flow Area, a      sq.ft    0.00
    Wetted perimeter, Pw                 ft    0.00
    Hydraulic radius, r = a/Pw           ft   0.000
    Channel slope, s                  ft/ft   0.0000
    Manning's roughness coeff., n             0.0000

                  2/3    1/2
        1.49  *  r    *  s
    V = --------------------          ft/s   0.0000
                 n

    Flow length, L                      ft         0

    T = L / (3600*V)                   hrs     0.00              = 0.00

:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                       TOTAL TIME (hrs)          0.28
```

```
Quick TR-55 Ver.5.46   S/N:
Executed: 08:57:44   06-18-1997    a:COVER2.TCT

                           Dairyland Power Coop.
                            Feasibility Report
                           Landfill Final Cover
                                 BJK 3/97

                     Tc COMPUTATIONS FOR: 2B

 SHEET FLOW (Applicable to Tc only)
     Segment ID                                  1
     Surface description                    Brush
     Manning's roughness coeff., n                0.1300
     Flow length, L (total < or = 300)       ft    300.0
     Two-yr 24-hr rainfall, P2               in    2.800
     Land slope, s                        ft/ft   0.2000
                      0.8
          .007 * (n*L)
     T =  --------------                   hrs      0.15                = 0.15
             0.5    0.4
           P2   *  s

 SHALLOW CONCENTRATED FLOW
     Segment ID                                  2         3
     Surface (paved or unpaved)?              Unpaved   Unpaved
     Flow length, L                          ft    560.0     300.0
     Watercourse slope, s                 ft/ft   0.4400    0.0800

                        0.5
     Avg.V =  Csf *  (s)                   ft/s   %10.7024  4.5635
     where:   Unpaved Csf = 16.1345
         .    Paved   Csf = 20.3282

     T = L / (3600*V)                      hrs      0.01  +   0.02     = 0.03


CHANNEL FLOW
    Segment ID
    Cross Sectional Flow Area, a         sq.ft      0.00
    Wetted perimeter, Pw                    ft      0.00
    Hydraulic radius, r = a/Pw              ft     0.000
    Channel slope, s                     ft/ft    0.0000
    Manning's roughness coeff., n                 0.0000

                   2/3    1/2
         1.49  *  r    *  s
    V =  --------------------            ft/s    0.0000
                  n

    Flow length, L                          ft          0

    T = L / (3600*V)                      hrs     0.00                 = 0.00

   ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                              TOTAL TIME (hrs)        0.18
```

```
Quick TR-55 Version: 5.46 S/N:                                  Page 1
                                          Return Frequency:  25 years

                        TR-55 TABULAR HYDROGRAPH METHOD
                            Type II. Distribution
                           (24 hr. Duration Storm)

                       Executed:  09-18-2000  12:51:33
                Watershed file:  --> P:\DATA\PROJECTS\3081\40\SW\COVER1  .MOP
                Hydrograph file: --> P:\DATA\PROJECTS\3081\40\SW\COVER125.HYD

                             Dairyland Power Coop.
                               Fesibility Study
                                Landfill Cover
                                  BJK 3/97


             >>>> Input Parameters Used to Compute Hydrograph <<<<
------------------------------------------------------------------------------
  Subarea         AREA     CN     Tc     * Tt    Precip. |  Runoff     Ia/p
Description      (acres)          (hrs)  (hrs)   (in)    |   (in)  input/used
------------------------------------------------------------------------------
 1A                1.40   74.0    0.20    0.00    4.90   |   2.28  I.14  .14
 1B                2.20   74.0    0.20    0.00    4.90   |   2.28  I.14  .14
 1C                2.90   74.0    0.20    0.00    4.90   |   2.28  I.14  .14
 1D                5.30   74.0    0.40    0.00    4.90   |   2.28  I.14  .14
 1E                1.20   74.0    0.20    0.00    4.90   |   2.28  I.14  .14
 1F                9.50   74.0    0.50    0.00    4.90   |   2.28  I.14  .14
 1G                7.40   84.0    0.20    0.00    4.90   |   3.18  I.08  .10
------------------------------------------------------------------------------
* Travel time from subarea outfall to composite watershed outfall point.
I -- Subarea where user specified interpolation between Ia/p tables.

                Total area = 29.90 acres  or  0.04672 sq.mi
                      Peak discharge =  67 cfs

             WARNING: Drainage areas of two or more subareas
                      differ by a factor of 5 or greater.




            >>>> Computer Modifications of Input Parameters <<<<<
------------------------------------------------------------------------------
                 Input Values    Rounded Values    Ia/p
  Subarea         Tc    * Tt      Tc    * Tt    Interpolated       Ia/p
 Description     (hr)   (hr)     (hr)   (hr)     (Yes/No)        Messages
------------------------------------------------------------------------------
1A               0.18   0.00     0.20   0.00       Yes              --
1B               0.23   0.00     0.20   0.00       Yes              --
1C               0.23   0.00     0.20   0.00       Yes              --
1D               0.35   0.00     0.40   0.00       Yes              --
1E               0.18   0.00     0.20   0.00       Yes              --
1F               0.45   0.00     0.50   0.00       Yes              --
1G               0.22   0.00     0.20   0.00       No       Computed Ia/p < .1
------------------------------------------------------------------------------
* Travel time from subarea outfall to composite watershed outfall point.
```

Total Runoff =

$$\frac{22.5\text{ ac}(2.28") + 7.4\text{ac}(3.18\text{in})}{12}$$

= 6.2 ac-FT

```
                                                Return Frequency:  25 years

                  TR-55 TABULAR HYDROGRAPH METHOD
                      Type II. Distribution
                     (24 hr. Duration Storm)

                  Executed:  09-18-2000  12:51:33
          Watershed file:  --> P:\DATA\PROJECTS\3081\40\SW\COVER1  .MOP
          Hydrograph file: --> P:\DATA\PROJECTS\3081\40\SW\COVER125.HYD

                       Dairyland Power Coop.
                         Fesibility Study
                          Landfill Cover
                             BJK 3/97


              >>>> Summary of Subarea Times to Peak <<<<

                           Peak Discharge at  Time to Peak at
                           Composite Outfall  Composite Outfall
           Subarea                (cfs)              (hrs)
         --------------      --------------     ------------
         1A                           4              12.2
         1B                           6              12.2
         1C                           8              12.2
         1D                          11              12.3
         1E                           3              12.1
         1F                          17              12.4
         1G                          29              12.2
         --------------      --------------     ------------
       Composite Watershed           67              12.2
```

```
                                           Return Frequency:  25 years

                      TR-55 TABULAR HYDROGRAPH METHOD
                          Type II. Distribution
                         (24 hr. Duration Storm)

                      Executed:  09-18-2000  12:51:33
            Watershed file:  --> P:\DATA\PROJECTS\3081\40\SW\COVER1   .MOP
            Hydrograph file: --> P:\DATA\PROJECTS\3081\40\SW\COVER125.HYD

                           Dairyland Power Coop.
                             Fesibility Study
                              Landfill Cover
                                BJK 3/97



                     Composite Hydrograph Summary (cfs)
------------------------------------------------------------------------------
  Subarea      11.0   11.3   11.6   11.9   12.0   12.1   12.2   12.3   12.4
 Description    hr     hr     hr     hr     hr     hr     hr     hr     hr
------------------------------------------------------------------------------
1A               0      0      0      1      2      3      4      2      1
1B               0      0      0      1      3      5      6      4      2
1C               0      0      0      2      4      7      8      5      3
1D               0      0      1      1      2      5      8     11     11
1E               0      0      0      1      2      3      3      2      1
1F               0      1      1      2      3      5      9     15     17
1G               1      1      2      8     15     27     29     18      9
------------------------------------------------------------------------------
Total (cfs)      1      2      4     16     31     55     67     57     44


------------------------------------------------------------------------------
  Subarea      12.5   12.6   12.7   12.8   13.0   13.2   13.4   13.6   13.8
 Description    hr     hr     hr     hr     hr     hr     hr     hr     hr
------------------------------------------------------------------------------
1A               1      1      1      0      0      0      0      0      0
1B               1      1      1      1      1      1      0      0      0
1C               2      1      1      1      1      1      1      1      0
1D               8      6      4      3      2      2      1      1      1
1E               1      1      0      0      0      0      0      0      0
1F              17     13     10      8      5      3      3      2      2
1G               6      5      4      3      3      2      2      2      2
------------------------------------------------------------------------------
Total (cfs)     36     28     21     16     12      9      7      6      5
```

```
                                                   Return Frequency:  25 years

                         TR-55 TABULAR HYDROGRAPH METHOD
                             Type II. Distribution
                            (24 hr. Duration Storm)

                         Executed:  09-18-2000  12:51:33
                Watershed file:  --> P:\DATA\PROJECTS\3081\40\SW\COVER1   .MOP
                Hydrograph file: --> P:\DATA\PROJECTS\3081\40\SW\COVER125.HYD

                              Dairyland Power Coop.
                                Fesibility Study
                                 Landfill Cover
                                    BJK 3/97


                        Composite Hydrograph Summary (cfs)
----------------------------------------------------------------------------
  Subarea       14.0   14.3   14.6   15.0   15.5   16.0   16.5   17.0   17.5
 Description     hr     hr     hr     hr     hr     hr     hr     hr     hr
----------------------------------------------------------------------------
1A                0      0      0      0      0      0      0      0      0
1B                0      0      0      0      0      0      0      0      0
1C                0      0      0      0      0      0      0      0      0
1D                1      1      1      1      1      1      0      0      0
1E                0      0      0      0      0      0      0      0      0
1F                2      1      1      1      1      1      1      1      1
1G                1      1      1      1      1      1      1      1      1
----------------------------------------------------------------------------
Total (cfs)       4      3      3      3      3      3      2      2      2



----------------------------------------------------------------------------
  Subarea       18.0   19.0   20.0   22.0   26.0
 Description     hr     hr     hr     hr     hr
----------------------------------------------------------------------------
1A                0      0      0      0      0
1B                0      0      0      0      0
1C                0      0      0      0      0
1D                0      0      0      0      0
1E                0      0      0      0      0
1F                1      1      1      0      0
1G                1      1      0      0      0
----------------------------------------------------------------------------
Total (cfs)       2      2      1      0      0
```

```
                                                Return Frequency: 100 years

                          TR-55 TABULAR HYDROGRAPH METHOD
                              Type II. Distribution
                             (24 hr. Duration Storm)

                          Executed:  07-30-1998  11:54:55
                 Watershed file:  --> A:COVER1  .MOP
                 Hydrograph file: --> A:COVER100.HYD

                              Dairyland Power Coop.
                                Fesibility Study
                                 Landfill Cover
                                    BJK 3/97


              >>>> Input Parameters Used to Compute Hydrograph <<<<
------------------------------------------------------------------------------
 Subarea         AREA      CN      Tc     * Tt    Precip. |  Runoff     Ia/p
Description     (acres)           (hrs)   (hrs)    (in)   |   (in)  input/used
------------------------------------------------------------------------------
1A                1.40    74.0    0.20    0.00     6.10   |   3.27  I.12  .12
1B                2.20    74.0    0.20    0.00     6.10   |   3.27  I.12  .12
1C                2.90    74.0    0.20    0.00     6.10   |   3.27  I.12  .12
1D                5.30    74.0    0.40    0.00     6.10   |   3.27  I.12  .12
1E                1.20    74.0    0.20    0.00     6.10   |   3.27  I.12  .12
1F                9.50    74.0    0.50    0.00     6.10   |   3.27  I.12  .12
1G                7.40    84.0    0.20    0.00     6.10   |   4.29  I.06  .10
------------------------------------------------------------------------------
* Travel time from subarea outfall to composite watershed outfall point.
I -- Subarea where user specified interpolation between Ia/p tables.

                 Total area = 29.90 acres  or  0.04672 sq.mi
                        Peak discharge =  98 cfs

             WARNING: Drainage areas of two or more subareas
                      differ by a factor of 5 or greater.



            >>>> Computer Modifications of Input Parameters <<<<<
------------------------------------------------------------------------------
              Input Values     Rounded Values     Ia/p
 Subarea      Tc     * Tt      Tc     * Tt    Interpolated       Ia/p
Description  (hr)    (hr)     (hr)    (hr)     (Yes/No)        Messages
------------------------------------------------------------------------------
1A           0.18    0.00     0.20    0.00       Yes              --
1B           0.23    0.00     0.20    0.00       Yes              --
1C           0.23    0.00     0.20    0.00       Yes              --
1D           0.35    0.00     0.40    0.00       Yes              --
1E           0.18    0.00     0.20    0.00       Yes              --
1F           0.45    0.00     0.50    0.00       Yes              --
1G           0.22    0.00     0.20    0.00       No       Computed Ia/p < .1
------------------------------------------------------------------------------
* Travel time from subarea outfall to composite watershed outfall point.
```

/BLG
8/20/98

Total Runoff =

$$\frac{22.5\text{ ac }(3.27") + 7.4\text{ ac }(4.29")}{12}$$

= 8.8 ac-FT

```
                                               Return Frequency: 100 years

                TR-55 TABULAR HYDROGRAPH METHOD
                    Type II. Distribution
                   (24 hr. Duration Storm)

                Executed:  07-30-1998  11:54:55
        Watershed file:  --> A:COVER1  .MOP
        Hydrograph file: --> A:COVER100.HYD

                    Dairyland Power Coop.
                      Fesibility Study
                       Landfill Cover
                          BJK 3/97


            >>>> Summary of Subarea Times to Peak <<<<

                          Peak Discharge at   Time to Peak at
                          Composite Outfall  Composite Outfall
           Subarea              (cfs)               (hrs)
        --------------    --------------      ------------
        1A                        6                 12.2
        1B                        9                 12.2
        1C                       12                 12.2
        1D                       16                 12.3
        1E                        5                 12.2
        1F                       25                 12.4
        1G                       40                 12.2
        --------------    --------------      ------------
      Composite Watershed        98                 12.2
```

```
                                          Return Frequency: 100 years

                    TR-55 TABULAR HYDROGRAPH METHOD
                        Type II. Distribution
                      (24 hr. Duration Storm)

                    Executed:  07-30-1998  11:54:55
              Watershed file:  --> A:COVER1  .MOP
              Hydrograph file: --> A:COVER100.HYD

                         Dairyland Power Coop.
                           Fesibility Study
                            Landfill Cover
                              BJK 3/97


                   Composite Hydrograph Summary (cfs)
------------------------------------------------------------------------------
  Subarea       11.0   11.3   11.6   11.9   12.0   12.1   12.2   12.3   12.4
 Description     hr     hr     hr     hr     hr     hr     hr     hr     hr
------------------------------------------------------------------------------
1A                0      0      0      1      3      5      6      3      2
1B                0      0      0      2      4      8      9      5      3
1C                0      0      1      3      6     11     12      7      4
1D                0      1      1      2      4      7     12     16     15
1E                0      0      0      1      2      4      5      3      2
1F                1      1      1      2      4      8     14     22     25
1G                1      2      2     10     20     37     40     24     12
------------------------------------------------------------------------------
Total (cfs)       2      4      5     21     43     80     98     80     63


------------------------------------------------------------------------------
  Subarea       12.5   12.6   12.7   12.8   13.0   13.2   13.4   13.6   13.8
 Description     hr     hr     hr     hr     hr     hr     hr     hr     hr
------------------------------------------------------------------------------
1A                1      1      1      1      1      0      0      0      0
1B                2      1      1      1      1      1      1      1      1
1C                3      2      2      1      1      1      1      1      1
1D               12      8      6      4      3      2      2      2      1
1E                1      1      1      1      0      0      0      0      0
1F               24     19     14     11      7      5      4      3      3
1G                8      6      5      4      3      3      3      2      2
------------------------------------------------------------------------------
Total (cfs)      51     38     30     23     16     12     11      9      8
```

```
                    TR-55 TABULAR HYDROGRAPH METHOD
                        Type II. Distribution
                       (24 hr. Duration Storm)

                    Executed:  07-30-1998  11:54:55
            Watershed file:  --> A:COVER1  .MOP
            Hydrograph file: --> A:COVER100.HYD

                          Dairyland Power Coop.
                            Fesibility Study
                             Landfill Cover
                               BJK 3/97

                   Composite Hydrograph Summary (cfs)
--------------------------------------------------------------------------
  Subarea      14.0  14.3  14.6  15.0  15.5  16.0  16.5  17.0  17.5
 Description    hr    hr    hr    hr    hr    hr    hr    hr    hr
--------------------------------------------------------------------------
1A               0     0     0     0     0     0     0     0     0
1B               0     0     0     0     0     0     0     0     0
1C               1     1     1     0     0     0     0     0     0
1D               1     1     1     1     1     1     1     1     1
1E               0     0     0     0     0     0     0     0     0
1F               2     2     2     2     1     1     1     1     1
1G               2     2     2     1     1     1     1     1     1
--------------------------------------------------------------------------
Total (cfs)      6     6     6     4     3     3     3     3     3


--------------------------------------------------------------------------
  Subarea      18.0  19.0  20.0  22.0  26.0
 Description    hr    hr    hr    hr    hr
--------------------------------------------------------------------------
1A               0     0     0     0     0
1B               0     0     0     0     0
1C               0     0     0     0     0
1D               1     0     0     0     0
1E               0     0     0     0     0
1F               1     1     1     1     0
1G               1     1     1     1     0
--------------------------------------------------------------------------
Total (cfs)      3     2     2     2     0
```

```
Quick TR-55 Version: 5.46 S/N:                            Page 1
                                        Return Frequency:  25 years

                       TR-55 TABULAR HYDROGRAPH METHOD
                          Type II. Distribution
                         (24 hr. Duration Storm)

                       Executed:  09-18-2000  12:51:16
                Watershed file:  --> P:\DATA\PROJECTS\3081\40\SW\COVER2  .MOP
                Hydrograph file: --> P:\DATA\PROJECTS\3081\40\SW\COVER225.HYD

                           Dairyland Power Coop.
                             Fesibility Study
                              Landfill Cover
                                BJK 3/97


          >>>> Input Parameters Used to Compute Hydrograph <<<<
---------------------------------------------------------------------------------
  Subarea        AREA     CN      Tc     * Tt    Precip. |  Runoff     Ia/p
 Description    (acres)          (hrs)   (hrs)    (in)   |   (in)  input/used
---------------------------------------------------------------------------------
 2A               2.70   74.0    0.30    0.00    4.90    |   2.28  I.14  .14
 2B              21.50   69.0    0.20    0.00    4.90    |   1.89  I.18  .18
---------------------------------------------------------------------------------
 * Travel time from subarea outfall to composite watershed outfall point.
 I -- Subarea where user specified interpolation between Ia/p tables.

                 Total area = 24.20 acres   or   0.03781 sq.mi
                           Peak discharge =  54 cfs

          WARNING: Drainage areas of two or more subareas
                   differ by a factor of 5 or greater.



          >>>> Computer Modifications of Input Parameters <<<<<
---------------------------------------------------------------------------------
                 Input Values      Rounded Values      Ia/p
  Subarea        Tc     * Tt       Tc     * Tt     Interpolated        Ia/p
 Description    (hr)    (hr)      (hr)    (hr)      (Yes/No)          Messages
---------------------------------------------------------------------------------
2A              0.28    0.00      0.30    0.00        Yes                --
2B              0.18    0.00      0.20    0.00        Yes                --
---------------------------------------------------------------------------------
 * Travel time from subarea outfall to composite watershed outfall point.
```

```
                                                   Return Frequency:  25 years

                   TR-55 TABULAR HYDROGRAPH METHOD
                       Type II. Distribution
                      (24 hr. Duration Storm)

                  Executed:  09-18-2000  12:51:16
         Watershed file:  --> P:\DATA\PROJECTS\3081\40\SW\COVER2  .MOP
         Hydrograph file: --> P:\DATA\PROJECTS\3081\40\SW\COVER225.HYD

                        Dairyland Power Coop.
                          Fesibility Study
                           Landfill Cover
                             BJK 3/97


              >>>> Summary of Subarea Times to Peak <<<<

                          Peak Discharge at   Time to Peak at
                          Composite Outfall  Composite Outfall
            Subarea             (cfs)              (hrs)
          --------------    --------------     ------------
          2A                       6               12.2
          2B                      48               12.2
          --------------    --------------     ------------
        Composite Watershed       54               12.2
```

```
                                           Return Frequency:  25 years

                    TR-55 TABULAR HYDROGRAPH METHOD
                        Type II. Distribution
                      (24 hr. Duration Storm)

                    Executed:  09-18-2000  12:51:16
           Watershed file:  --> P:\DATA\PROJECTS\3081\40\SW\COVER2  .MOP
           Hydrograph file: --> P:\DATA\PROJECTS\3081\40\SW\COVER225.HYD

                          Dairyland Power Coop.
                            Fesibility Study
                             Landfill Cover
                               BJK 3/97



                   Composite Hydrograph Summary (cfs)
 ------------------------------------------------------------------------------
  Subarea        11.0   11.3   11.6   11.9   12.0   12.1   12.2   12.3   12.4
 Description      hr     hr     hr     hr     hr     hr     hr     hr     hr
 ------------------------------------------------------------------------------
 2A                0      0      0      1      2      4      6      6      4
 2B                1      1      2      9     20     42     48     31     17
 ------------------------------------------------------------------------------
 Total (cfs)       1      1      2     10     22     46     54     37     21


 ------------------------------------------------------------------------------
  Subarea        12.5   12.6   12.7   12.8   13.0   13.2   13.4   13.6   13.8
 Description      hr     hr     hr     hr     hr     hr     hr     hr     hr
 ------------------------------------------------------------------------------
 2A                3      2      1      1      1      1      1      1      0
 2B               11      9      7      6      5      4      4      4      3
 ------------------------------------------------------------------------------
 Total (cfs)      14     11      8      7      6      5      5      5      3


 ------------------------------------------------------------------------------
  Subarea        14.0   14.3   14.6   15.0   15.5   16.0   16.5   17.0   17.5
 Description      hr     hr     hr     hr     hr     hr     hr     hr     hr
 ------------------------------------------------------------------------------
 2A                0      0      0      0      0      0      0      0      0
 2B                3      3      2      2      2      2      2      2      1
 ------------------------------------------------------------------------------
 Total (cfs)       3      3      2      2      2      2      2      2      1


 ------------------------------------------------------------------------------
  Subarea        18.0   19.0   20.0   22.0   26.0
 Description      hr     hr     hr     hr     hr
 ------------------------------------------------------------------------------
 2A                0      0      0      0      0
 2B                1      1      1      1      0
 ------------------------------------------------------------------------------
```

```
                                                   Return Frequency: 100 years

                    TR-55 TABULAR HYDROGRAPH METHOD
                        Type II. Distribution
                       (24 hr. Duration Storm)

                   Executed:  10-01-1998  15:19:47
            Watershed file:  --> A:\COVER2  .MOP
            Hydrograph file: --> A:\COVER200.HYD

                          Dairyland Power Coop.
                            Fesibility Study
                             Landfill Cover
                                BJK 3/97


          >>>> Input Parameters Used to Compute Hydrograph <<<<
--------------------------------------------------------------------------------
  Subarea       AREA     CN     Tc     * Tt    Precip. |  Runoff     Ia/p
Description    (acres)         (hrs)   (hrs)    (in)   |   (in)  input/used
--------------------------------------------------------------------------------
2A               2.70   74.0   0.30    0.00    6.10    |   3.27  I.12   .12
2B              21.50   69.0   0.20    0.00    6.10    |   2.79  I.15   .15
--------------------------------------------------------------------------------
 * Travel time from subarea outfall to composite watershed outfall point.
 I -- Subarea where user specified interpolation between Ia/p tables.

              Total area = 24.20 acres  or  0.03781 sq.mi
                         Peak discharge =  82 cfs

           WARNING: Drainage areas of two or more subareas
                    differ by a factor of 5 or greater.



          >>>> Computer Modifications of Input Parameters <<<<<
--------------------------------------------------------------------------------
               Input Values    Rounded Values     Ia/p
  Subarea       Tc    * Tt       Tc    * Tt    Interpolated        Ia/p
Description    (hr)   (hr)      (hr)    (hr)     (Yes/No)         Messages
--------------------------------------------------------------------------------
2A             0.28   0.00      0.30    0.00       Yes               --
2B             0.18   0.00      0.20    0.00       Yes               --
--------------------------------------------------------------------------------
 * Travel time from subarea outfall to composite watershed outfall point.
```

```
                                         Return Frequency: 100 years

                  TR-55 TABULAR HYDROGRAPH METHOD
                       Type II. Distribution
                     (24 hr. Duration Storm)

                  Executed:  10-01-1998  15:19:47
          Watershed file:  --> A:\COVER2   .MOP
          Hydrograph file: --> A:\COVER200.HYD

                         Dairyland Power Coop.
                           Fesibility Study
                            Landfill Cover
                              BJK 3/97


             >>>> Summary of Subarea Times to Peak <<<<

                           Peak Discharge at   Time to Peak at
                           Composite Outfall  Composite Outfall
             Subarea             (cfs)              (hrs)
          --------------    --------------     ------------
           2A                      9               12.2
           2B                     73               12.2
          --------------    --------------     ------------
         Composite Watershed      82               12.2
```

```
Quick TR-55 Version: 5.46 S/N:                                 Page 3
                                            Return Frequency: 100 years

                        TR-55 TABULAR HYDROGRAPH METHOD
                            Type II. Distribution
                           (24 hr. Duration Storm)

                       Executed:  10-01-1998  15:19:47
                Watershed file:  --> A:\COVER2  .MOP
                Hydrograph file: --> A:\COVER200.HYD

                             Dairyland Power Coop.
                               Fesibility Study
                                Landfill Cover
                                  BJK 3/97


                      Composite Hydrograph Summary (cfs)
---------------------------------------------------------------------------
  Subarea      11.0   11.3   11.6   11.9   12.0   12.1   12.2   12.3   12.4
 Description    hr     hr     hr     hr     hr     hr     hr     hr     hr
---------------------------------------------------------------------------
2A               0      0      1      1      3      6      9      9      6
2B               2      2      3     16     33     65     73     45     24
---------------------------------------------------------------------------
Total (cfs)      2      2      4     17     36     71     82     54     30



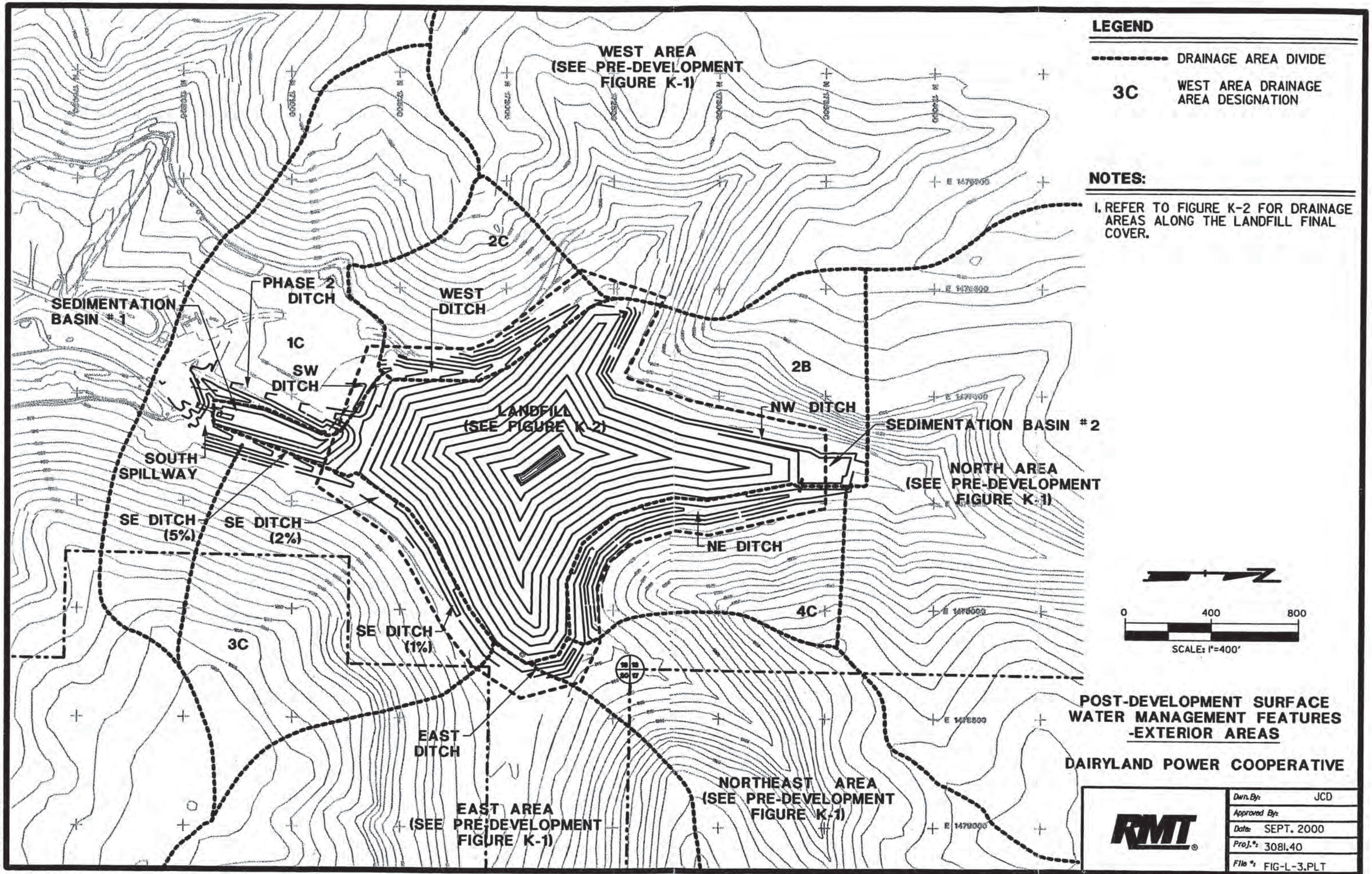
---------------------------------------------------------------------------
  Subarea      12.5   12.6   12.7   12.8   13.0   13.2   13.4   13.6   13.8
 Description    hr     hr     hr     hr     hr     hr     hr     hr     hr
---------------------------------------------------------------------------
2A               4      3      2      2      1      1      1      1      1
2B              16     13     10      9      7      6      6      5      5
---------------------------------------------------------------------------
Total (cfs)     20     16     12     11      8      7      7      6      6



---------------------------------------------------------------------------
  Subarea      14.0   14.3   14.6   15.0   15.5   16.0   16.5   17.0   17.5
 Description    hr     hr     hr     hr     hr     hr     hr     hr     hr
---------------------------------------------------------------------------
2A               1      1      0      0      0      0      0      0      0
2B               4      4      3      3      3      3      2      2      2
---------------------------------------------------------------------------
Total (cfs)      5      5      3      3      3      3      2      2      2



---------------------------------------------------------------------------
  Subarea      18.0   19.0   20.0   22.0   26.0
 Description    hr     hr     hr     hr     hr
---------------------------------------------------------------------------
2A               0      0      0      0      0
2B               2      2      1      1      0
---------------------------------------------------------------------------
```



LEGEND

----------	DRAINAGE AREA DIVIDE
3C	WEST AREA DRAINAGE AREA DESIGNATION

NOTES:

1. REFER TO FIGURE K-2 FOR DRAINAGE AREAS ALONG THE LANDFILL FINAL COVER.

POST-DEVELOPMENT SURFACE WATER MANAGEMENT FEATURES -EXTERIOR AREAS

DAIRYLAND POWER COOPERATIVE

RMT

Dwn.By: JCD
Approved By:
Date: SEPT. 2000
Proj.#: 3081.40
File #: FIG-L-3.PLT

FIGURE K-3

Design File = J:\3081\40\FIG-L-3.PLT
DEFOE.Plot Da[illegible] = Tue Sep 19 11:12:17 2000
Plot File = [illegible]081\40\FIG-L-3.prf
Pen Table = [illegible]NET\TBL\default.tbl
Levels On = 1-[illegible]

Ref. File 1 = bmclient.dgn
Ref. File 2 = bmrmt.dgn
Ref. File 3 = proposed.dgn
Ref. File 4 = surface.dgn

(1) b[illegible]
(2[illegible]
(3[illegible]
(4[illegible]

(1) 4-6,9,10,12,21,23,24,26-28,32,34,40,43,45,54,55,57,61
(2) 1-4,10-16
(3) 33,45-50
(4) 2,3,14-16

RMT COMPUTER AIDED DESIGN & DRAFTING

```
Quick TR-55 Ver.5.46   S/N:
Executed: 11:43:33   07-30-1998


                     Dairyland Power Coop.
                      Feasibility Report
                   PostDevelopment Conditions
                       BJK 5/97 rev 7/98


                  RUNOFF CURVE NUMBER SUMMARY
:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::


           Subarea            Area         CN
         Description        (acres)    (weighted)
        -------------      ---------  ------------
        1C                    42.00        67
        2C                    15.00        56
        3C                    33.00        58
        4C                    16.00        57
        East                 520.00        67
        Northeast             80.00        63
        North                236.00        63
        West                 100.00        71
```

```
Quick TR-55 Ver.5.46   S/N:
Executed: 11:43:33   07-30-1998
```

√BLB
8/20/98

```
                    Dairyland Power Coop.
                     Feasibility Report
                 PostDevelopment Conditions
                     BJK 5/97 rev 7/98


                  RUNOFF CURVE NUMBER DATA
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::


Composite Area: 1C


                                        AREA      CN
       SURFACE DESCRIPTION            (acres)
    -------------------------------  ---------   ----
    Woods (35%)                         15.00     55
    Existing Landfill (50%)             21.00     74
    Graded Areas (10%)                   4.00     61
    Fallow - Bare Soil (5%)              2.00     86

               COMPOSITE AREA --->      42.00     66.5  ( 67 )
    :::::::::::::::::::::::::::::::::::::::::::::::::::::


Composite Area: 2C


                                        AREA      CN
       SURFACE DESCRIPTION            (acres)
    -------------------------------  ---------   ----
    Woods (85%)                         12.80     55
    Graded Areas (15%)                   2.20     61

               COMPOSITE AREA --->      15.00     55.9  ( 56 )
    :::::::::::::::::::::::::::::::::::::::::::::::::::::


Composite Area: 3C


                                        AREA      CN
       SURFACE DESCRIPTION            (acres)
    -------------------------------  ---------   ----
    Woods (80%)                         27.00     55
    Graded Areas (10%)                   3.00     61
    Fallow - Bare Soil (10%)             3.00     86

               COMPOSITE AREA --->      33.00     58.4  ( 58 )
    :::::::::::::::::::::::::::::::::::::::::::::::::::::
```

```
Quick TR-55 Ver.5.46   S/N:
Executed: 11:43:33   07-30-1998
```

✓BLB
8/20/98

```
Composite Area: 4C


                                          AREA      CN
       SURFACE DESCRIPTION               (acres)
    -------------------------------     ---------   ----
    Woods (75%)                            12.00     55
    Graded Areas (25%)                      4.00     61

                COMPOSITE AREA --->        16.00     56.5   ( 57 )
    ::::::::::::::::::::::::::::::::::::::::::::::::::::


Composite Area: East


                                          AREA      CN
       SURFACE DESCRIPTION               (acres)
    -------------------------------     ---------   ----
    Woods (60%)                           312.00     55
    Fallow - Bare Soil (40%)              208.00     86

                COMPOSITE AREA --->       520.00     67.4   ( 67 )
    ::::::::::::::::::::::::::::::::::::::::::::::::::::


Composite Area: Northeast


                                          AREA      CN
       SURFACE DESCRIPTION               (acres)
    -------------------------------     ---------   ----
    Woods (75%)                            60.00     55
    Fallow - Bare Soil (25%)               20.00     86

                COMPOSITE AREA --->        80.00     62.8   ( 63 )
    ::::::::::::::::::::::::::::::::::::::::::::::::::::


Composite Area: North


                                          AREA      CN
       SURFACE DESCRIPTION               (acres)
    -------------------------------     ---------   ----
    Woods (75%)                           177.00     55
    Fallow - Bare Soil (25%)               59.00     86

                COMPOSITE AREA --->       236.00     62.8   ( 63 )
    ::::::::::::::::::::::::::::::::::::::::::::::::::::
```

```
Quick TR-55 Ver.5.46   S/N:
Executed: 11:43:33   07-30-1998
```

√BLG
8/20/98

```
Composite Area: West


                                         AREA       CN
      SURFACE DESCRIPTION              (acres)
    -------------------------------   ---------    ----
     Woods (50%)                         50.00      55
     Fallow - Bare Soil (50%)            50.00      86

                  COMPOSITE AREA --->   100.00      70.5   ( 71 )
    ::::::::::::::::::::::::::::::::::::::::::::::::::::
```

```
Quick TR-55 Ver.5.46   S/N:
Executed: 09:21:09   05-09-1997    a:POSTDVTC.TCT



                 SUMMARY SHEET FOR Tc or Tt COMPUTATIONS
                  (Solved for Time using TR-55 Methods)


                          Dairyland Power Coop.
                           Feasibility Report
                       PostDevelopment Conditions
                                BJK 5/97


                 Subarea descr.  Tc or Tt   Time (hrs)
                 --------------  --------   ----------
                 1C                 Tc         0.35
                 2C                 Tc         0.32
                 3C                 Tc         0.41
                 4C                 Tc         0.38
                 East               Tc         0.68
                 Northeast          Tc         0.37
                 North              Tc         0.53
                 West               Tc         0.52
```

```
Quick TR-55 Ver.5.46   S/N:
Executed: 09:21:09   05-09-1997    a:POSTDVTC.TCT

                          Dairyland Power Coop.
                           Feasibility Report
                        PostDevelopment Conditions
                                BJK 5/97

                     Tc COMPUTATIONS FOR: 1C

 SHEET FLOW (Applicable to Tc only)
    Segment ID                                    1
    Surface description                  Woods
    Manning's roughness coeff., n               0.4000
    Flow length, L (total < or = 300)   ft     300.0 ✓
    Two-yr 24-hr rainfall, P2            in     2.800
    Land slope, s                     ft/ft    0.2700 ✓
                      0.8
        .007 * (n*L)
    T =  --------------                 hrs      0.33              = 0.33
              0.5    0.4
          P2   *   s

 SHALLOW CONCENTRATED FLOW
    Segment ID                                   2
    Surface (paved or unpaved)?                  Unpaved
    Flow length, L                       ft     650.0 ✓
    Watercourse slope, s              ft/ft    0.5000 ✓

                      0.5
    Avg.V =  Csf *  (s)               ft/s    %11.4088
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                   hrs      0.02              = 0.02


 CHANNEL FLOW
    Segment ID                                   3
    Cross Sectional Flow Area, a     sq.ft     42.00
    Wetted perimeter, Pw                 ft     28.00
    Hydraulic radius, r = a/Pw           ft     1.500
    Channel slope, s                  ft/ft    0.1500 ✓
    Manning's roughness coeff., n              0.0450

                   2/3    1/2
        1.49  *  r   *  s
    V =  --------------------         ft/s    %16.8040
                  n

    Flow length, L                       ft       500 ✓

    T = L / (3600*V)                   hrs      0.01              = 0.01

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                                        TOTAL TIME (hrs)         0.35
```

√BAG
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Quick TR-55 Ver.5.46   S/N:
Executed: 09:21:09   05-09-1997    a:POSTDVTC.TCT

                    Dairyland Power Coop.
                     Feasibility Report
                  PostDevelopment Conditions
                          BJK 5/97

                 Tc COMPUTATIONS FOR: 2C

 SHEET FLOW (Applicable to Tc only)
    Segment ID                                  1
    Surface description                 Woods
    Manning's roughness coeff., n            0.4000
    Flow length, L (total < or = 300)   ft    300.0 ✓
    Two-yr 24-hr rainfall, P2           in    2.800
    Land slope, s                     ft/ft  0.4200 ✓
                      0.8
         .007 * (n*L)
    T =  --------------                 hrs    0.27              = 0.27
            0.5    0.4
          P2   *  s

SHALLOW CONCENTRATED FLOW
    Segment ID                                 2
    Surface (paved or unpaved)?                Unpaved
    Flow length, L                      ft    370.0 ✓
    Watercourse slope, s              ft/ft  0.4200 ✓

                      0.5
    Avg.V =  Csf *  (s)                 ft/s  %10.4564
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                    hrs    0.01              = 0.01


CHANNEL FLOW
    Segment ID                                 3
    Cross Sectional Flow Area, a      sq.ft   17.00
    Wetted perimeter, Pw                 ft   17.00
    Hydraulic radius, r = a/Pw           ft   1.000
    Channel slope, s                  ft/ft  0.0600 ✓
    Manning's roughness coeff., n            0.0450

                   2/3   1/2
        1.49  *  r   *  s
    V =  --------------------           ft/s  8.1105
                   n

    Flow length, L                       ft    1050 ✓

    T = L / (3600*V)                    hrs    0.04              = 0.04

  ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                             TOTAL TIME (hrs)      0.32
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                         Dairyland Power Coop.
                          Feasibility Report
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                     Tc COMPUTATIONS FOR: 3C

 SHEET FLOW (Applicable to Tc only)
    Segment ID                                   1
    Surface description                     Row Crops
    Manning's roughness coeff., n              0.1700
    Flow length, L (total < or = 300)    ft    300.0
    Two-yr 24-hr rainfall, P2            in    2.800
    Land slope, s                      ft/ft   0.0500
                         0.8
         .007 * (n*L)
    T =  --------------                hrs     0.32              =  0.32
              0.5    0.4
            P2   *   s

SHALLOW CONCENTRATED FLOW
    Segment ID                                   2
    Surface (paved or unpaved)?                 Unpaved
    Flow length, L                        ft   1020.0
    Watercourse slope, s                ft/ft  0.3600

                         0.5
   Avg.V =  Csf *  (s)                 ft/s   9.6807
   where:   Unpaved Csf = 16.1345
            Paved   Csf = 20.3282

   T = L / (3600*V)                    hrs     0.03              =  0.03


CHANNEL FLOW
   Segment ID                                    3
   Cross Sectional Flow Area, a       sq.ft   150.00
   Wetted perimeter, Pw                  ft    45.00
   Hydraulic radius, r = a/Pw            ft    3.333
   Channel slope, s                   ft/ft   0.0150
   Manning's roughness coeff., n              0.0600

                   2/3    1/2
        1.49  *  r   *  s
   V =  --------------------           ft/s   6.7868
                  n

   Flow length, L                        ft     1450

   T = L / (3600*V)                     hrs     0.06              =  0.06

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                                         TOTAL TIME (hrs)        0.41
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                         Dairyland Power Coop.
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                     Tc COMPUTATIONS FOR: 4C

 SHEET FLOW (Applicable to Tc only)
    Segment ID                                     1
    Surface description                     Woods
    Manning's roughness coeff., n                0.4000
    Flow length, L (total < or = 300)    ft     300.0
    Two-yr 24-hr rainfall, P2             in     2.800
    Land slope, s                       ft/ft   0.3700
                           0.8
         .007 * (n*L)
    T =  --------------                  hrs      0.29               = 0.29
              0.5     0.4
          P2    *   s

SHALLOW CONCENTRATED FLOW
    Segment ID                                    2
    Surface (paved or unpaved)?                   Unpaved
    Flow length, L                          ft     390.0
    Watercourse slope, s                  ft/ft   0.5000

                           0.5
    Avg.V =  Csf *  (s)                   ft/s   %11.4088
    where:   Unpaved Csf = 16.1345
             Paved    Csf = 20.3282

    T = L / (3600*V)                      hrs     0.01               = 0.01


CHANNEL FLOW
    Segment ID                                    3
    Cross Sectional Flow Area, a        sq.ft    28.00
    Wetted perimeter, Pw                   ft    20.00
    Hydraulic radius, r = a/Pw             ft    1.400
    Channel slope, s                     ft/ft   0.0200
    Manning's roughness coeff., n                0.0500

                     2/3    1/2
         1.49  *  r   *  s
    V =  --------------------             ft/s   5.2741
                     n

    Flow length, L                         ft     1670

    T = L / (3600*V)                      hrs     0.09               = 0.09

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                                          TOTAL TIME (hrs)         0.38
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                        Dairyland Power Coop.
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                    Tc COMPUTATIONS FOR: East

SHEET FLOW (Applicable to Tc only)
   Segment ID                                     1
   Surface description                        Row Crops
   Manning's roughness coeff., n                 0.1700
   Flow length, L (total < or = 300)     ft     300.0
   Two-yr 24-hr rainfall, P2             in     2.800
   Land slope, s                        ft/ft   0.0500
                    0.8
      .007 * (n*L)
   T = --------------                    hrs     0.32              = 0.32
          0.5    0.4
        P2   *  s

SHALLOW CONCENTRATED FLOW
   Segment ID                                     2
   Surface (paved or unpaved)?                  Unpaved
   Flow length, L                        ft     2000.0
   Watercourse slope, s                 ft/ft   0.0700

                     0.5
   Avg.V =  Csf *  (s)                   ft/s   4.2688
   where:   Unpaved Csf = 16.1345
            Paved   Csf = 20.3282

   T = L / (3600*V)                      hrs     0.13              = 0.13


CHANNEL FLOW
   Segment ID                                   3         4
   Cross Sectional Flow Area, a        sq.ft   27.00     27.00
   Wetted perimeter, Pw                  ft    16.40     16.40
   Hydraulic radius, r = a/Pw            ft    1.646     1.646
   Channel slope, s                    ft/ft   0.0700    0.0400
   Manning's roughness coeff., n               0.0700    0.0700

                2/3   1/2
      1.49  *  r   *  s
   V = --------------------              ft/s  7.8521    5.9356
                n

   Flow length, L                        ft     2500      3000

   T = L / (3600*V)                      hrs     0.09  +   0.14   = 0.23

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                                         TOTAL TIME (hrs)          0.68
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                     Tc COMPUTATIONS FOR: Northeast

 SHEET FLOW (Applicable to Tc only)
    Segment ID                                  1
    Surface description                     Row Crops
    Manning's roughness coeff., n               0.1700
    Flow length, L (total < or = 300)    ft     300.0
    Two-yr 24-hr rainfall, P2            in     2.800
    Land slope, s                     ft/ft    0.0800
                     0.8
         .007 * (n*L)
    T = --------------                  hrs     0.27                = 0.27
            0.5    0.4
          P2   *  s

SHALLOW CONCENTRATED FLOW
    Segment ID                                 2
    Surface (paved or unpaved)?                Unpaved
    Flow length, L                       ft     600.0
    Watercourse slope, s              ft/ft    0.0700

                       0.5
    Avg.V =  Csf *  (s)                ft/s    4.2688
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                    hrs     0.04                = 0.04


CHANNEL FLOW
    Segment ID                                 3
    Cross Sectional Flow Area, a      sq.ft     27.00
    Wetted perimeter, Pw                 ft     16.40
    Hydraulic radius, r = a/Pw           ft     1.646
    Channel slope, s                  ft/ft    0.1400
    Manning's roughness coeff., n              0.0700

                   2/3    1/2
         1.49  *  r   *  s
    V = --------------------           ft/s    %11.1045
                  n

    Flow length, L                       ft     2400

    T = L / (3600*V)                    hrs     0.06                = 0.06

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                                              TOTAL TIME (hrs)      0.37
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                        Dairyland Power Coop.
                         Feasibility Report
                      PostDevelopment Conditions
                              BJK 5/97

                    Tc COMPUTATIONS FOR: North

 SHEET FLOW (Applicable to Tc only)
    Segment ID                                    1
    Surface description                       Row Crops
    Manning's roughness coeff., n                  0.1700
    Flow length, L (total < or = 300)    ft       300.0 ✓
    Two-yr 24-hr rainfall, P2             in      2.800
    Land slope, s                        ft/ft    0.0500 ✓
                      0.8
         .007 * (n*L)
    T =  --------------                  hrs      0.32              = 0.32
             0.5    0.4
           P2   *  s

 SHALLOW CONCENTRATED FLOW
    Segment ID                                    2
    Surface (paved or unpaved)?                  Unpaved
    Flow length, L                        ft     1000.0 ✓
    Watercourse slope, s                 ft/ft    0.0600 ✓

                      0.5
    Avg.V =  Csf *  (s)                  ft/s    3.9521
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                     hrs      0.07              = 0.07


 CHANNEL FLOW
    Segment ID                                    3
    Cross Sectional Flow Area, a        sq.ft    27.00
    Wetted perimeter, Pw                  ft     16.40
    Hydraulic radius, r = a/Pw            ft     1.646
    Channel slope, s                     ft/ft   0.0830 ✓
    Manning's roughness coeff., n                0.0700

                 2/3    1/2
        1.49  *  r   *  s
    V = --------------------             ft/s    8.5502
                 n

    Flow length, L                        ft      4200 ✓

    T = L / (3600*V)                     hrs      0.14              = 0.14

 ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                          TOTAL TIME (hrs)          0.53
```

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Quick TR-55 Ver.5.46   S/N:
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                         Dairyland Power Coop.
                          Feasibility Report
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                               BJK 5/97

                     Tc COMPUTATIONS FOR: West

 SHEET FLOW (Applicable to Tc only)
    Segment ID                                      1
    Surface description                        Row Crops
    Manning's roughness coeff., n                0.1700
    Flow length, L (total < or = 300)    ft      300.0 ✓
    Two-yr 24-hr rainfall, P2            in      2.800
    Land slope, s                      ft/ft    0.0500 ✓
                    0.8
        .007 * (n*L)
    T = --------------                  hrs       0.32              = 0.32
            0.5    0.4
         P2    *  s

SHALLOW CONCENTRATED FLOW
    Segment ID                                      2
    Surface (paved or unpaved)?                  Unpaved
    Flow length, L                       ft      1600.0 ✓
    Watercourse slope, s               ft/ft    0.0850 ✓

                     0.5
    Avg.V =  Csf *  (s)                ft/s   4.7040
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                   hrs      0.09               = 0.09


CHANNEL FLOW
    Segment ID                                      3
    Cross Sectional Flow Area, a      sq.ft     17.00
    Wetted perimeter, Pw                 ft     16.40
    Hydraulic radius, r = a/Pw           ft     1.037
    Channel slope, s                  ft/ft    0.1000 ✓
    Manning's roughness coeff., n              0.0700

                  2/3    1/2
        1.49  *  r   *  s
    V = --------------------           ft/s   6.8943
                  n

    Flow length, L                      ft      2600 ✓

    T = L / (3600*V)                   hrs      0.10               = 0.10

  ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                            TOTAL TIME (hrs)        0.52
```

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Quick TR-55 Ver.5.46   S/N:
Executed: 11:30:57   06-18-1997     a:POSTDVTT.TCT


                    SUMMARY SHEET FOR Tc or Tt COMPUTATIONS
                     (Solved for Time using TR-55 Methods)


                          Dairyland Power Coop.
                            Feasibility Report
                        PostDevelopment Conditions
                                BJK 5/97


                    Subarea descr.  Tc or Tt   Time (hrs)
                    --------------  --------   ----------
                    1C                 Tt          0.00
                    2C                 Tt          0.05
                    3C                 Tt          0.01
                    4C                 Tt          0.09
                    East               Tt          0.07
                    Northeast          Tt          0.09
                    North              Tt          0.18
                    West               Tt          0.08
```

✓ BLB
6/17/97

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Quick TR-55 Ver.5.46   S/N:
Executed: 09:24:17   05-09-1997    a:POSTDVTT.TCT

                         Dairyland Power Coop.
                          Feasibility Report
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                               BJK 5/97

                     Tt COMPUTATIONS FOR: 2C

 SHEET FLOW (Applicable to Tc only)
    Segment ID
    Surface description
    Manning's roughness coeff., n                0.0000
    Flow length, L (total < or = 300)     ft        0.0
    Two-yr 24-hr rainfall, P2             in      0.000
    Land slope, s                      ft/ft     0.0000
                         0.8
        .007 * (n*L)
    T = --------------                   hrs       0.00           = 0.00
             0.5    0.4
           P2   *  s

 SHALLOW CONCENTRATED FLOW
    Segment ID
    Surface (paved or unpaved)?
    Flow length, L                        ft        0.0
    Watercourse slope, s               ft/ft     0.0000

                         0.5
    Avg.V =  Csf *  (s)                 ft/s     0.0000
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                     hrs       0.00           = 0.00


 CHANNEL FLOW
    Segment ID                                   1
    Cross Sectional Flow Area, a       sq.ft      17.00
    Wetted perimeter, Pw                  ft      17.00
    Hydraulic radius, r = a/Pw            ft      1.000
    Channel slope, s                   ft/ft     0.0500 ✓
    Manning's roughness coeff., n                0.0450

                  2/3    1/2
       1.49  *  r   *  s
    V = --------------------            ft/s     7.4039
                  n

    Flow length, L                        ft       1200 ✓

    T = L / (3600*V)                     hrs       0.05           = 0.05

 :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                           TOTAL TIME (hrs)        0.05
```

✓ BAB
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                        Dairyland Power Coop.
                         Feasibility Report
                      PostDevelopment Conditions
                               BJK 5/97

                   Tt COMPUTATIONS FOR: 3C

 SHEET FLOW (Applicable to Tc only)
    Segment ID
    Surface description
    Manning's roughness coeff., n                0.0000
    Flow length, L (total < or = 300)   ft         0.0
    Two-yr 24-hr rainfall, P2           in       0.000
    Land slope, s                    ft/ft      0.0000
                      0.8
        .007 * (n*L)
    T = --------------               hrs         0.00              = 0.00
            0.5    0.4
         P2   *  s

SHALLOW CONCENTRATED FLOW
    Segment ID
    Surface (paved or unpaved)?
    Flow length, L                      ft         0.0
    Watercourse slope, s             ft/ft      0.0000

                       0.5
    Avg.V =  Csf *  (s)             ft/s      0.0000
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                 hrs         0.00              = 0.00


CHANNEL FLOW
    Segment ID                                    1
    Cross Sectional Flow Area, a    sq.ft      42.00 ✓
    Wetted perimeter, Pw               ft      28.00 ✓
    Hydraulic radius, r = a/Pw         ft      1.500
    Channel slope, s                ft/ft     0.1500 ✓
    Manning's roughness coeff., n              0.0450

                   2/3    1/2
        1.49  *  r   *  s
    V = --------------------          ft/s   %16.8040
                  n

    Flow length, L                     ft        550 ✓

    T = L / (3600*V)                  hrs       0.01               = 0.01

    ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                           TOTAL TIME (hrs)          0.01
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                         Dairyland Power Coop.
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                       PostDevelopment Conditions
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                      Tt COMPUTATIONS FOR: 4C

SHEET FLOW (Applicable to Tc only)
    Segment ID
    Surface description
    Manning's roughness coeff., n                0.0000
    Flow length, L (total < or = 300)    ft       0.0
    Two-yr 24-hr rainfall, P2            in      0.000
    Land slope, s                      ft/ft   0.0000
                     0.8
         .007 * (n*L)
    T =  --------------                  hrs      0.00            = 0.00
              0.5    0.4
            P2   *  s

SHALLOW CONCENTRATED FLOW
    Segment ID
    Surface (paved or unpaved)?
    Flow length, L                       ft       0.0
    Watercourse slope, s               ft/ft   0.0000

                       0.5
    Avg.V =  Csf *  (s)                ft/s    0.0000
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                    hrs      0.00            = 0.00


CHANNEL FLOW
    Segment ID                                   1         2
    Cross Sectional Flow Area, a      sq.ft   150.00     42.00
    Wetted perimeter, Pw                 ft    45.00     28.00
    Hydraulic radius, r = a/Pw           ft    3.333     1.500
    Channel slope, s                  ft/ft   0.0150✓   0.1500✓
    Manning's roughness coeff., n             0.0600    0.0450

                  2/3   1/2
       1.49  *  r   *  s
    V =  --------------------          ft/s   6.7868    %16.8040
                  n

    Flow length, L                       ft     1950✓     550✓

    T = L / (3600*V)                    hrs     0.08  +  0.01   = 0.09

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                                          TOTAL TIME (hrs)        0.09
```

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Quick TR-55 Ver.5.46   S/N:
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                        Dairyland Power Coop.
                          Feasibility Report
                      PostDevelopment Conditions
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                    Tt COMPUTATIONS FOR: East

SHEET FLOW (Applicable to Tc only)
    Segment ID
    Surface description
    Manning's roughness coeff., n               0.0000
    Flow length, L (total < or = 300)   ft        0.0
    Two-yr 24-hr rainfall, P2            in      0.000
    Land slope, s                      ft/ft    0.0000
                      0.8
         .007 * (n*L)
    T =  --------------                  hrs      0.00             =  0.00
            0.5    0.4
          P2   *  s

SHALLOW CONCENTRATED FLOW
    Segment ID
    Surface (paved or unpaved)?
    Flow length, L                       ft        0.0
    Watercourse slope, s               ft/ft    0.0000

                      0.5
    Avg.V =  Csf *  (s)                 ft/s    0.0000
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                     hrs      0.00             =  0.00


CHANNEL FLOW
    Segment ID                                     1        2
    Cross Sectional Flow Area, a       sq.ft   150.00    42.00
    Wetted perimeter, Pw                  ft    45.00    28.00
    Hydraulic radius, r = a/Pw            ft    3.333    1.500
    Channel slope, s                   ft/ft   0.0150✓  0.1500✓
    Manning's roughness coeff., n              0.0600   0.0450

                   2/3   1/2
        1.49  *  r   *  s
    V =  --------------------           ft/s   6.7868   %16.8040
                   n

    Flow length, L                        ft     1600✓     550✓

    T = L / (3600*V)                     hrs     0.07  +  0.01   =  0.07

  ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                        TOTAL TIME (hrs)        0.07
```

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Quick TR-55 Ver.5.46   S/N:
Executed: 11:30:57   06-18-1997    a:POSTDVTT.TCT

                         Dairyland Power Coop.
                          Feasibility Report
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                     Tt COMPUTATIONS FOR: Northeast

SHEET FLOW (Applicable to Tc only)
    Segment ID
    Surface description
    Manning's roughness coeff., n                 0.0000
    Flow length, L (total < or = 300)    ft        0.0
    Two-yr 24-hr rainfall, P2            in       0.000
    Land slope, s                      ft/ft     0.0000
                   0.8
         .007 * (n*L)
    T =  --------------                hrs        0.00              = 0.00
             0.5   0.4
          P2   *  s

SHALLOW CONCENTRATED FLOW
    Segment ID
    Surface (paved or unpaved)?
    Flow length, L                       ft        0.0
    Watercourse slope, s               ft/ft     0.0000

                     0.5
    Avg.V =  Csf *  (s)                ft/s      0.0000
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                   hrs        0.00              = 0.00


CHANNEL FLOW
    Segment ID                                   1          2
    Cross Sectional Flow Area, a      sq.ft   150.00      42.00
    Wetted perimeter, Pw                 ft    45.00      28.00
    Hydraulic radius, r = a/Pw           ft    3.333      1.500
    Channel slope, s                  ft/ft   0.0150     0.1500
    Manning's roughness coeff., n             0.0600     0.0450

                 2/3    1/2
      1.49  *  r   *  s
    V =  --------------------         ft/s    6.7868    %16.8040
                  n

    Flow length, L                      ft      1870        550

    T = L / (3600*V)                   hrs      0.08  +   0.01    = 0.09

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                                          TOTAL TIME (hrs)        0.09
```

```
Quick TR-55 Ver.5.46   S/N:
Executed: 11:30:57   06-18-1997     a:POSTDVTT.TCT

                        Dairyland Power Coop.
                         Feasibility Report
                      PostDevelopment Conditions
                              BJK 5/97

                    Tt COMPUTATIONS FOR: North

 SHEET FLOW (Applicable to Tc only)
    Segment ID
    Surface description
    Manning's roughness coeff., n              0.0000
    Flow length, L (total < or = 300)    ft      0.0
    Two-yr 24-hr rainfall, P2            in    0.000
    Land slope, s                      ft/ft   0.0000
                     0.8
        .007 * (n*L)
    T = --------------                  hrs     0.00              =  0.00
           0.5    0.4
         P2    *  s

SHALLOW CONCENTRATED FLOW
    Segment ID
    Surface (paved or unpaved)?
    Flow length, L                       ft      0.0
    Watercourse slope, s               ft/ft   0.0000

                      0.5
    Avg.V =  Csf *  (s)                ft/s    0.0000
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                    hrs     0.00              =  0.00


CHANNEL FLOW
    Segment ID                                   1         2
    Cross Sectional Flow Area, a       sq.ft    28.00    150.00
    Wetted perimeter, Pw                 ft     20.00     45.00
    Hydraulic radius, r = a/Pw           ft     1.400     3.333
    Channel slope, s                   ft/ft   0.0200    0.0150
    Manning's roughness coeff., n              0.0500    0.0600

                 2/3    1/2
       1.49  *  r   *  s
    V = --------------------           ft/s    5.2741    6.7868
                  n

    Flow length, L                       ft      1670      2250

    T = L / (3600*V)                    hrs     0.09  +   0.09    =  0.18

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                         TOTAL TIME (hrs)           0.18
```

✓ BLB
6/17/97

```
Quick TR-55 Ver.5.46   S/N:
Executed: 09:24:17   05-09-1997    a:POSTDVTT.TCT

                        Dairyland Power Coop.
                         Feasibility Report
                     PostDevelopment Conditions
                              BJK 5/97

                    Tt COMPUTATIONS FOR: West

 SHEET FLOW (Applicable to Tc only)
    Segment ID
    Surface description
    Manning's roughness coeff., n               0.0000
    Flow length, L (total < or = 300)   ft       0.0
    Two-yr 24-hr rainfall, P2           in      0.000
    Land slope, s                     ft/ft     0.0000
                      0.8
        .007 * (n*L)
    T = --------------                 hrs       0.00              = 0.00
             0.5   0.4
          P2   *  s

SHALLOW CONCENTRATED FLOW
    Segment ID
    Surface (paved or unpaved)?
    Flow length, L                      ft       0.0
    Watercourse slope, s              ft/ft    0.0000

                      0.5
   Avg.V =  Csf *  (s)                ft/s     0.0000
   where:   Unpaved Csf = 16.1345
            Paved   Csf = 20.3282

   T = L / (3600*V)                    hrs      0.00               = 0.00


CHANNEL FLOW
   Segment ID                                    1        2
   Cross Sectional Flow Area, a      sq.ft    17.00     17.00
   Wetted perimeter, Pw                 ft    17.00     17.00
   Hydraulic radius, r = a/Pw           ft    1.000     1.000  ✓
   Channel slope, s                  ft/ft   0.0600✓   0.0500 ✓
   Manning's roughness coeff., n             0.0450    0.0450

                 2/3   1/2
       1.49  *  r   *  s
   V = --------------------           ft/s   8.1105    7.4039
                 n

   Flow length, L                       ft     1050 ✓    1200 ✓

   T = L / (3600*V)                    hrs     0.04  +   0.05   = 0.08

 ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                         TOTAL TIME (hrs)          0.08
```

✓ BLG
6/17/97

```
Quick TR-55 Version: 5.46 S/N:                                Page 1
                                             Return Frequency:  25 years

                       TR-55 TABULAR HYDROGRAPH METHOD
                           Type II. Distribution
                          (24 hr. Duration Storm)

                       Executed:  09-18-2000  12:58:17
               Watershed file:  --> P:\DATA\PROJECTS\3081\40\SW\POSTDV2 .MOP
               Hydrograph file: --> P:\DATA\PROJECTS\3081\40\SW\POSTDV25.HYD

                           Dairyland Power Coop.
                            Feasibility Report
                         PostDevelopment Conditions
                             BJK 5/97 REV 9/98


            >>>> Input Parameters Used to Compute Hydrograph <<<<
----------------------------------------------------------------------------
  Subarea        AREA      CN      Tc     * Tt    Precip.  |  Runoff    Ia/p
 Description    (acres)           (hrs)   (hrs)    (in)    |   (in)  input/used
----------------------------------------------------------------------------
 1C              42.00    67.0    0.40    0.00    4.90     |   1.73  I.2   .20
 2C              15.00    56.0    0.30    0.10    4.90     |   0.99  I.32  .32
 3C              33.00    58.0    0.40    0.00    4.90     |   1.11  I.3   .30
 4C              16.00    57.0    0.40    0.10    4.90     |   1.05  I.31  .31
 East           520.00    67.0    0.75    0.00    4.90     |   1.73  I.2   .20
 Northeast       80.00    63.0    0.40    0.10    4.90     |   1.45  I.24  .24
 North          236.00    63.0    0.50    0.20    4.90     |   1.45  I.24  .24
 West           100.00    71.0    0.50    0.10    4.90     |   2.04  I.17  .17
----------------------------------------------------------------------------
 * Travel time from subarea outfall to composite watershed outfall point.
 I -- Subarea where user specified interpolation between Ia/p tables.

              Total area = 1042.00 acres  or   1.6281 sq.mi
                     Peak discharge =  1027 cfs

             WARNING: Drainage areas of two or more subareas
                      differ by a factor of 5 or greater.



           >>>> Computer Modifications of Input Parameters <<<<<
----------------------------------------------------------------------------
                 Input Values    Rounded Values     Ia/p
  Subarea        Tc     * Tt      Tc    * Tt    Interpolated       Ia/p
 Description    (hr)    (hr)     (hr)    (hr)     (Yes/No)       Messages
----------------------------------------------------------------------------
 1C             0.35    0.00     0.40    0.00       Yes             --
 2C             0.32    0.05     0.30    0.10       Yes             --
 3C             0.41    0.01     0.40    0.00       Yes             --
 4C             0.38    0.09     0.40    0.10       Yes             --
 East           0.68    0.07     0.75    0.00       Yes             --
 Northeast      0.37    0.09     0.40    0.10       Yes             --
 North          0.53    0.18     0.50    0.20       Yes             --
 West           0.52    0.08     0.50    0.10       Yes             --
----------------------------------------------------------------------------
 * Travel time from subarea outfall to composite watershed outfall point.
```

Total Runoff
= 141.9 ac-ft

```
                                                  Return Frequency:  25 years

                    TR-55 TABULAR HYDROGRAPH METHOD
                        Type II. Distribution
                       (24 hr. Duration Storm)

                    Executed:  09-18-2000  12:58:17
          Watershed file:  --> P:\DATA\PROJECTS\3081\40\SW\POSTDV2 .MOP
          Hydrograph file: --> P:\DATA\PROJECTS\3081\40\SW\POSTDV25.HYD

                         Dairyland Power Coop.
                          Feasibility Report
                      PostDevelopment Conditions
                           BJK 5/97 REV 9/98


               >>>> Summary of Subarea Times to Peak <<<<

                        Peak Discharge at   Time to Peak at
                        Composite Outfall  Composite Outfall
           Subarea            (cfs)              (hrs)
         --------------   --------------     ------------
         1C                     61                12.3
         2C                     11                12.4
         3C                     28                12.4
         4C                     12                12.5
         East                  533                12.7
         Northeast              84                12.5
         North                 219                12.6
         West                  145                12.5
         --------------   --------------     ------------
       Composite Watershed    1027                12.6
```

```
                                              Return Frequency:  25 years

                     TR-55 TABULAR HYDROGRAPH METHOD
                          Type II. Distribution
                         (24 hr. Duration Storm)

                      Executed:  09-18-2000  12:58:17
            Watershed file:  --> P:\DATA\PROJECTS\3081\40\SW\POSTDV2 .MOP
            Hydrograph file: --> P:\DATA\PROJECTS\3081\40\SW\POSTDV25.HYD

                           Dairyland Power Coop.
                            Feasibility Report
                         PostDevelopment Conditions
                              BJK 5/97 REV 9/98


                     Composite Hydrograph Summary (cfs)
-------------------------------------------------------------------------------
  Subarea       11.0   11.3   11.6   11.9   12.0   12.1   12.2   12.3   12.4
 Description     hr     hr     hr     hr     hr     hr     hr     hr     hr
-------------------------------------------------------------------------------
1C                1      1      2      5      9     22     43     61     61
2C                0      0      0      0      0      1      4      9     11
3C                0      0      0      0      1      6     17     27     28
4C                0      0      0      0      0      0      2      6     10
East              9     13     17     25     33     52    102    197    329
Northeast         1      1      2      4      7     14     31     57     80
North             2      3      4      6      8     13     28     66    126
West              3      5      6     11     17     30     56     95    128
-------------------------------------------------------------------------------
Total (cfs)      16     23     31     51     75    138    283    518    773


-------------------------------------------------------------------------------
  Subarea       12.5   12.6   12.7   12.8   13.0   13.2   13.4   13.6   13.8
 Description     hr     hr     hr     hr     hr     hr     hr     hr     hr
-------------------------------------------------------------------------------
1C               48     34     26     20     13     10      8      7      7
2C               10      8      6      5      3      2      2      2      2
3C               24     18     13     11      7      6      5      4      4
4C               12     11      9      7      4      3      3      2      2
East            454    527    533    490    350    248    183    143    117
Northeast        84     74     58     45     28     20     16     14     12
North           187    219    217    191    130     86     62     49     41
West            145    136    115     92     58     39     29     24     20
-------------------------------------------------------------------------------
Total (cfs)     964   1027    977    861    593    414    308    245    205
```

```
                                                  Return Frequency:  25 years

                          TR-55 TABULAR HYDROGRAPH METHOD
                              Type II. Distribution
                             (24 hr. Duration Storm)

                          Executed:  09-18-2000  12:58:17
                 Watershed file:  --> P:\DATA\PROJECTS\3081\40\SW\POSTDV2 .MOP
                 Hydrograph file: --> P:\DATA\PROJECTS\3081\40\SW\POSTDV25.HYD

                              Dairyland Power Coop.
                               Feasibility Report
                            PostDevelopment Conditions
                                BJK 5/97 REV 9/98


                       Composite Hydrograph Summary (cfs)
-----------------------------------------------------------------------------
  Subarea      14.0   14.3   14.6   15.0   15.5   16.0   16.5   17.0   17.5
 Description    hr     hr     hr     hr     hr     hr     hr     hr     hr
-----------------------------------------------------------------------------
1C                6      5      5      4      4      4      3      3      3
2C                1      1      1      1      1      1      1      1      1
3C                3      3      3      3      2      2      2      2      2
4C                2      2      1      1      1      1      1      1      1
East             98     81     69     59     53     47     42     38     36
Northeast        11      9      8      8      7      6      6      5      5
North            35     30     26     23     21     19     17     16     14
West             18     15     13     12     11     10      9      8      7
-----------------------------------------------------------------------------
Total (cfs)     174    146    126    111    100     90     81     74     69



-----------------------------------------------------------------------------
  Subarea      18.0   19.0   20.0   22.0   26.0
 Description    hr     hr     hr     hr     hr
-----------------------------------------------------------------------------
1C                3      2      2      2      0
2C                1      1      1      0      0
3C                2      1      1      1      0
4C                1      1      1      1      0
East             34     30     27     22      0
Northeast         5      4      4      3      0
North            14     12     10      9      0
West              7      6      5      5      0
-----------------------------------------------------------------------------
Total (cfs)      67     57     51     43      0
```

```
Quick TR-55 Version: 5.46 S/N:                                    Page 1
                                              Return Frequency: 100 years

                          TR-55 TABULAR HYDROGRAPH METHOD
                              Type II. Distribution
                             (24 hr. Duration Storm)

                          Executed:  10-01-1998  11:25:28
                  Watershed file:  --> A:\POSTDV2 .MOP
                  Hydrograph file: --> A:\POSTDV00.HYD

                              Dairyland Power Coop.
                               Feasibility Report
                            PostDevelopment Conditions
                                BJK 5/97 REV 9/98


                 >>>> Input Parameters Used to Compute Hydrograph <<<<
 ----------------------------------------------------------------------------
  Subarea       AREA      CN      Tc    * Tt    Precip. |  Runoff    Ia/p
 Description   (acres)          (hrs)   (hrs)    (in)   |   (in)  input/used
 ----------------------------------------------------------------------------
 1C              42.00   67.0    0.40    0.00    6.10   |   2.61  I.16  .16
 2C              15.00   56.0    0.30    0.10    6.10   |   1.66  I.26  .26
 3C              33.00   58.0    0.40    0.00    6.10   |   1.82  I.24  .24
 4C              16.00   57.0    0.40    0.10    6.10   |   1.74  I.25  .25
 East           520.00   67.0    0.75    0.00    6.10   |   2.61  I.16  .16
 Northeast       80.00   63.0    0.40    0.10    6.10   |   2.25  I.19  .19
 North          236.00   63.0    0.50    0.20    6.10   |   2.25  I.19  .19
 West           100.00   71.0    0.50    0.10    6.10   |   2.98  I.13  .13
 ----------------------------------------------------------------------------
 * Travel time from subarea outfall to composite watershed outfall point.
 I -- Subarea where user specified interpolation between Ia/p tables.

                   Total area = 1042.00 acres  or   1.6281 sq.mi
                           Peak discharge =  1618 cfs

                WARNING: Drainage areas of two or more subareas
                         differ by a factor of 5 or greater.



               >>>> Computer Modifications of Input Parameters <<<<<
 ----------------------------------------------------------------------------
                 Input Values     Rounded Values    Ia/p
  Subarea         Tc    * Tt       Tc    * Tt    Interpolated        Ia/p
 Description     (hr)   (hr)      (hr)   (hr)      (Yes/No)        Messages
 ----------------------------------------------------------------------------
 1C              0.35   0.00      0.40   0.00        Yes              --
 2C              0.32   0.05      0.30   0.10        Yes              --
 3C              0.41   0.01      0.40   0.00        Yes              --
 4C              0.38   0.09      0.40   0.10        Yes              --
 East            0.68   0.07      0.75   0.00        Yes              --
 Northeast       0.37   0.09      0.40   0.10        Yes              --
 North           0.53   0.18      0.50   0.20        Yes              --
 West            0.52   0.08      0.50   0.10        Yes              --
 ----------------------------------------------------------------------------
 * Travel time from subarea outfall to composite watershed outfall point.
```

Total Runoff

= 215.7 ac-ft

```
            TR-55 TABULAR HYDROGRAPH METHOD
                 Type II. Distribution
                (24 hr. Duration Storm)

            Executed:  10-01-1998  11:25:28
    Watershed file:  --> A:\POSTDV2 .MOP
    Hydrograph file: --> A:\POSTDV00.HYD

                 Dairyland Power Coop.
                  Feasibility Report
              PostDevelopment Conditions
                   BJK 5/97 REV 9/98


        >>>> Summary of Subarea Times to Peak <<<<

                     Peak Discharge at  Time to Peak at
                     Composite Outfall  Composite Outfall
       Subarea             (cfs)             (hrs)
      --------------   --------------     ------------
      1C                     96               12.3
      2C                     20               12.4
      3C                     49               12.4
      4C                     20               12.5
      East                  837               12.6
      Northeast             136               12.4
      North                 360               12.6
      West                  223               12.5
      --------------   --------------     ------------
    Composite Watershed    1618               12.6
```

```
                                              Return Frequency: 100 years

                    TR-55 TABULAR HYDROGRAPH METHOD
                        Type II. Distribution
                       (24 hr. Duration Storm)

                    Executed:  10-01-1998  11:25:28
              Watershed file:  --> A:\POSTDV2 .MOP
              Hydrograph file: --> A:\POSTDV00.HYD

                         Dairyland Power Coop.
                          Feasibility Report
                      PostDevelopment Conditions
                          BJK 5/97 REV 9/98


                   Composite Hydrograph Summary (cfs)
------------------------------------------------------------------------
  Subarea      11.0   11.3   11.6   11.9   12.0   12.1   12.2   12.3   12.4
 Description    hr     hr     hr     hr     hr     hr     hr     hr     hr
------------------------------------------------------------------------
1C                2      3      4      9     18     38     71     96     94
2C                0      0      0      1      2      4     10     18     20
3C                1      1      1      2      6     15     33     48     49
4C                0      0      0      1      1      3      7     13     19
East             19     27     36     53     69    105    190    343    547
Northeast         3      4      5     10     18     36     70    109    136
North             6      9     11     17     22     33     63    127    224
West              6      9     12     20     32     56    102    165    209
------------------------------------------------------------------------
Total (cfs)      37     53     69    113    168    290    546    919   1298


------------------------------------------------------------------------
  Subarea      12.5   12.6   12.7   12.8   13.0   13.2   13.4   13.6   13.8
 Description    hr     hr     hr     hr     hr     hr     hr     hr     hr
------------------------------------------------------------------------
C                73     51     38     29     19     14     12     10      9
C                18     13     10      7      5      4      3      3      3
C                39     28     21     17     11      9      7      6      6
C                20     18     14     11      7      5      4      3      3
ast             733    837    830    756    531    370    270    208    168
ortheast        132    110     85     65     40     28     23     19     17
orth            315    360    350    303    200    130     92     71     59
est             223    201    163    128     79     53     40     32     27
------------------------------------------------------------------------
otal (cfs)     1553   1618   1511   1316    892    613    451    352    292
```

```
Quick TR-55 Version: 5.46 S/N:                                    Page 4
                                           Return Frequency: 100 years

                      TR-55 TABULAR HYDROGRAPH METHOD
                           Type II. Distribution
                          (24 hr. Duration Storm)

                      Executed:  10-01-1998  11:25:28
               Watershed file:  --> A:\POSTDV2 .MOP
               Hydrograph file: --> A:\POSTDV00.HYD

                          Dairyland Power Coop.
                           Feasibility Report
                        PostDevelopment Conditions
                           BJK 5/97 REV 9/98


                    Composite Hydrograph Summary (cfs)
-----------------------------------------------------------------------------
  Subarea       14.0   14.3   14.6   15.0   15.5   16.0   16.5   17.0   17.5
 Description     hr     hr     hr     hr     hr     hr     hr     hr     hr
-----------------------------------------------------------------------------
1C                 8      7      7      6      5      5      4      4      4
2C                 2      2      2      2      1      1      1      1      1
3C                 5      5      4      4      3      3      3      3      2
4C                 3      2      2      2      2      2      1      1      1
East             141    115     97     83     74     66     59     53     49
Northeast         15     13     12     11     10      9      8      7      7
North             51     44     38     33     30     27     24     22     20
West              24     21     18     16     14     13     12     11     10
-----------------------------------------------------------------------------
Total (cfs)      249    209    180    157    139    126    112    102     94



-----------------------------------------------------------------------------
  Subarea       18.0   19.0   20.0   22.0   26.0
 Description     hr     hr     hr     hr     hr
-----------------------------------------------------------------------------
1C                 4      3      3      2      0
2C                 1      1      1      1      0
3C                 2      2      2      2      0
4C                 1      1      1      1      0
ast               47     42     37     30      0
ortheast           6      6      5      4      0
orth              19     17     15     13      0
est               10      8      7      6      0
-----------------------------------------------------------------------------
otal (cfs)        90     80     71     59      0
```

```
POND-2 Version: 5.21  S/N:                              Page 1 of 4

            Executed 09-18-2000      13:11:11

     Data directory: p:\data\projects\3081\40\sw\*.HYD

          File Summary for Composite Hydrograph

     Time     POSTDV25  BSN1OUT1  BSN2OUT1  TPTPST25
     (hrs)     (cfs)     (cfs)     (cfs)    (Total)
     --------  --------  --------  --------  --------
      11.00      16.0       0.0       0.0      16.0
      11.10      18.0       0.2       0.2      18.4
      11.20      21.0       0.2       0.2      21.4
      11.30      23.0       0.3       0.2      23.5
      11.40      26.0       0.3       0.2      26.5
      11.50      28.0       0.3       0.2      28.5
      11.60      31.0       0.4       0.2      31.6
      11.70      38.0       0.4       0.3      38.7
      11.80      44.0       0.4       0.3      44.7
      11.90      51.0       0.5       0.3      51.8
      12.00      75.0       0.5       0.4      75.9
      12.10     138.0       0.6       0.4     139.0
      12.20     283.0       0.6       0.5     284.1
      12.30     518.0       0.7       0.5     519.2
      12.40     773.0       0.7       0.5     774.2
      12.50     964.0       0.7       0.6     965.3
      12.60    1027.0       0.7       0.6    1028.3 ← Peak
      12.70     977.0       0.7       0.6     978.3
      12.80     861.0       0.7       0.6     862.3
      12.90     727.0       0.7       0.6     728.3
      13.00     593.0       0.8       0.6     594.3
      13.10     503.0       0.8       0.6     504.4
      13.20     414.0       0.8       0.6     415.4
      13.30     361.0       0.8       0.6     362.4
      13.40     308.0       0.8       0.6     309.4
      13.50     277.0       0.8       0.6     278.4
      13.60     245.0       0.8       0.6     246.4
      13.70     225.0       0.8       0.6     226.4
      13.80     205.0       0.8       0.6     206.4
      13.90     190.0       0.8       0.6     191.4
      14.00     174.0       0.8       0.6     175.4
      14.10     165.0       0.8       0.6     166.4
      14.20     155.0       0.8       0.6     156.4
      14.30     146.0       0.9       0.6     147.5
      14.40     139.0       1.2       0.6     140.8
      14.50     133.0       1.5       0.6     135.1
      14.60     126.0       1.8       0.6     128.4
      14.70     122.0       2.0       0.6     124.6
      14.80     118.0       2.2       0.6     120.8
      14.90     115.0       2.3       0.6     117.9
```

Combined Post-Development
Hydrograph 25yr storm

Basin 1 +
Basin 2 +
Surrounding watershed.

```
                Executed 09-18-2000       13:11:11

         Data directory: p:\data\projects\3081\40\sw\*.HYD

               File Summary for Composite Hydrograph

           Time     POSTDV25  BSN1OUT1  BSN2OUT1  TPTPST25
           (hrs)     (cfs)     (cfs)     (cfs)    (Total)
          --------  --------  --------  --------  --------
           15.00     111.0       2.4       0.6     114.0
           15.10     109.0       2.5       0.6     112.1
           15.20     107.0       2.6       0.6     110.2
           15.30     104.0       2.7       0.6     107.3
           15.40     102.0       2.7       0.6     105.3
           15.50     100.0       2.8       0.6     103.4
           15.60      98.0       2.8       0.6     101.4
           15.70      96.0       2.8       0.6      99.4
           15.80      94.0       2.9       0.6      97.5
           15.90      92.0       2.9       0.6      95.5
           16.00      90.0       2.9       0.6      93.5
           16.10      88.0       2.9       0.6      91.5
           16.20      86.0       2.9       0.6      89.5
           16.30      85.0       2.9       0.6      88.5
           16.40      83.0       2.7       0.6      86.3
           16.50      81.0       2.6       0.6      84.2
           16.60      80.0       2.5       0.6      83.1
           16.70      78.0       2.4       0.6      81.0
           16.80      77.0       2.3       0.6      79.9
           16.90      75.0       2.3       0.6      77.9
           17.00      74.0       2.2       0.6      76.8
           17.10      73.0       2.2       0.6      75.8
           17.20      72.0       2.2       0.6      74.8
           17.30      71.0       2.1       0.6      73.7
           17.40      70.0       2.1       0.6      72.7
           17.50      69.0       2.1       0.6      71.7
           17.60      69.0       2.1       0.6      71.7
           17.70      68.0       2.1       0.6      70.7
           17.80      68.0       2.0       0.6      70.7
           17.90      67.0       2.0       0.6      69.6
           18.00      67.0       2.0       0.6      69.6
           18.10      66.0       2.0       0.6      68.6
           18.20      65.0       2.0       0.6      67.6
           18.30      64.0       2.0       0.6      66.6
           18.40      63.0       2.0       0.6      65.6
           18.50      62.0       2.0       0.6      64.6
           18.60      61.0       2.0       0.6      63.6
           18.70      60.0       2.0       0.6      62.6
           18.80      59.0       2.0       0.7      61.7
           18.90      58.0       2.0       0.7      60.8
           19.00      57.0       2.0       0.8      59.8
```

```
                 Executed 09-18-2000      13:11:11

          Data directory: p:\data\projects\3081\40\sw\*.HYD

               File Summary for Composite Hydrograph

            Time     POSTDV25  BSN1OUT1  BSN2OUT1  TPTPST25
            (hrs)     (cfs)     (cfs)     (cfs)    (Total)
          --------  --------  --------  --------  --------
            19.10      56.0       2.0       0.8      58.8
            19.20      56.0       2.0       0.9      58.9
            19.30      55.0       2.0       0.9      57.9
            19.40      55.0       2.0       0.9      57.9
            19.50      54.0       2.0       0.9      56.9
            19.60      53.0       1.9       0.9      55.9
            19.70      53.0       1.8       0.9      55.7
            19.80      52.0       1.6       1.0      54.6
            19.90      52.0       1.5       1.0      54.5
            20.00      51.0       1.4       1.0      53.4
            20.10      51.0       1.4       1.0      53.3
            20.20      50.0       1.3       1.0      52.3
            20.30      50.0       1.2       1.0      52.2
            20.40      49.0       1.2       1.0      51.2
            20.50      49.0       1.2       1.0      51.2
            20.60      49.0       1.1       1.0      51.1
            20.70      48.0       1.1       1.0      50.1
            20.80      48.0       1.1       1.0      50.1
            20.90      47.0       1.1       1.0      49.1
            21.00      47.0       1.0       1.0      49.0
            21.10      47.0       0.8       1.0      48.8
            21.20      46.0       0.8       1.0      47.8
            21.30      46.0       0.8       1.0      47.8
            21.40      45.0       0.8       1.0      46.8
            21.50      45.0       0.8       1.0      46.8
            21.60      45.0       0.8       1.0      46.8
            21.70      44.0       0.8       1.0      45.8
            21.80      44.0       0.8       1.0      45.8
            21.90      43.0       0.8       1.0      44.8
            22.00      43.0       0.8       1.0      44.8
            22.10      42.0       0.8       1.0      43.8
            22.20      41.0       0.8       1.0      42.8
            22.30      40.0       0.8       1.0      41.8
            22.40      39.0       0.8       1.0      40.8
            22.50      38.0       0.8       1.0      39.8
            22.60      37.0       0.8       1.0      38.8
            22.70      35.0       0.8       1.0      36.8
            22.80      34.0       0.8       1.0      35.8
            22.90      33.0       0.8       1.0      34.8
            23.00      32.0       0.8       1.0      33.8
            23.10      31.0       0.8       1.0      32.8
```

```
               Executed 09-18-2000      13:11:11

           Data directory: p:\data\projects\3081\40\sw\*.HYD

                File Summary for Composite Hydrograph

            Time     POSTDV25  BSN1OUT1  BSN2OUT1  TPTPST25
            (hrs)     (cfs)     (cfs)     (cfs)    (Total)
           --------  --------  --------  --------  --------
             23.20     30.0       0.8       1.0      31.8
             23.30     29.0       0.8       1.0      30.8
             23.40     28.0       0.8       1.0      29.8
             23.50     27.0       0.8       1.0      28.8
             23.60     26.0       0.8       1.0      27.8
             23.70     25.0       0.8       1.0      26.8
             23.80     24.0       0.8       1.0      25.8
             23.90     23.0       0.8       1.0      24.8
             24.00     22.0       0.8       0.9      23.7
             24.10     20.0       0.8       0.7      21.5
             24.20     19.0       0.8       0.6      20.4
             24.30     18.0       0.8       0.6      19.4
             24.40     17.0       0.8       0.6      18.4
             24.50     16.0       0.8       0.6      17.4
             24.60     15.0       0.8       0.6      16.4
             24.70     14.0       0.8       0.6      15.4
             24.80     13.0       0.8       0.6      14.4
             24.90     12.0       0.8       0.6      13.4
             25.00     11.0       0.8       0.6      12.4
             25.10     10.0       0.8       0.6      11.4
             25.20      9.0       0.8       0.6      10.4
             25.30      8.0       0.8       0.6       9.4
             25.40      6.0       0.8       0.6       7.4
             25.50      5.0       0.8       0.6       6.4
```

```
POND-2 Version: 5.21  S/N:                              Page 1 of 4

                    Executed 09-18-2000     13:14:54

              Data directory: p:\data\projects\3081\40\sw\*.HYD

                   File Summary for Composite Hydrograph

              Time      POSTDV00  BSN1OUT2  BSN2OUT2  TOTPST00
              (hrs)      (cfs)     (cfs)     (cfs)    (Total)
              --------  --------  --------  --------  --------
               11.00      37.0      0.0       0.0      37.0
               11.10      42.0      0.2       0.2      42.4
               11.20      48.0      0.3       0.2      48.5
               11.30      53.0      0.3       0.2      53.5
               11.40      58.0      0.4       0.3      58.6
               11.50      64.0      0.4       0.3      64.7
               11.60      69.0      0.4       0.3      69.7
               11.70      84.0      0.4       0.3      84.7
               11.80      98.0      0.5       0.3      98.8
               11.90     113.0      0.5       0.4     113.9
               12.00     168.0      0.6       0.4     169.0
               12.10     290.0      0.6       0.5     291.1
               12.20     546.0      0.7       0.5     547.2
               12.30     919.0      0.7       0.6     920.3
               12.40    1298.0      0.7       0.6    1299.3
               12.50    1553.0      0.8       0.6    1554.4
               12.60    1618.0      2.8       1.2    1622.0 ← Peak
               12.70    1511.0      8.2       3.7    1522.9
               12.80    1316.0     12.2       5.2    1333.4
               12.90    1104.0     14.8       6.1    1124.9
               13.00     892.0     15.7       6.6     914.3
               13.10     752.0     15.5       6.9     774.4
               13.20     613.0     14.8       7.0     634.8
               13.30     532.0     14.0       7.0     553.0
               13.40     451.0     13.3       7.0     471.3
               13.50     402.0     12.5       7.0     421.5
               13.60     352.0     11.7       6.9     370.6
               13.70     322.0     10.8       6.7     339.5
               13.80     292.0     10.0       6.6     308.6
               13.90     270.0      9.6       6.5     286.0
               14.00     249.0      9.1       6.3     264.3
               14.10     236.0      8.5       6.0     250.6
               14.20     222.0      8.1       5.8     235.9
               14.30     209.0      7.7       5.7     222.4
               14.40     199.0      7.4       5.4     211.9
               14.50     190.0      7.2       5.2     202.3
               14.60     180.0      7.0       4.8     191.8
               14.70     174.0      6.8       4.5     185.3
               14.80     168.0      6.6       4.2     178.8
               14.90     163.0      6.2       4.0     173.2
```

Combined Post-Development
Hydrograph - 100 yr Storm

Basin 1 +
Basin 2 +
Surrounding Watershed.

```
           Executed 09-18-2000      13:14:54

      Data directory: p:\data\projects\3081\40\sw\*.HYD

         File Summary for Composite Hydrograph

       Time     POSTDV00  BSN1OUT2  BSN2OUT2  TOTPST00
       (hrs)     (cfs)     (cfs)     (cfs)    (Total)
      --------  --------  --------  --------  --------
        15.00     157.0       5.8       3.8     166.6
        15.10     153.0       5.5       3.6     162.1
        15.20     150.0       5.3       3.5     158.8
        15.30     146.0       5.0       3.4     154.4
        15.40     143.0       4.6       3.3     150.9
        15.50     139.0       4.3       3.3     146.6
        15.60     136.0       4.1       3.2     143.3
        15.70     134.0       3.9       3.2     141.1
        15.80     131.0       3.8       3.1     137.9
        15.90     129.0       3.6       3.1     135.7
        16.00     126.0       3.5       3.1     132.6
        16.10     123.0       3.4       3.1     129.5
        16.20     120.0       3.4       3.1     126.4
        16.30     118.0       3.3       3.0     124.2
        16.40     115.0       3.2       2.8     121.0
        16.50     112.0       3.2       2.6     117.8
        16.60     110.0       3.2       2.5     115.7
        16.70     108.0       3.1       2.4     113.5
        16.80     106.0       3.1       2.3     111.4
        16.90     104.0       3.1       2.3     109.3
        17.00     102.0       3.1       2.2     107.3
        17.10     100.0       3.1       2.2     105.2
        17.20      99.0       3.0       2.1     104.2
        17.30      97.0       3.0       2.1     102.2
        17.40      96.0       3.0       2.1     101.1
        17.50      94.0       3.0       2.1      99.1
        17.60      93.0       3.0       2.1      98.1
        17.70      92.0       3.0       2.0      97.1
        17.80      92.0       3.0       2.0      97.1
        17.90      91.0       3.0       2.0      96.0
        18.00      90.0       3.0       2.0      95.0
        18.10      89.0       3.0       2.0      94.0
        18.20      88.0       3.0       2.0      93.0
        18.30      87.0       3.0       2.0      92.0
        18.40      86.0       3.0       2.0      91.0
        18.50      85.0       2.9       2.0      89.9
        18.60      84.0       2.8       2.0      88.8
        18.70      83.0       2.6       2.0      87.6
        18.80      82.0       2.5       2.0      86.5
        18.90      81.0       2.4       2.0      85.4
        19.00      80.0       2.4       2.0      84.4
```

```
                    Executed 09-18-2000       13:14:54

          Data directory: p:\data\projects\3081\40\sw\*.HYD

              File Summary for Composite Hydrograph

          Time     POSTDV00  BSN1OUT2  BSN2OUT2  TOTPST00
          (hrs)     (cfs)     (cfs)     (cfs)    (Total)
          --------  --------  --------  --------  --------
           19.10      79.0       2.3       2.0      83.3
           19.20      78.0       2.2       2.0      82.2
           19.30      77.0       2.2       2.0      81.2
           19.40      76.0       2.2       2.0      80.2
           19.50      76.0       2.1       2.0      80.1
           19.60      75.0       2.1       1.9      79.0
           19.70      74.0       2.1       1.7      77.8
           19.80      73.0       2.1       1.6      76.7
           19.90      72.0       2.1       1.5      75.5
           20.00      71.0       2.0       1.4      74.4
           20.10      70.0       2.0       1.3      73.3
           20.20      70.0       2.0       1.3      73.3
           20.30      69.0       2.0       1.2      72.2
           20.40      69.0       2.0       1.2      72.2
           20.50      68.0       2.0       1.1      71.1
           20.60      67.0       2.0       1.1      70.1
           20.70      67.0       2.0       1.1      70.1
           20.80      66.0       2.0       1.1      69.1
           20.90      66.0       2.0       1.0      69.1
           21.00      65.0       2.0       1.0      68.1
           21.10      64.0       2.0       1.0      67.0
           21.20      64.0       2.0       1.0      67.0
           21.30      63.0       2.0       1.0      66.0
           21.40      63.0       2.0       1.0      66.0
           21.50      62.0       2.0       1.0      65.0
           21.60      61.0       2.0       1.0      64.0
           21.70      61.0       2.0       1.0      64.0
           21.80      60.0       2.0       1.0      63.0
           21.90      60.0       2.0       1.0      63.0
           22.00      59.0       2.0       1.0      62.0
           22.10      58.0       2.0       1.0      61.0
           22.20      56.0       2.0       1.0      59.0
           22.30      55.0       2.0       1.0      58.0
           22.40      53.0       2.0       1.0      56.0
           22.50      52.0       2.0       1.0      55.0
           22.60      50.0       2.0       1.0      53.0
           22.70      49.0       2.0       1.0      52.0
           22.80      47.0       2.0       1.0      50.0
           22.90      46.0       2.0       1.0      49.0
           23.00      44.0       2.0       1.0      47.0
           23.10      43.0       1.9       1.0      45.9
```

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                  Executed 09-18-2000      13:14:54

              Data directory: p:\data\projects\3081\40\sw\*.HYD

                 File Summary for Composite Hydrograph

               Time     POSTDV00  BSN1OUT2  BSN2OUT2  TOTPST00
               (hrs)     (cfs)     (cfs)     (cfs)    (Total)
              --------  --------  --------  --------  --------
               23.20      41.0       1.8       1.0      43.8
               23.30      40.0       1.6       1.0      42.6
               23.40      38.0       1.5       1.0      40.5
               23.50      37.0       1.4       1.0      39.4
               23.60      35.0       1.4       1.0      37.3
               23.70      34.0       1.3       1.0      36.3
               23.80      32.0       1.2       1.0      34.2
               23.90      31.0       1.2       1.0      33.2
               24.00      30.0       1.2       0.9      32.1
               24.10      28.0       1.1       0.7      29.9
               24.20      27.0       1.1       0.6      28.7
               24.30      25.0       1.1       0.6      26.7
               24.40      24.0       1.1       0.6      25.7
               24.50      22.0       1.1       0.6      23.7
               24.60      21.0       1.0       0.6      22.6
               24.70      19.0       1.0       0.6      20.6
               24.80      18.0       1.0       0.6      19.6
               24.90      16.0       1.0       0.6      17.6
               25.00      15.0       0.9       0.6      16.5
               25.10      13.0       0.8       0.6      14.4
               25.20      12.0       0.8       0.6      13.4
               25.30      10.0       0.8       0.6      11.4
               25.40       9.0       0.8       0.6      10.4
               25.50       7.0       0.8       0.6       8.4
```

Operational Run-off Calculations

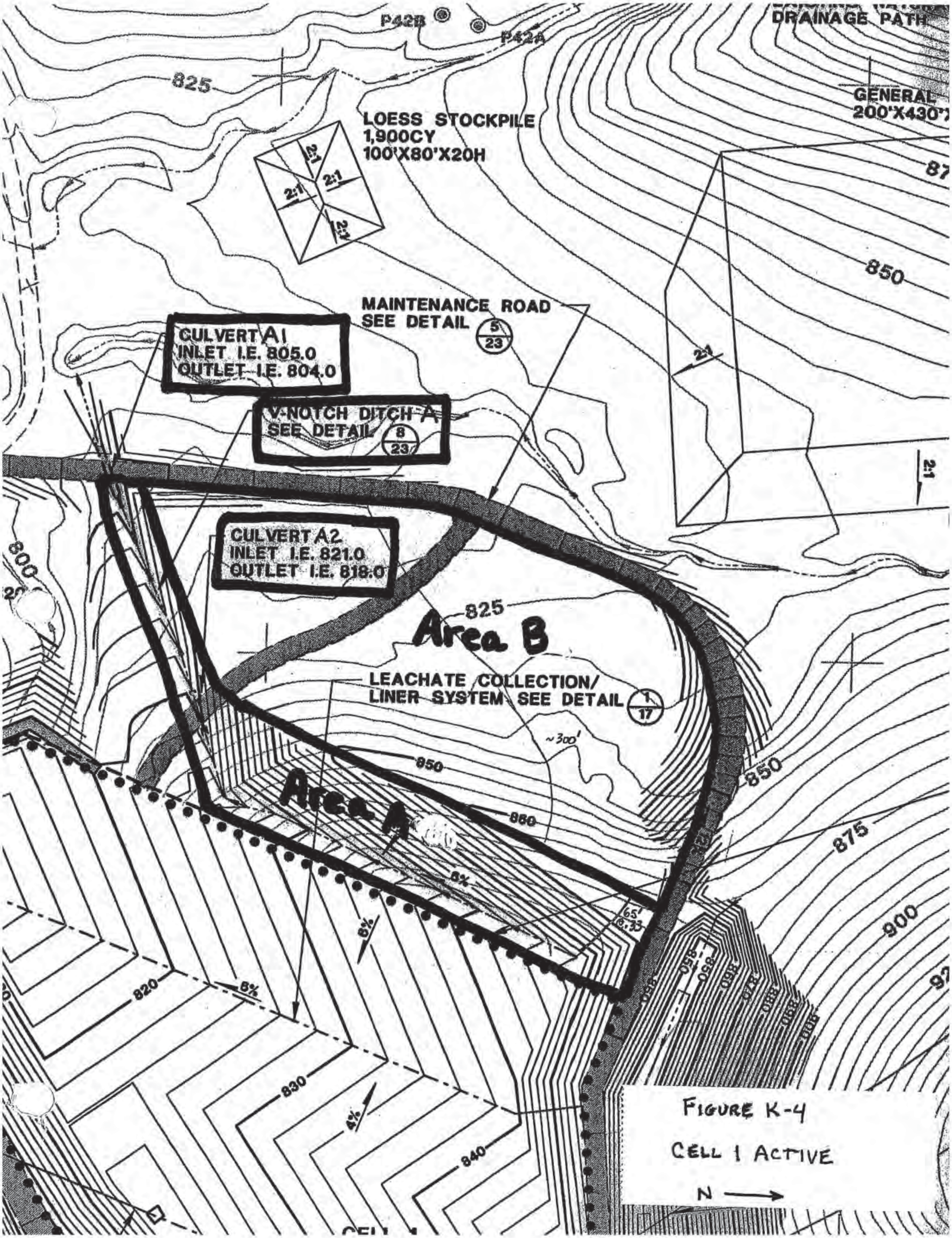

FIGURE K-4

CELL 1 ACTIVE

N →

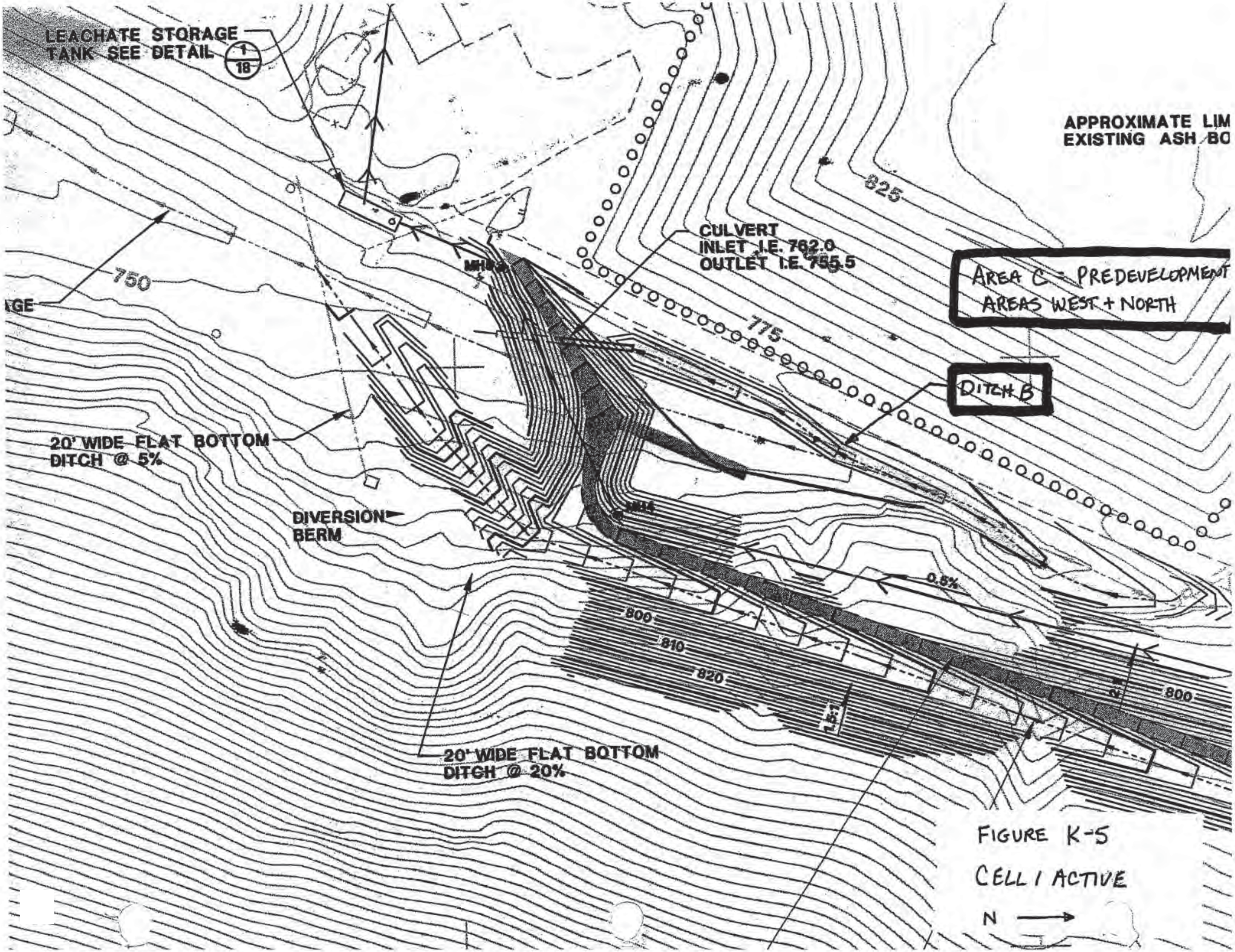

FIGURE K-5

CELL 1 ACTIVE

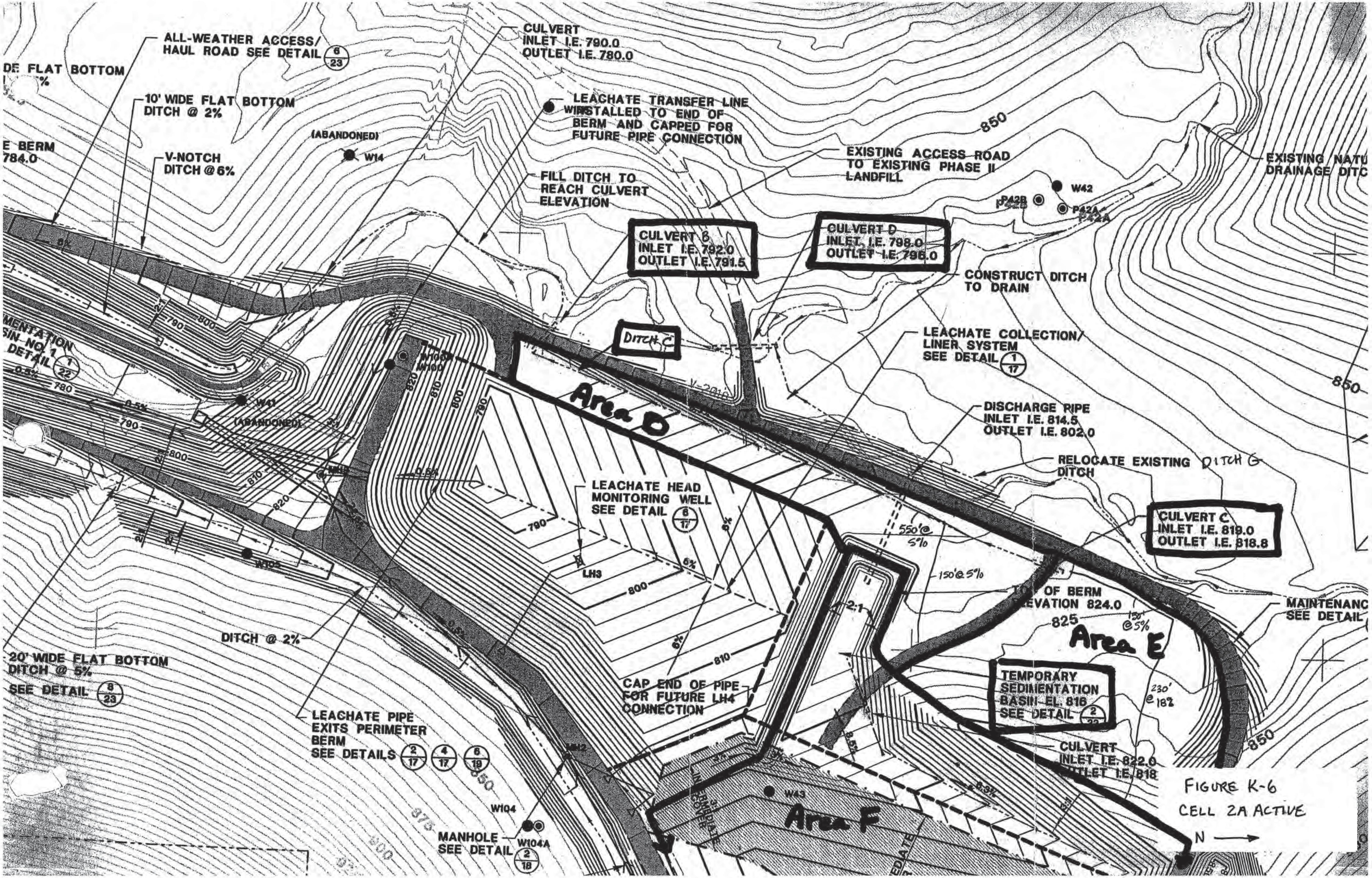

FIGURE K-6
CELL 2A ACTIVE

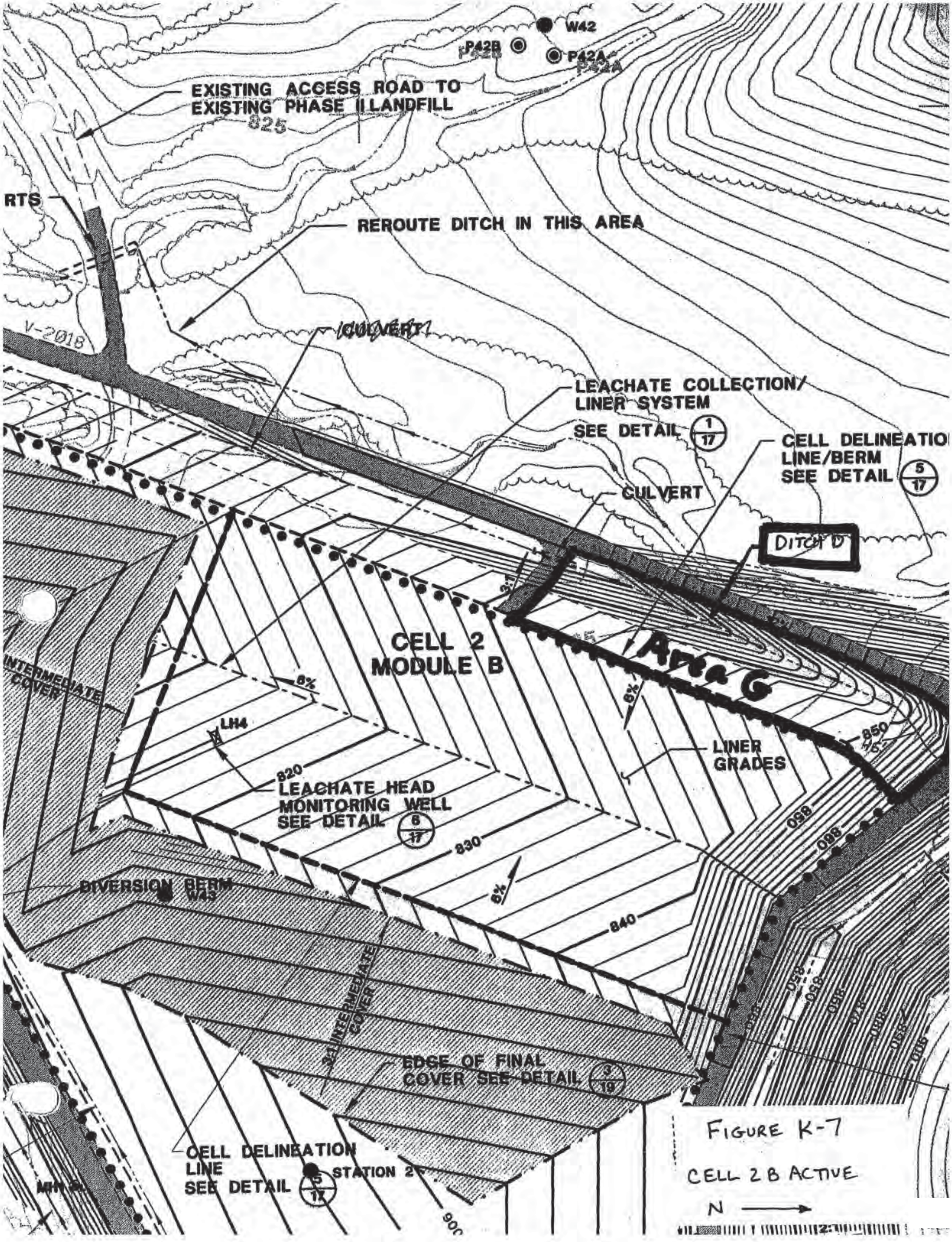

FIGURE K-7

CELL 2 B ACTIVE

N →

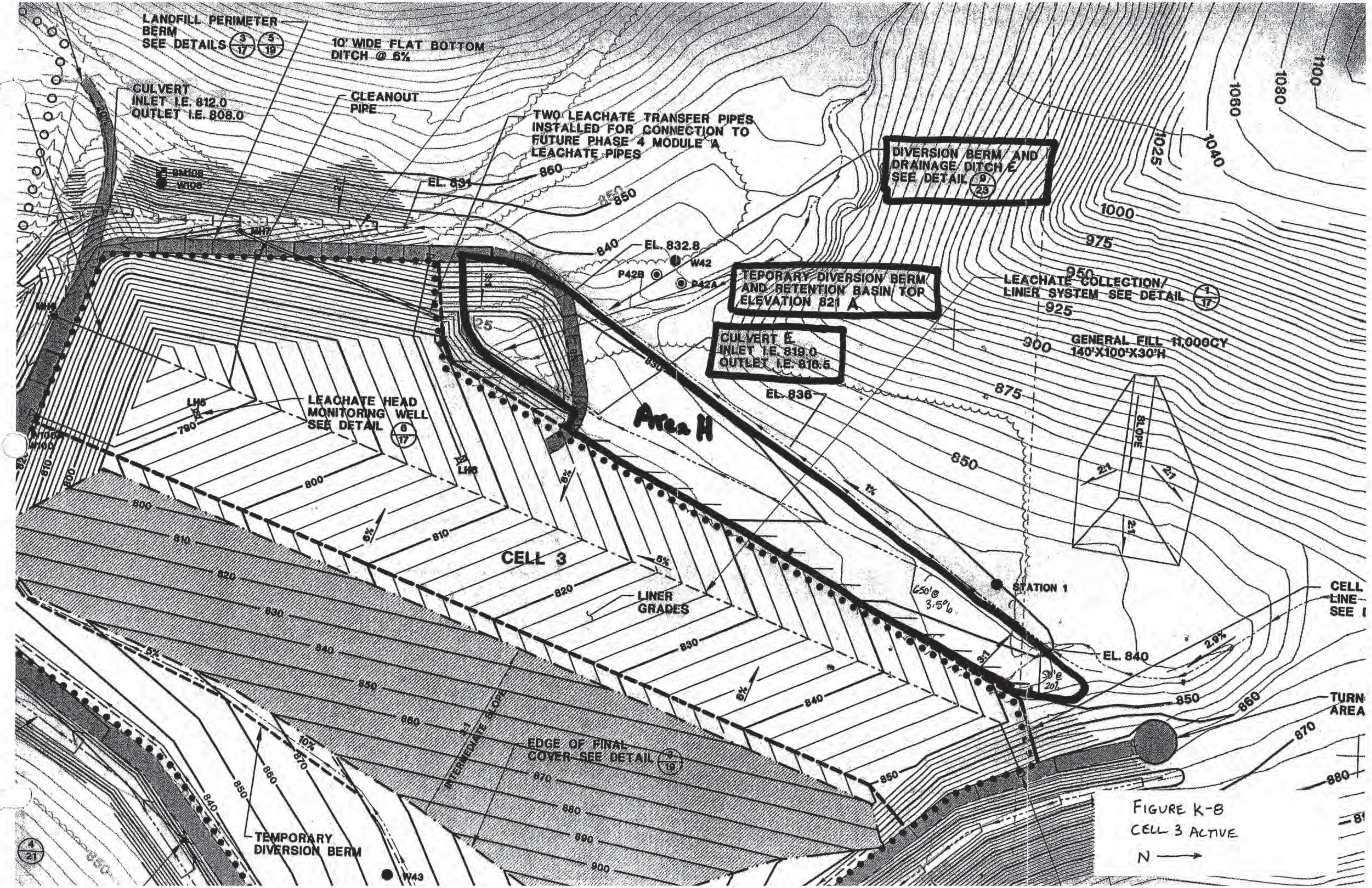

FIGURE K-8
CELL 3 ACTIVE
N ⟶

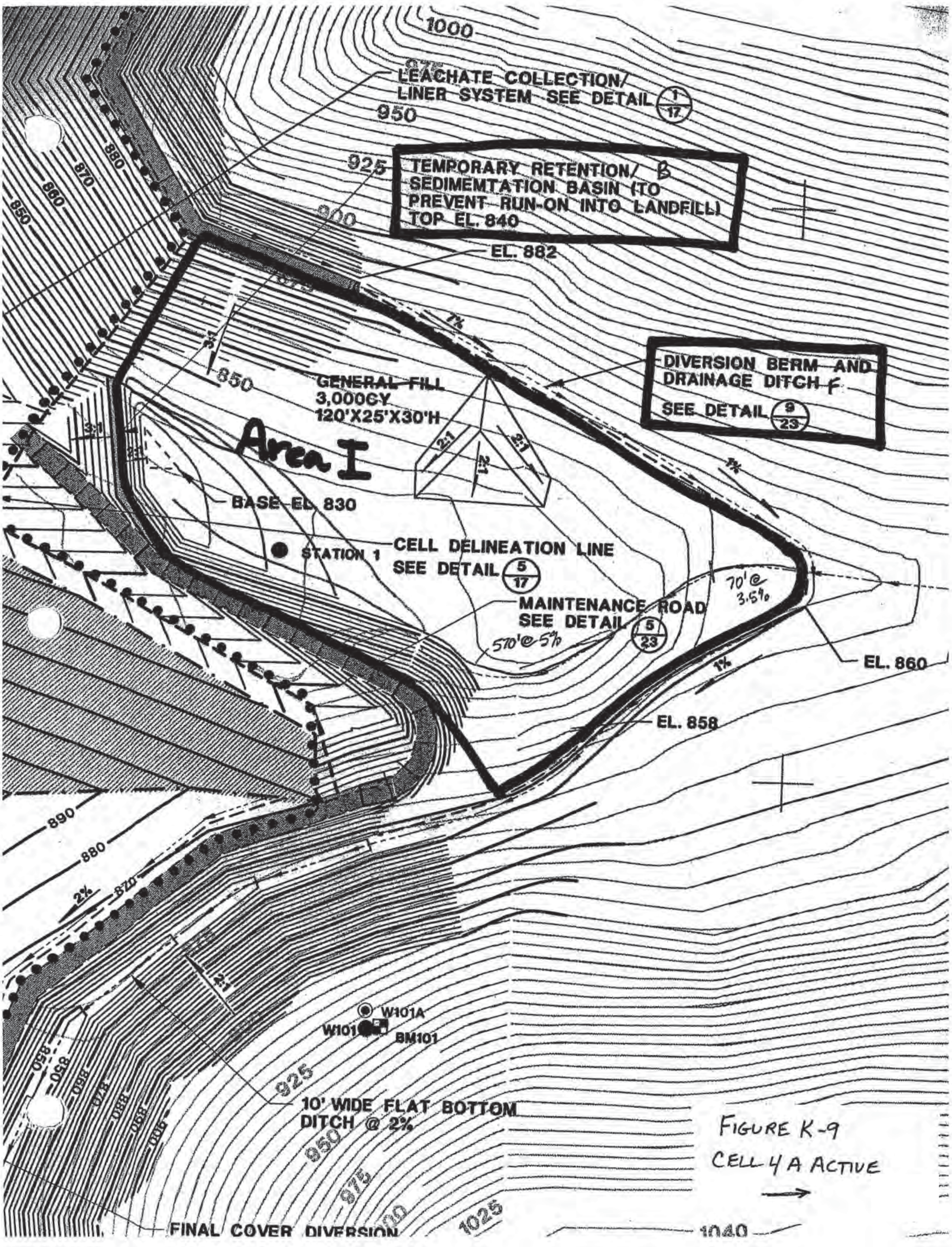

Figure K-9

Cell 4 A Active

→

```
Quick TR-55 Ver.5.46   S/N:
Executed: 19:42:40   10-12-2000    p:\data\projects\3081\40\sw\op\OPERAT.TCT


                 SUMMARY SHEET FOR Tc or Tt COMPUTATIONS
                  (Solved for Time using TR-55 Methods)


                        Dairyland Power Coop.
                          Plan of Operation
                       Operational Conditions



                 Subarea descr.  Tc or Tt   Time (hrs)
                 --------------  --------   ----------
                 Area A             Tc         0.08
                 Area B             Tc         0.21
                 Area D             Tc         0.06 - Round to 0.10
                 Area E             Tc         0.15
                 Area F             Tc         0.24
                 Area G             Tc         0.05 - Round to 0.10
                 Area H             Tc         0.10
                 Area I             Tc         0.15
```

```
Quick TR-55 Ver.5.46   S/N:
Executed: 19:42:40   10-12-2000    p:\data\projects\3081\40\sw\op\OPERAT.TCT

                         Dairyland Power Coop.
                          Plan of Operation
                        Operational Conditions


                    Tc COMPUTATIONS FOR: Area A

 SHEET FLOW (Applicable to Tc only)
    Segment ID                                    1
    Surface description                      grass
    Manning's roughness coeff., n                 0.1500
    Flow length, L (total < or = 300)    ft      65.0
    Two-yr 24-hr rainfall, P2             in     2.800
    Land slope, s                        ft/ft   0.3330
                     0.8
        .007 * (n*L)
    T =  --------------                  hrs      0.04                 =  0.04
           0.5    0.4
        P2   *  s

 SHALLOW CONCENTRATED FLOW
    Segment ID                                    2
    Surface (paved or unpaved)?                   Unpaved
    Flow length, L                        ft      625.0
    Watercourse slope, s                 ft/ft   0.0600

                      0.5
    Avg.V =  Csf *  (s)                  ft/s    3.9521
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                     hrs      0.04                 =  0.04


 CHANNEL FLOW
    Segment ID
    Cross Sectional Flow Area, a        sq.ft     0.00
    Wetted perimeter, Pw                  ft      0.00
    Hydraulic radius, r = a/Pw            ft      0.000
    Channel slope, s                     ft/ft   0.0000
    Manning's roughness coeff., n                0.0000

                  2/3    1/2
        1.49  *  r   *  s
    V =  --------------------            ft/s    0.0000
                  n

    Flow length, L                        ft        0

    T = L / (3600*V)                     hrs      0.00                 =  0.00

  ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                              TOTAL TIME (hrs)        0.08
```

```
Quick TR-55 Ver.5.46   S/N:
Executed: 19:42:40   10-12-2000    p:\data\projects\3081\40\sw\op\OPERAT.TCT

                           Dairyland Power Coop.
                             Plan of Operation
                          Operational Conditions


                      Tc COMPUTATIONS FOR: Area B

 SHEET FLOW (Applicable to Tc only)
    Segment ID                                  1
    Surface description                    grass
    Manning's roughness coeff., n              0.1500
    Flow length, L (total < or = 300)   ft    300.0
    Two-yr 24-hr rainfall, P2           in     2.800
    Land slope, s                     ft/ft   0.1700
                    0.8
         .007 * (n*L)
    T = --------------                hrs      0.18               = 0.18
              0.5    0.4
           P2    *  s

 SHALLOW CONCENTRATED FLOW
    Segment ID                                 2
    Surface (paved or unpaved)?                Unpaved
    Flow length, L                      ft     220.0
    Watercourse slope, s              ft/ft   0.0200

                      0.5
    Avg.V =  Csf *  (s)               ft/s    2.2818
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                  hrs      0.03               = 0.03


 CHANNEL FLOW
    Segment ID
    Cross Sectional Flow Area, a     sq.ft     0.00
    Wetted perimeter, Pw                ft     0.00
    Hydraulic radius, r = a/Pw          ft    0.000
    Channel slope, s                  ft/ft   0.0000
    Manning's roughness coeff., n             0.0000

                  2/3    1/2
        1.49  *  r   *  s
    V = --------------------          ft/s    0.0000
                 n

    Flow length, L                      ft        0

    T = L / (3600*V)                  hrs      0.00               = 0.00

   ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                           TOTAL TIME (hrs)        0.21
```

```
Quick TR-55 Ver.5.46   S/N:
Executed: 19:42:40   10-12-2000    p:\data\projects\3081\40\sw\op\OPERAT.TCT

                           Dairyland Power Coop.
                             Plan of Operation
                          Operational Conditions


                     Tc COMPUTATIONS FOR: Area D

 SHEET FLOW (Applicable to Tc only)
     Segment ID                                 1
     Surface description                    soil
     Manning's roughness coeff., n               0.0110
     Flow length, L (total < or = 300)     ft     150.0
     Two-yr 24-hr rainfall, P2             in     2.800
     Land slope, s                      ft/ft    0.0500
                      0.8
          .007 * (n*L)
     T = --------------                   hrs      0.02                = 0.02
             0.5    0.4
          P2   *   s

 SHALLOW CONCENTRATED FLOW
     Segment ID                                 2
     Surface (paved or unpaved)?                Unpaved
     Flow length, L                        ft     550.0
     Watercourse slope, s               ft/ft    0.0500

                        0.5
     Avg.V =  Csf *  (s)                 ft/s    3.6078
     where:   Unpaved Csf = 16.1345
              Paved   Csf = 20.3282

     T = L / (3600*V)                     hrs      0.04                = 0.04


 CHANNEL FLOW
     Segment ID
     Cross Sectional Flow Area, a       sq.ft      0.00
     Wetted perimeter, Pw                  ft      0.00
     Hydraulic radius, r = a/Pw            ft     0.000
     Channel slope, s                   ft/ft    0.0000
     Manning's roughness coeff., n               0.0000

                    2/3    1/2
          1.49  *  r    *  s
     V = --------------------            ft/s    0.0000
                  n

     Flow length, L                        ft         0

     T = L / (3600*V)                     hrs      0.00                = 0.00

    ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                               TOTAL TIME (hrs)       0.06
```

```
Quick TR-55 Ver.5.46   S/N:
Executed: 19:42:40   10-12-2000    p:\data\projects\3081\40\sw\op\OPERAT.TCT

                         Dairyland Power Coop.
                           Plan of Operation
                        Operational Conditions


                  Tc COMPUTATIONS FOR: Area E

 SHEET FLOW (Applicable to Tc only)
    Segment ID                                  1
    Surface description                     grass
    Manning's roughness coeff., n              0.1500
    Flow length, L (total < or = 300)   ft    230.0
    Two-yr 24-hr rainfall, P2           in     2.800
    Land slope, s                      ft/ft   0.1800
                      0.8
         .007 * (n*L)
    T = --------------                  hrs     0.14              =  0.14
           0.5    0.4
         P2    *  s

 SHALLOW CONCENTRATED FLOW
    Segment ID                                  2
    Surface (paved or unpaved)?                Unpaved
    Flow length, L                       ft     150.0
    Watercourse slope, s               ft/ft   0.0500

                        0.5
    Avg.V =  Csf *  (s)                ft/s    3.6078
    Where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                    hrs     0.01              =  0.01


 CHANNEL FLOW
    Segment ID
    Cross Sectional Flow Area, a      sq.ft     0.00
    Wetted perimeter, Pw                 ft     0.00
    Hydraulic radius, r = a/Pw           ft    0.000
    Channel slope, s                   ft/ft   0.0000
    Manning's roughness coeff., n              0.0000

                 2/3    1/2
         1.49  *  r   *  s
    V = --------------------           ft/s    0.0000
                  n

    Flow length, L                       ft        0

    T = L / (3600*V)                    hrs     0.00              =  0.00

   :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                            TOTAL TIME (hrs)        0.15
```

```
Quick TR-55 Ver.5.46   S/N:
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                           Dairyland Power Coop.
                             Plan of Operation
                          Operational Conditions


                     Tc COMPUTATIONS FOR: Area F

 SHEET FLOW (Applicable to Tc only)
    Segment ID                                 1
    Surface description                    grass
    Manning's roughness coeff., n             0.1500
    Flow length, L (total < or = 300)    ft    185.0
    Two-yr 24-hr rainfall, P2            in    2.800
    Land slope, s                      ft/ft  0.2500
                      0.8
        .007 * (n*L)
    T = --------------                  hrs     0.10              = 0.10
           0.5    0.4
         P2   *  s

 SHALLOW CONCENTRATED FLOW
    Segment ID                                2
    Surface (paved or unpaved)?               Unpaved
    Flow length, L                       ft   1370.0
    Watercourse slope, s               ft/ft  0.0300

                        0.5
    Avg.V =  Csf *  (s)                 ft/s  2.7946
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                    hrs     0.14              = 0.14


 CHANNEL FLOW
    Segment ID
    Cross Sectional Flow Area, a      sq.ft     0.00
    Wetted perimeter, Pw                 ft     0.00
    Hydraulic radius, r = a/Pw           ft    0.000
    Channel slope, s                   ft/ft  0.0000
    Manning's roughness coeff., n             0.0000

                    2/3    1/2
        1.49  *  r   *  s
    V = --------------------            ft/s  0.0000
                   n

    Flow length, L                       ft        0

    T = L / (3600*V)                    hrs     0.00              = 0.00

   ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                              TOTAL TIME (hrs)      0.24
```

```
Quick TR-55 Ver.5.46   S/N:
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                          Dairyland Power Coop.
                            Plan of Operation
                         Operational Conditions


                     Tc COMPUTATIONS FOR: Area G

 SHEET FLOW (Applicable to Tc only)
    Segment ID                                  1
    Surface description                  grass
    Manning's roughness coeff., n               0.1500
    Flow length, L (total < or = 300)     ft      45.0
    Two-yr 24-hr rainfall, P2             in     2.800
    Land slope, s                       ft/ft   0.3300
                      0.8
        .007 * (n*L)
    T = --------------                   hrs      0.03              =  0.03
            0.5    0.4
          P2   *  s

 SHALLOW CONCENTRATED FLOW
    Segment ID                                 2
    Surface (paved or unpaved)?                Unpaved
    Flow length, L                        ft     320.0
    Watercourse slope, s                ft/ft   0.1200

                       0.5
    Avg.V =  Csf *  (s)                  ft/s   5.5892
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                     hrs      0.02              =  0.02


 CHANNEL FLOW
    Segment ID
    Cross Sectional Flow Area, a       sq.ft      0.00
    Wetted perimeter, Pw                  ft      0.00
    Hydraulic radius, r = a/Pw            ft     0.000
    Channel slope, s                    ft/ft   0.0000
    Manning's roughness coeff., n               0.0000

                    2/3    1/2
       1.49  *  r   *  s
    V = --------------------             ft/s   0.0000
                   n

    Flow length, L                        ft         0

    T = L / (3600*V)                     hrs      0.00              =  0.00

  ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                            TOTAL TIME (hrs)        0.05
```

```
Quick TR-55 Ver.5.46   S/N:
Executed: 19:42:40   10-12-2000    p:\data\projects\3081\40\sw\op\OPERAT.TCT

                          Dairyland Power Coop.
                            Plan of Operation
                          Operational Conditions


                     Tc COMPUTATIONS FOR: Area H

 SHEET FLOW (Applicable to Tc only)
    Segment ID                                 1
    Surface description                    grass
    Manning's roughness coeff., n              0.1500
    Flow length, L (total < or = 300)    ft     50.0
    Two-yr 24-hr rainfall, P2            in     2.800
    Land slope, s                      ft/ft   0.2000
                      0.8
         .007 * (n*L)
    T =  --------------                 hrs     0.04              =  0.04
            0.5    0.4
          P2   *  s

 SHALLOW CONCENTRATED FLOW
    Segment ID                                 2
    Surface (paved or unpaved)?               Unpaved
    Flow length, L                       ft    650.0
    Watercourse slope, s               ft/ft   0.0350

                       0.5
    Avg.V =  Csf *  (s)                ft/s   3.0185
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                    hrs     0.06              =  0.06


 CHANNEL FLOW
    Segment ID
    Cross Sectional Flow Area, a      sq.ft     0.00
    Wetted perimeter, Pw                 ft     0.00
    Hydraulic radius, r = a/Pw           ft    0.000
    Channel slope, s                   ft/ft   0.0000
    Manning's roughness coeff., n              0.0000

                 2/3    1/2
        1.49  *  r   *  s
    V = --------------------           ft/s   0.0000
                 n

    Flow length, L                       ft        0

    T = L / (3600*V)                    hrs     0.00              =  0.00

  ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                        TOTAL TIME (hrs)          0.10
```

```
Quick TR-55 Ver.5.46   S/N:
Executed: 19:42:40   10-12-2000    p:\data\projects\3081\40\sw\op\OPERAT.TCT

                          Dairyland Power Coop.
                            Plan of Operation
                         Operational Conditions


                    Tc COMPUTATIONS FOR: Area I

 SHEET FLOW (Applicable to Tc only)
    Segment ID                                 1
    Surface description                 grass
    Manning's roughness coeff., n             0.1500
    Flow length, L (total < or = 300)   ft     70.0
    Two-yr 24-hr rainfall, P2           in     2.800
    Land slope, s                     ft/ft   0.0350
                         0.8
        .007 * (n*L)
    T = --------------                  hrs     0.10              =  0.10
              0.5    0.4
          P2   *   s

 SHALLOW CONCENTRATED FLOW
    Segment ID                                 2
    Surface (paved or unpaved)?               Unpaved
    Flow length, L                      ft     570.0
    Watercourse slope, s              ft/ft   0.0500

                         0.5
    Avg.V =  Csf *  (s)                ft/s   3.6078
    where:   Unpaved Csf = 16.1345
             Paved   Csf = 20.3282

    T = L / (3600*V)                    hrs     0.04              =  0.04


 CHANNEL FLOW
    Segment ID
    Cross Sectional Flow Area, a     sq.ft     0.00
    Wetted perimeter, Pw                ft     0.00
    Hydraulic radius, r = a/Pw          ft    0.000
    Channel slope, s                 ft/ft   0.0000
    Manning's roughness coeff., n            0.0000

                   2/3    1/2
         1.49  *  r   *  s
    V = --------------------           ft/s   0.0000
                    n

    Flow length, L                      ft        0

    T = L / (3600*V)                   hrs     0.00              =  0.00

   ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                          TOTAL TIME (hrs)        0.15
```

```
                    TR-55 TABULAR HYDROGRAPH METHOD
                         Type II  Distribution
                        (24 hr. Duration Storm)

                    Executed:  10-12-2000  20:11:42
         Watershed file:  --> p:\data\projects\3081\40\sw\op\CELL1    .WSD
         Hydrograph file: --> p:\data\projects\3081\40\sw\op\CELL1    .HYD

                          Dairyland Power Coop.
                            Plan of Operation
                          Operational Conditions
                                 Cell 1


            >>>> Input Parameters Used to Compute Hydrograph <<<<
-------------------------------------------------------------------------------
  Subarea        AREA     CN      Tc     * Tt    Precip.  |  Runoff     Ia/p
 Description    (acres)          (hrs)   (hrs)    (in)    |   (in)   input/used
-------------------------------------------------------------------------------
 Area A           1.10    69.0    0.10    0.00    6.10    |   2.79    .15  .10
 Area B           2.70    69.0    0.20    0.00    6.10    |   2.79    .15  .10
-------------------------------------------------------------------------------
 * Travel time from subarea outfall to composite watershed outfall point.
               Total area = 3.80 acres   or  0.00594 sq.mi
                        Peak discharge =  14 cfs



          >>>> Computer Modifications of Input Parameters <<<<<
-------------------------------------------------------------------------------
                Input Values    Rounded Values      Ia/p
  Subarea       Tc     * Tt      Tc     * Tt     Interpolated       Ia/p
 Description    (hr)    (hr)     (hr)    (hr)     (Yes/No)        Messages
-------------------------------------------------------------------------------
Area A          0.10    0.00      **      **         No              --
Area B          0.21    0.00     0.20    0.00        No              --
-------------------------------------------------------------------------------
 * Travel time from subarea outfall to composite watershed outfall point.
** Tc & Tt are available in the hydrograph tables.
```

```
               TR-55 TABULAR HYDROGRAPH METHOD
                    Type II  Distribution
                   (24 hr. Duration Storm)

               Executed:  10-12-2000  20:11:42
     Watershed file:  --> p:\data\projects\3081\40\sw\op\CELL1    .WSD
     Hydrograph file: --> p:\data\projects\3081\40\sw\op\CELL1    .HYD

                     Dairyland Power Coop.
                       Plan of Operation
                    Operational Conditions
                            Cell 1


            >>>> Summary of Subarea Times to Peak <<<<

                         Peak Discharge at  Time to Peak at
                         Composite Outfall  Composite Outfall
       Subarea                 (cfs)              (hrs)
      --------------      --------------      ------------
      Area A                     5                12.1
      Area B                     9                12.1
      --------------      --------------      ------------
    Composite Watershed         14                12.1
```

```
                  TR-55 TABULAR HYDROGRAPH METHOD
                       Type II  Distribution
                      (24 hr. Duration Storm)

                  Executed:  10-12-2000  20:11:49
        Watershed file:  --> p:\data\projects\3081\40\sw\op\CELL2A  .WSD
        Hydrograph file: --> p:\data\projects\3081\40\sw\op\CELL2A  .HYD

                         Dairyland Power Coop.
                          Plan of Opertaion
                        Operational Conditions
                               Cell 2A


           >>>> Input Parameters Used to Compute Hydrograph <<<<
-------------------------------------------------------------------------------
  Subarea        AREA     CN     Tc    * Tt    Precip. |  Runoff    Ia/p
 Description    (acres)         (hrs)  (hrs)    (in)   |   (in)  input/used
-------------------------------------------------------------------------------
 Area D            1.30   69.0   0.10   0.00    6.10   |   2.79   .15  .10
 Area E            1.60   69.0   0.20   0.00    6.10   |   2.79   .15  .10
-------------------------------------------------------------------------------
 * Travel time from subarea outfall to composite watershed outfall point.
              Total area = 2.90 acres   or  0.00453 sq.mi
                       Peak discharge =  11 cfs


           >>>> Computer Modifications of Input Parameters <<<<<
-------------------------------------------------------------------------------
                 Input Values    Rounded Values     Ia/p
  Subarea         Tc    * Tt      Tc    * Tt    Interpolated        Ia/p
 Description     (hr)   (hr)     (hr)   (hr)      (Yes/No)        Messages
-------------------------------------------------------------------------------
Area D           0.10   0.00      **     **          No              --
Area E           0.15   0.00     0.20   0.00         No              --
-------------------------------------------------------------------------------
 * Travel time from subarea outfall to composite watershed outfall point.
** Tc & Tt are available in the hydrograph tables.
```

```
                      TR-55 TABULAR HYDROGRAPH METHOD
                           Type II  Distribution
                          (24 hr. Duration Storm)

                      Executed:  10-12-2000  20:11:49
            Watershed file:  --> p:\data\projects\3081\40\sw\op\CELL2A  .WSD
            Hydrograph file: --> p:\data\projects\3081\40\sw\op\CELL2A  .HYD

                            Dairyland Power Coop.
                              Plan of Opertaion
                           Operational Conditions
                                  Cell 2A


                 >>>> Summary of Subarea Times to Peak <<<<

                              Peak Discharge at  Time to Peak at
                              Composite Outfall Composite Outfall
              Subarea               (cfs)             (hrs)
            --------------  --------------  ------------
            Area D                  6               12.1
            Area E                  6               12.2
            --------------  --------------  ------------
          Composite Watershed      11               12.1
```

```
                    TR-55 TABULAR HYDROGRAPH METHOD
                         Type II  Distribution
                        (24 hr. Duration Storm)

                   Executed:  10-12-2000  20:11:57
         Watershed file:  --> p:\data\projects\3081\40\sw\op\TEMPBAS .WSD
         Hydrograph file: --> p:\data\projects\3081\40\sw\op\TEMPBAS .HYD

                          Dairyland Power Coop.
                           Plan of Opertaion
                         Operational Conditions
                         Cell 2A Temporary Basin


          >>>> Input Parameters Used to Compute Hydrograph <<<<
-------------------------------------------------------------------------------
  Subarea       AREA     CN      Tc     * Tt    Precip. |  Runoff     Ia/p
 Description   (acres)          (hrs)   (hrs)    (in)   |   (in)  input/used
-------------------------------------------------------------------------------
 Area F           7.60   69.0    0.20    0.00    6.10   |   2.79    .15  .10
-------------------------------------------------------------------------------
 * Travel time from subarea outfall to composite watershed outfall point.
                Total area = 7.60 acres  or  0.01187 sq.mi
                         Peak discharge =  27 cfs



          >>>> Computer Modifications of Input Parameters <<<<<
-------------------------------------------------------------------------------
                 Input Values    Rounded Values     Ia/p
  Subarea        Tc     * Tt       Tc     * Tt   Interpolated       Ia/p
 Description    (hr)    (hr)      (hr)    (hr)     (Yes/No)       Messages
-------------------------------------------------------------------------------
Area F           0.24    0.00      0.20    0.00       No               --
-------------------------------------------------------------------------------
 * Travel time from subarea outfall to composite watershed outfall point.
```

```
               TR-55 TABULAR HYDROGRAPH METHOD
                   Type II  Distribution
                  (24 hr. Duration Storm)

               Executed:  10-12-2000  20:11:57
     Watershed file:  --> p:\data\projects\3081\40\sw\op\TEMPBAS .WSD
     Hydrograph file: --> p:\data\projects\3081\40\sw\op\TEMPBAS .HYD

                    Dairyland Power Coop.
                     Plan of Opertaion
                   Operational Conditions
                  Cell 2A Temporary Basin


          >>>> Summary of Subarea Times to Peak <<<<

                      Peak Discharge at  Time to Peak at
                      Composite Outfall  Composite Outfall
       Subarea              (cfs)              (hrs)
     --------------    --------------     ------------
     Area F                  27                12.2
     --------------    --------------     ------------
   Composite Watershed       27                12.2
```

```
                    TR-55 TABULAR HYDROGRAPH METHOD
                         Type II  Distribution
                        (24 hr. Duration Storm)

                    Executed:  10-12-2000  20:12:03
          Watershed file:  --> p:\data\projects\3081\40\sw\op\CELL2B  .WSD
          Hydrograph file: --> p:\data\projects\3081\40\sw\op\CELL2B  .HYD

                          Dairyland Power Coop.
                            Plan of Opertaion
                          Operational Conditions
                                 Cell 2B


          >>>> Input Parameters Used to Compute Hydrograph <<<<
-------------------------------------------------------------------------------
  Subarea       AREA     CN      Tc     * Tt    Precip. |  Runoff    Ia/p
 Description   (acres)          (hrs)   (hrs)    (in)   |   (in)  input/used
-------------------------------------------------------------------------------
 Area G          0.60    69.0    0.10    0.00    6.10   |   2.79   .15  .10
-------------------------------------------------------------------------------
 * Travel time from subarea outfall to composite watershed outfall point.
                 Total area = 0.60 acres  or  0.00094 sq.mi
                         Peak discharge =  3 cfs



          >>>> Computer Modifications of Input Parameters <<<<<
-------------------------------------------------------------------------------
                  Input Values   Rounded Values    Ia/p
  Subarea          Tc    * Tt     Tc    * Tt    Interpolated       Ia/p
 Description      (hr)   (hr)    (hr)   (hr)     (Yes/No)        Messages
-------------------------------------------------------------------------------
Area G            0.10   0.00     **     **         No              --
-------------------------------------------------------------------------------
 * Travel time from subarea outfall to composite watershed outfall point.
** Tc & Tt are available in the hydrograph tables.
```

```
               TR-55 TABULAR HYDROGRAPH METHOD
                   Type II  Distribution
                  (24 hr. Duration Storm)

               Executed:  10-12-2000  20:12:03
    Watershed file:  --> p:\data\projects\3081\40\sw\op\CELL2B  .WSD
    Hydrograph file: --> p:\data\projects\3081\40\sw\op\CELL2B  .HYD

                    Dairyland Power Coop.
                     Plan of Opertaion
                   Operational Conditions
                          Cell 2B


         >>>> Summary of Subarea Times to Peak <<<<

                         Peak Discharge at  Time to Peak at
                         Composite Outfall  Composite Outfall
       Subarea                 (cfs)             (hrs)
     --------------      --------------      ------------
      Area G                     3               12.1
     --------------      --------------      ------------
    Composite Watershed          3               12.1
```

```
                    TR-55 TABULAR HYDROGRAPH METHOD
                         Type II  Distribution
                        (24 hr. Duration Storm)

                    Executed:  10-12-2000  20:12:08
               Watershed file:  --> p:\data\projects\3081\40\sw\op\CELL3   .WSD
               Hydrograph file: --> p:\data\projects\3081\40\sw\op\CELL3   .HYD

                         Dairyland Power Coop.
                           Plan of Operation
                        Operational Conditions
                                Cell 3


           >>>> Input Parameters Used to Compute Hydrograph <<<<
-------------------------------------------------------------------------------
  Subarea       AREA     CN     Tc     * Tt    Precip. |  Runoff    Ia/p
 Description   (acres)         (hrs)  (hrs)    (in)   |   (in)  input/used
-------------------------------------------------------------------------------
 Area H          1.70   69.0   0.10    0.00    6.10   |   2.79   .15  .10
-------------------------------------------------------------------------------
 * Travel time from subarea outfall to composite watershed outfall point.
             Total area = 1.70 acres  or  0.00266 sq.mi
                      Peak discharge =  7 cfs


          >>>> Computer Modifications of Input Parameters <<<<<
-------------------------------------------------------------------------------
                Input Values    Rounded Values     Ia/p
  Subarea       Tc    * Tt       Tc    * Tt   Interpolated       Ia/p
 Description   (hr)   (hr)      (hr)   (hr)    (Yes/No)        Messages
-------------------------------------------------------------------------------
Area H          0.10   0.00      **     **        No              --
-------------------------------------------------------------------------------
 * Travel time from subarea outfall to composite watershed outfall point.
** Tc & Tt are available in the hydrograph tables.
```

```
                 TR-55 TABULAR HYDROGRAPH METHOD
                      Type II  Distribution
                     (24 hr. Duration Storm)

                 Executed:  10-12-2000  20:12:08
      Watershed file:  --> p:\data\projects\3081\40\sw\op\CELL3   .WSD
      Hydrograph file: --> p:\data\projects\3081\40\sw\op\CELL3   .HYD

                       Dairyland Power Coop.
                         Plan of Operation
                      Operational Conditions
                              Cell 3


            >>>> Summary of Subarea Times to Peak <<<<

                           Peak Discharge at   Time to Peak at
                           Composite Outfall  Composite Outfall
         Subarea                 (cfs)              (hrs)
       --------------      --------------     ------------
       Area H                      7                 12.1
       --------------      --------------     ------------
     Composite Watershed           7                 12.1
```

```
                      TR-55 TABULAR HYDROGRAPH METHOD
                           Type II  Distribution
                          (24 hr. Duration Storm)

                      Executed:  10-12-2000  20:21:09
             Watershed file:  --> p:\data\projects\3081\40\sw\op\CELL4A  .WSD
             Hydrograph file: --> p:\data\projects\3081\40\sw\op\CELL4A  .HYD

                            Dairyland Power Coop.
                              Plan of Operation
                           Operational Conditions
                                  Cell 4A


            >>>> Input Parameters Used to Compute Hydrograph <<<<
 ------------------------------------------------------------------------------
   Subarea        AREA     CN      Tc     * Tt    Precip. |  Runoff    Ia/p
  Description    (acres)          (hrs)   (hrs)    (in)   |   (in)  input/used
 ------------------------------------------------------------------------------
  Area I           3.60   69.0    0.20    0.00    6.10    |   2.79    .15  .10
 ------------------------------------------------------------------------------
  * Travel time from subarea outfall to composite watershed outfall point.
                Total area = 3.60 acres  or  0.00562 sq.mi
                         Peak discharge =  13 cfs


           >>>> Computer Modifications of Input Parameters <<<<<
 ------------------------------------------------------------------------------
                  Input Values    Rounded Values      Ia/p
   Subarea         Tc    * Tt      Tc    * Tt    Interpolated       Ia/p
  Description     (hr)    (hr)    (hr)    (hr)     (Yes/No)       Messages
 ------------------------------------------------------------------------------
 Area I           0.15    0.00    0.20    0.00        No             --
 ------------------------------------------------------------------------------
  * Travel time from subarea outfall to composite watershed outfall point.
```

```
                     TR-55 TABULAR HYDROGRAPH METHOD
                          Type II  Distribution
                         (24 hr. Duration Storm)

                     Executed:  10-12-2000  20:21:09
           Watershed file:  --> p:\data\projects\3081\40\sw\op\CELL4A  .WSD
           Hydrograph file: --> p:\data\projects\3081\40\sw\op\CELL4A  .HYD

                           Dairyland Power Coop.
                             Plan of Operation
                          Operational Conditions
                                  Cell 4A


              >>>> Summary of Subarea Times to Peak <<<<

                           Peak Discharge at  Time to Peak at
                           Composite Outfall  Composite Outfall
          Subarea                (cfs)              (hrs)
        --------------     --------------     ------------
         Area I                  13                12.2
        --------------     --------------     ------------
       Composite Watershed       13                12.2
```

Reference Information

Table 2-2a.—Runoff curve numbers for urban areas[1]

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area[2]	A	[✓ B]	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)...........		49	[✓ 69]	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)...........................		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)...................................		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]...		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders).		96	96	96	96
Urban districts:					
Commercial and business...........................	85	89	92	94	95
Industrial..	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses).......................	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	[✓ 86]	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

---

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4, based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2b.—Runoff curve numbers for cultivated agricultural lands[1]

Cover description			Curve numbers for hydrologic soil group—			
Cover type	Treatment[2]	Hydrologic condition[3]	A	[✓ B]	C	D
Fallow	Bare soil	—	77	[✓ 86]	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
	⊥ to slope	Good	67	[✓ 78]	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	→ Contoured (C)	Poor	70	[✓ 79] Ave =77	84	88
		Good	65	[✓ 75]	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T + CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T + CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

[1] Average runoff condition, and $I_a = 0.2S$.

[2] *Crop residue cover* applies only if residue is on at least 5% of the surface throughout the year.

[3] Hydrologic condition is based on combination of factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes in rotations, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

Table 2-2c.—Runoff curve numbers for other agricultural lands[1]

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing.[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element.[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	[4]30	48	65	73
Woods—grass combination (orchard or tree farm).[5]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods.[6]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	[4]30	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

[1] Average runoff condition, and $I_a = 0.2S$.

[2] *Poor:* <50% ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: >75% ground cover and lightly or only occasionally grazed.

[3] *Poor:* <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

[4] Actual curve number is less than 30; use CN = 30 for runoff computations.

[5] CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

[6] *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Sheet flow

Sheet flow is flow over plane surfaces. It usually occurs in the headwater of streams. With sheet flow, the friction value (Manning's n) is an effective roughness coefficient that includes the effect of raindrop impact; drag over the plane surface; obstacles such as litter, crop ridges, and rocks; and erosion and transportation of sediment. These n values are for very shallow flow depths of about 0.1 foot or so. Table 3-1 gives Manning's n values for sheet flow for various surface conditions.

For sheet flow of less than 300 feet, use Manning's kinematic solution (Overton and Meadows 1976) to compute T_t:

$$T_t = \frac{0.007\,(nL)^{0.8}}{(P_2)^{0.5}\,s^{0.4}} \qquad \text{[Eq. 3-3]}$$

where

T_t = travel time (hr),
n = Manning's roughness coefficient (table 3-1),
L = flow length (ft),
P_2 = 2-year, 24-hour rainfall (in), and
s = slope of hydraulic grade line (land slope, ft/ft).

This simplified form of the Manning's kinematic solution is based on the following: (1) shallow steady uniform flow, (2) constant intensity of rainfall excess (that part of a rain available for runoff), (3) rainfall duration of 24 hours, and (4) minor effect of infiltration on travel time. Rainfall depth can be obtained from appendix B.

Table 3-1.—Roughness coefficients (Manning's n) for sheet flow

Surface description	n[1]
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤20%	0.06
Residue cover >20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses[2]	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods:[3]	
Light underbrush	0.40
Dense underbrush	0.80

Shallow concentrated flow

After a maximum of 300 feet, sheet flow usually becomes shallow concentrated flow. The average velocity for this flow can be determined from figure 3-1, in which average velocity is a function of watercourse slope and type of channel. For slopes less than 0.005 ft/ft, use equations given in appendix F for figure 3-1. Tillage can affect the direction of shallow concentrated flow. Flow may not always be directly down the watershed slope if tillage runs across the slope.

After determining average velocity in figure 3-1, use equation 3-1 to estimate travel time for the shallow concentrated flow segment.

Open channels

Open channels are assumed to begin where surveyed cross section information has been obtained, where channels are visible on aerial photographs, or where blue lines (indicating streams) appear on United States Geological Survey (USGS) quadrangle sheets. Manning's equation or water surface profile information can be used to estimate average flow velocity. Average flow velocity is usually determined for bank-full elevation.

---

[1] The n values are a composite of information compiled by Engman (1986).

[2] Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.

[3] When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

CONTERMINOUS UNITED STATES

2-YEAR 24-HOUR RAINFALL (INCHES)

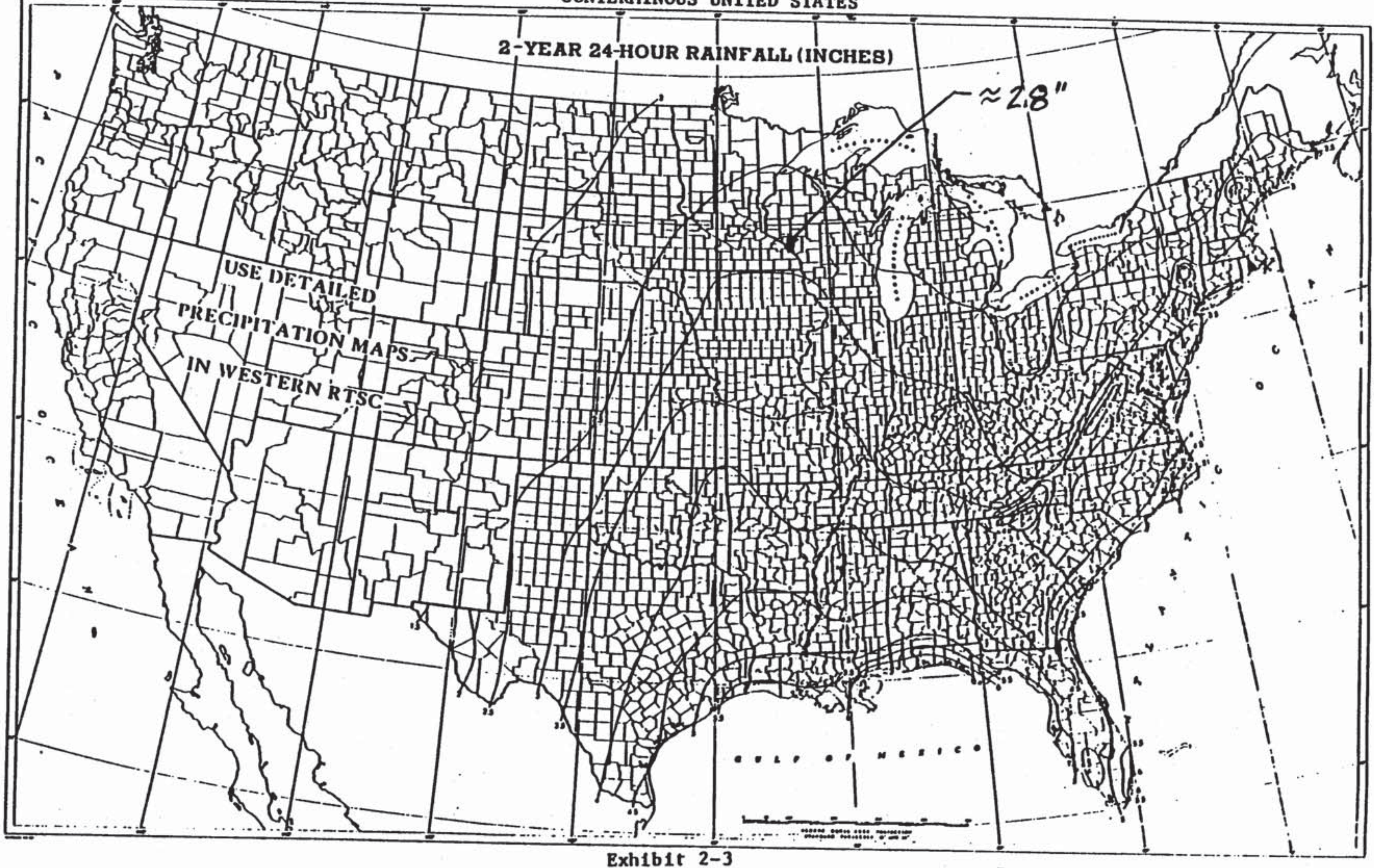
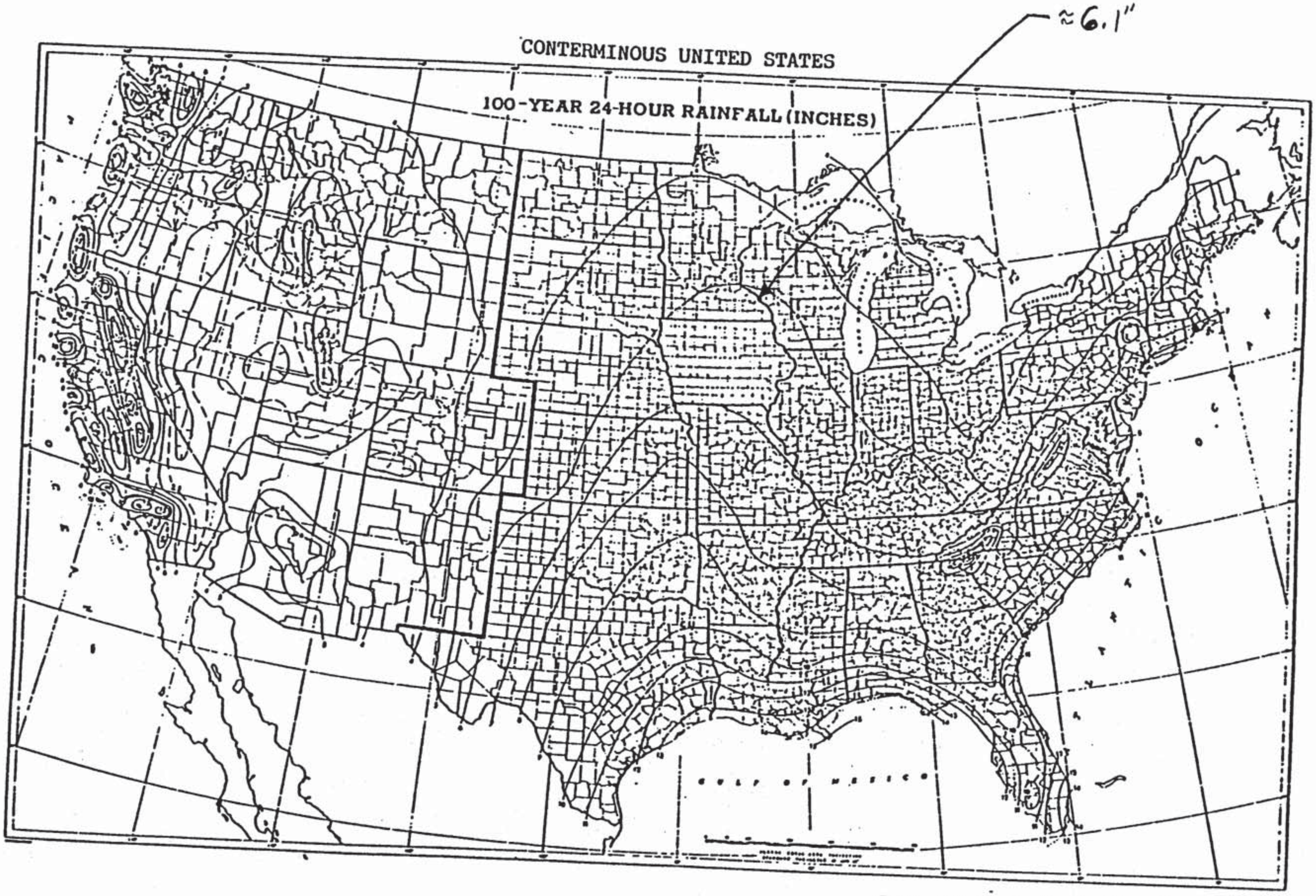


Exhibit 2-3
Sheet 1 of 5

Prepared by U. S. Weather Bureau



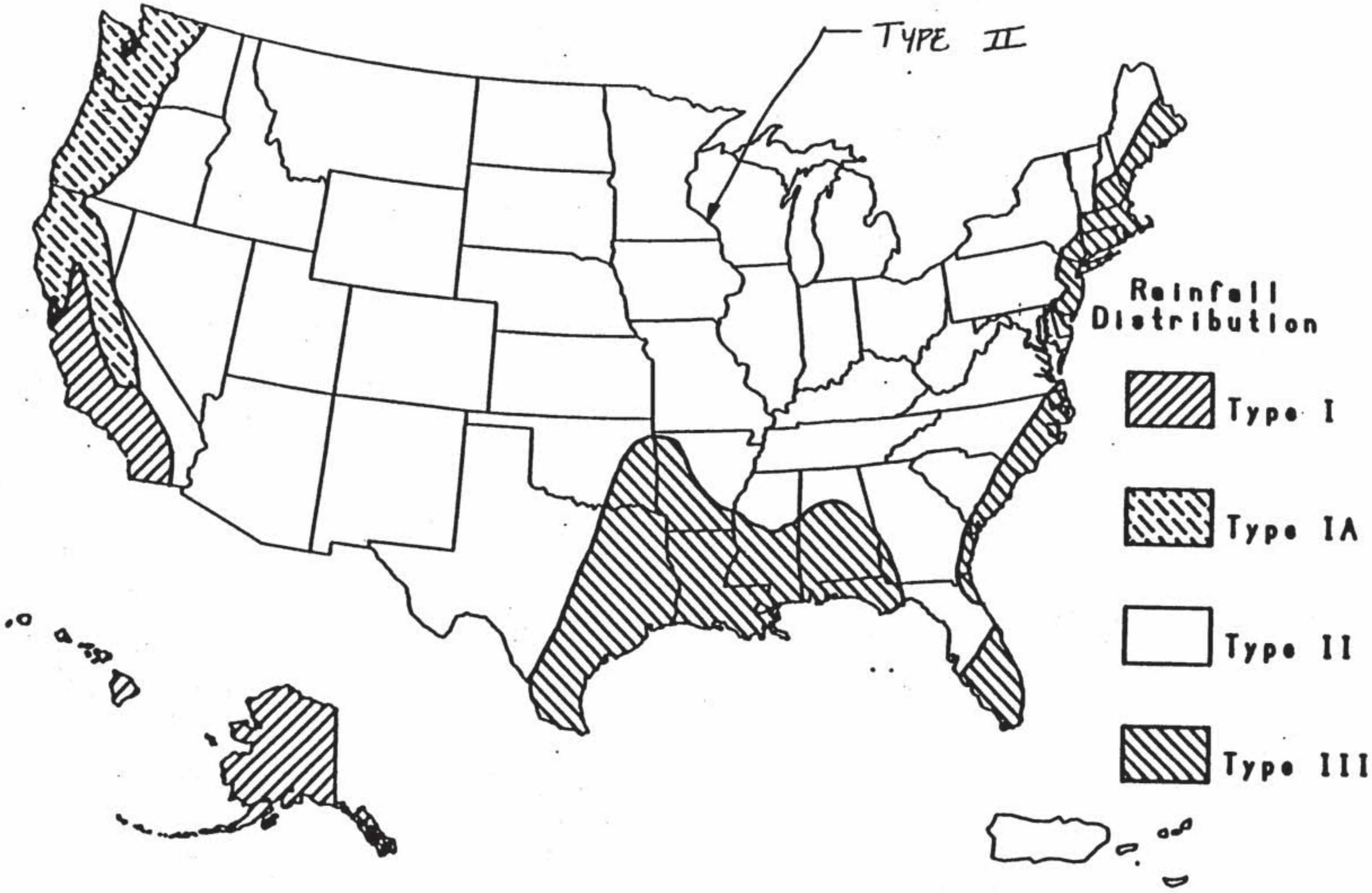
CONTERMINOUS UNITED STATES

100-YEAR 24-HOUR RAINFALL (INCHES)

≈6.1"

Prepared by U. S. Weather Bureau

FROM: Urban Hydrology for Small Watersheds. [n.p.]: U.S. Department of Agriculture.
Soil Conservation Service Engineering Division, (Technical Release No. 55).
1975, as revised 1981.



.—Approximate geographic boundaries for SCS rainfall distributions.

Diversion Berm, Perimeter Ditch, and Spillway Design Calculations

Purpose/Methodology/Assumptions/Results/References

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

DIVERSION BERM, PERIMETER DITCH, AND SPILLWAY DESIGN CALCULATIONS

Purpose

To size the diversion berms, perimeter ditches and spillway at the proposed Dairyland Power Cooperative Landfill to adequately handle the surface water runoff from a 100-year, 24-hour storm.

Methodologies

Ditches, diversion berms and spillways were designed to channel the surface water runoff from the landfill drainage areas to the sedimentation basins, receiving ditches, or spillways. The direction of surface water runoff from the drainage areas surrounding the proposed landfill is towards the proposed landfill. Perimeter drainage ditches were therefore incorporated into the design to route the surface water runoff from outside the proposed landfill limits along the perimeter of the landfill area to the existing main channel at the south end of the landfill. These ditches are labeled as the NW, NE, West, SE, and SW ditches. The perimeter ditches sized in this subsection of the appendix, then, include ditches to collect runoff from the landfill drainage areas as well as ditches to collect surface water run-on from the drainage areas surrounding the landfill.

The adequacy of the diversion berms and ditches in handling the surface water runoff and run-on and in limiting the amount of erosion is based on the depth of flow and velocity, respectively, in the ditch. An in-house RMT spreadsheet incorporating Manning's equation was used to assist in the design of the diversion berms and ditches. This program allows the user to input the ditch geometry, the peak flow (as determined by the surface water runoff calculation), and the vegetative retardance factor (Chow, 1959). The program then begins an iterative process which adjusts the flow depth and Manning's coefficient until the trial velocity and the resultant velocity are within 0.002 feet per second (fps) of each other. The end result is the peak flow depth and peak velocity for the geometry and peak flow entered. Design software provided by Synthetic Industries was also used to select erosion control matting for ditches and grouted riprap for spillways.

Permanent ditches, diversion berms, and spillways will be constructed as early in the site development as practicable. Where temporary ditching is required, these temporary ditches have been designed to the same standards as the permanent ditches. Calculations for the sizing of the temporary ditches are also attached.

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

It is noted that the storm water control structures have been designed using a 100-year, 24-hour storm event and a TR-55 Type II storm distribution. As noted in the surface water runoff calculations, the peak flows calculated using this method meet or exceed the peak flows calculated using a 25-year, time of concentration storm event (required by NR 504.09).

Assumptions

The following assumptions were used to design the diversion berms and perimeter ditches:

- Diversion berms, perimeter ditches and the spillway were designed to handle the runoff from the 100-year, 24-hour storm event.
- Diversion berm ditches were designed as V-notch ditches with a minimum 0.5 foot of freeboard for the 25-year, 24-hour storm. Diversion berm ditches were designed to convey the 100-year, 24-hour storm without overtopping.
- Perimeter ditches were designed as both V-notch and flat bottom (10-foot and 20-foot-wide) ditches with a minimum 0.5 foot of freeboard for the 25-year, 24-hour storm. Perimeter ditches were designed to convey the 100-year, 24-hour storm without overtopping.
- Grass-lined diversion berm and perimeter ditches were designed for a maximum velocity of 4 fps. Ditches with velocities exceeding 4 fps were designed to be lined with erosion mat or riprap, as appropriate.
- The spillway was designed as 20-foot–wide, flat-bottom spillway with a minimum 0.5 foot of freeboard.
- The peak flows in the diversion berms, perimeter ditches and the spillway were obtained from the hydrographs generated in the "Surface Water Runoff Calculations" subsection of this appendix.
- Manning's numbers were selected for both "low" retardance (Type "D") and "moderate" retardance (Type "C") as given by the U.S. Soil and Conservation Service. Type "D" is typical of spring conditions while Type "C" is typical of summer conditions. For ditches lined with erosion matting, default Manning numbers from the Synthetic Industries design software were utilized.

Results

The diversion berms and perimeter ditches were adequately sized to handle the surface water runoff from a 100-year, 24-hour storm event. The diversion berms at a 2 percent slope will be grass-lined. To limit erosion, permanent erosion matting will be placed in the diversion berms at a 6 percent slope, as well as in most of the perimeter ditching. Grouted riprap will be constructed in the spillways. The attached figure highlights the ditch sizing results.

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

References

Chow, V.T. 1959. Open Channel Hydraulics, McGraw Hill, New York.

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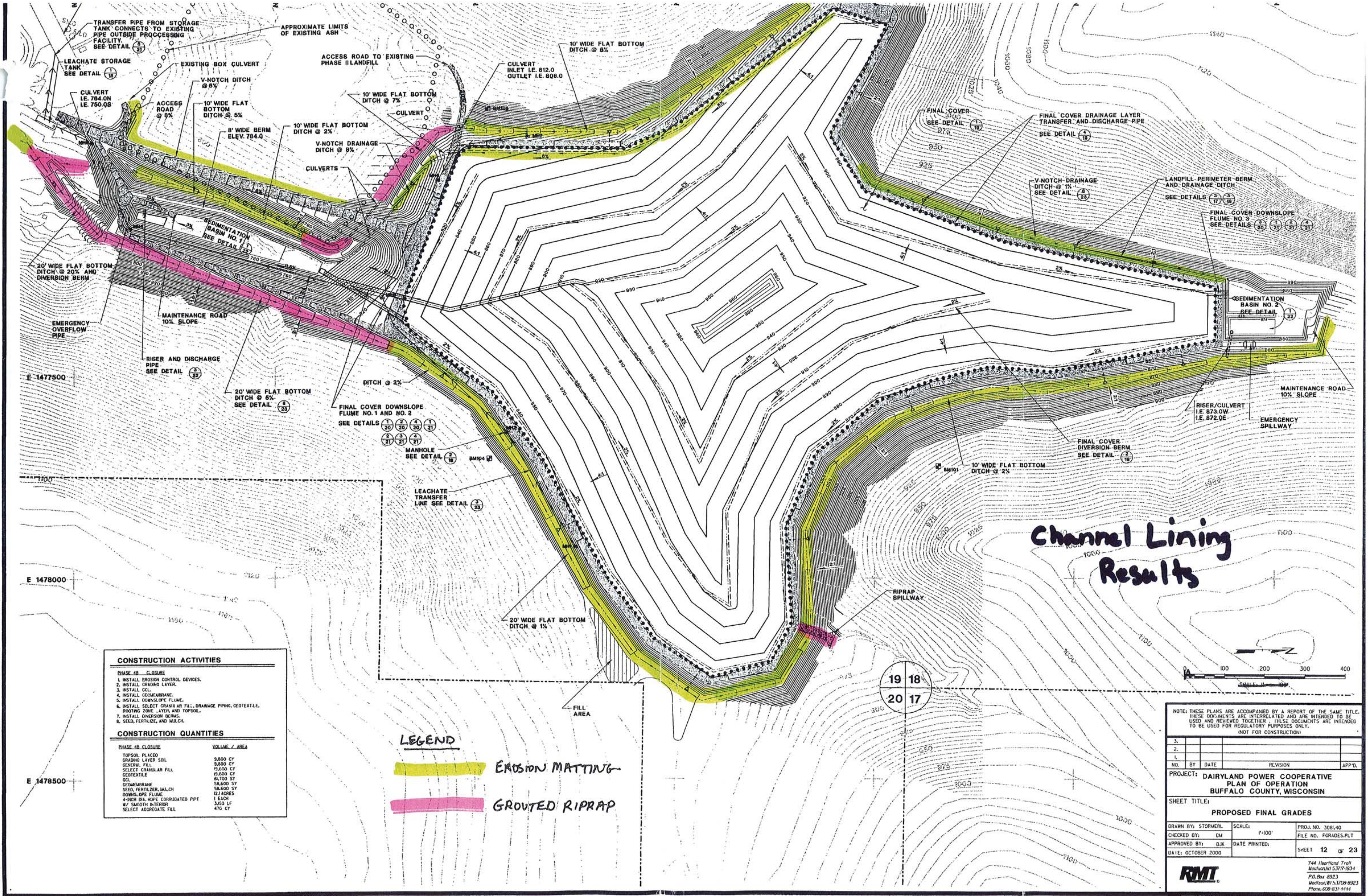

Channel Lining Results

LEGEND

- 🟩 EROSION MATTING
- 🟥 GROUTED RIPRAP

CONSTRUCTION ACTIVITIES

PHASE 4B CLOSURE

1. INSTALL EROSION CONTROL DEVICES.
2. INSTALL GRADING LAYER.
3. INSTALL GCL.
4. INSTALL GEOMEMBRANE.
5. INSTALL DOWNSLOPE FLUME.
6. INSTALL SELECT GRANULAR FILL, DRAINAGE PIPING, GEOTEXTILE, ROOTING ZONE LAYER, AND TOPSOIL.
7. INSTALL DIVERSION BERMS.
8. SEED, FERTILIZE, AND MULCH.

CONSTRUCTION QUANTITIES

PHASE 4B CLOSURE	VOLUME / AREA
TOPSOIL PLACED	
GRADING LAYER SOIL	9,800 CY
GENERAL FILL	9,800 CY
SELECT GRANULAR FILL	19,600 CY
GEOTEXTILE	19,600 CY
GCL	61,700 SY
GEOMEMBRANE	58,600 SY
SEED, FERTILZER, MULCH	58,600 SY
DOWNSLOPE FLUME	12.1 ACRES
4-INCH DIA. HDPE CORRUGATED PIPE	1 EACH
W/ SMOOTH INTERIOR	3,150 LF
SELECT AGGREGATE FILL	470 CY

NOTE: THESE PLANS ARE ACCOMPANIED BY A REPORT OF THE SAME TITLE. THESE DOCUMENTS ARE INTERRELATED AND ARE INTENDED TO BE USED AND REVIEWED TOGETHER. THESE DOCUMENTS ARE INTENDED TO BE USED FOR REGULATORY PURPOSES ONLY.
(NOT FOR CONSTRUCTION)

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

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

SHEET TITLE:
PROPOSED FINAL GRADES

DRAWN BY: STORMERL	SCALE: 1"=100'	PROJ. NO. 3081.40
CHECKED BY: DM		FILE NO. FGRADES.PLT
APPROVED BY: BJK	DATE PRINTED:	SHEET 12 OF 23
DATE: OCTOBER 2000		

RMT

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

RMT COMPUTER AIDED DESIGN & DRAFTING

FIGURE K-10

Calculations – Post-closure Landfill Conditions

RMT, Inc.
Grass Channel Sizing Calculations

Site:	Dairyland Power Cooperative	Date:	10/1/98
Project #:	3081.33	User:	BLP
Channel:	Diversion Berm (2%) - worst case flow		
	Area 1F		✓BBF 10/98

==

I. Input Parameters.

A. Side slope, Z1 (hor/vert) =	4.000 ft/ft ✓
B. Side slope, Z2 (hor/vert) =	2.000 ft/ft ✓
C. Bottom width, B =	0.000 ft ✓
D. Design channel slope, S =	0.020 ft/ft ✓
E. Channel Peak Flow, Q =	25.000 cfs ✓
F. Enter - 1 - for Type "C" Veg. Retardence - 2 - for Type "D" Veg. Retardence	1 ← Summer Conditions ✓

II. Peak Flow Calculations.

A. Trial flow depth, D = (Bisection method until Va=Vb)	1.570 ft 0.4' freeboard ✓
B. Channel flow area, Ac = (.5*Z1*D^2) + (B*D) + (.5*Z2*D^2)	7.390 sq ft
C. Wetted Perimeter, Pw = (D*(Z1^2+1)^.5) + B + (D*(Z2^2+1)^.5)	9.981 ft
D. Hydraulic radius, Rh = (Ac/Pw)	0.740 ft
E. Velocity and hydraulic radius, VR = (Va * Rh)	2.505 sfps
F. Channel flow Manning's coeff, nc = 0	0.051
G. Trial velocity, Va = (Q/Ac)	3.383 fps ✓
H. Resultant velocity, Vb = (1.49/nc) * (Rh^.667) * (S^.5)	3.383 fps < 4 fps

Invoke Solution Macro by typing - 'ctrl' D

`h:\data\common\template\sc-51\grasscha.xls`

RMT, Inc.
Grass Channel Sizing Calculations

Site:	Dairyland Power Cooperative	Date:	10/1/98
Project #:	3081.33	User:	BLP
Channel:	Diversion Berm (2%) - worst case flow Area 1F		✓ MJK 10/98

==

I. Input Parameters.

A. Side slope, Z1 (hor/vert) =	4.000 ft/ft	✓
B. Side slope, Z2 (hor/vert) =	2.000 ft/ft	✓
C. Bottom width, B =	0.000 ft	✓
D. Design channel slope, S =	0.020 ft/ft	✓
E. Channel Peak Flow, Q =	25.000 cfs	✓
F. Enter - 1 - for Type "C" Veg. Retardence - 2 - for Type "D" Veg. Retardence	2	← Spring Conditions ✓

II. Peak Flow Calculations.

A. Trial flow depth, D = (Bisection method until Va=Vb)	**1.456 ft**	0.5' freeboard ✓
B. Channel flow area, Ac = (.5*Z1*D^2) + (B*D) + (.5*Z2*D^2)	6.357 sq ft	
C. Wetted Perimeter, Pw = (D*(Z1^2+1)^.5) + B + (D*(Z2^2+1)^.5)	9.257 ft	
D. Hydraulic radius, Rh = (Ac/Pw)	0.687 ft	
E. Velocity and hydraulic radius, VR = (Va * Rh)	2.701 sfps	
F. Channel flow Manning's coeff, nc = 0	0.042	
G. Trial velocity, Va = (Q/Ac)	3.933 fps	
H. Resultant velocity, Vb = (1.49/nc) * (Rh^.667) * (S^.5)	**3.933 fps**	< 4 fps ✓

Invoke Solution Macro by typing - 'ctrl' D

`h:\data\common\template\sc-51\grasscha.xls`

RMT, Inc.
Grass Channel Sizing Calculations

Site: Dairyland Power Corp.
Date: 31-July-98
Project #: 3081.33
User: SRC
Channel: Ditch (8%)
Area 1G - Flow From Landfill Portion - 15 cfs

✓ 10/98

I. Input Parameters.

A. Side slope, Z1 (hor/vert) = 3.000 ft/ft

B. Side slope, Z2 (hor/vert) = 2.000 ft/ft

C. Bottom width, B = 0.000 ft

D. Design channel slope, S = 0.080 ft/ft

E. Channel Peak Flow, Q = 15.000 cfs

F. Enter
- 1 - for Type "C" Veg. Retardence
- 2 - for Type "D" Veg. Retardence

1 ← summer conditions

II. Peak Flow Calculations.

A. Trial flow depth, D = 1.071 ft 0.9' freeboard
(Bisection method until Va=Vb)

B. Channel flow area, Ac = 2.870 sq ft
(.5*Z1*D^2) + (B*D) + (.5*Z2*D^2)

C. Wetted Perimeter, Pw = 5.784 ft
(D*(Z1^2+1)^.5) + B + (D*(Z2^2+1)^.5)

D. Hydraulic radius, Rh = 0.496 ft
(Ac/Pw)

E. Velocity and hydraulic radius, VR = 2.593 sfps
(Va * Rh)

F. Channel flow Manning's coeff, nc = 0.051
0

G. Trial velocity, Va = 5.226 fps
(Q/Ac)

H. Resultant velocity, Vb = 5.226 fps > 4fps
(1.49/nc) * (Rh^.667) * (S^.5)

use permanent erosion

`H:\data\common\src\Grassch5.xls`

RMT, Inc.
Grass Channel Sizing Calculations

Site:	Dairyland Power Corp.	Date:	31-July-98
Project #:	3081.33	User:	SRC
Channel:	Ditch (8%)		
	Area 1G - Flow From Landfill Portion - 15 cfs		✓ 10/98

==

I. Input Parameters.

A. Side slope, Z1 (hor/vert) =	3.000 ft/ft	
B. Side slope, Z2 (hor/vert) =	2.000 ft/ft	
C. Bottom width, B =	0.000 ft	
D. Design channel slope, S =	0.080 ft/ft	
E. Channel Peak Flow, Q =	15.000 cfs	
F. Enter - 1 - for Type "C" Veg. Retardence - 2 - for Type "D" Veg. Retardence	2	← Spring conditions

II. Peak Flow Calculations.

A. Trial flow depth, D = (Bisection method until Va=Vb)	0.992 ft	1' freeboard
B. Channel flow area, Ac = `(.5*Z1*D^2) + (B*D) + (.5*Z2*D^2)`	2.459 sq ft	
C. Wetted Perimeter, Pw = `(D*(Z1^2+1)^.5) + B + (D*(Z2^2+1)^.5)`	5.353 ft	
D. Hydraulic radius, Rh = (Ac/Pw)	0.459 ft	
E. Velocity and hydraulic radius, VR = `(Va * Rh)`	2.802 sfps	
F. Channel flow Manning's coeff, nc = 0	0.041	
G. Trial velocity, Va = (Q/Ac)	6.101 fps	
H. Resultant velocity, Vb = `(1.49/nc) * (Rh^.667) * (S^.5)`	6.101 fps	> 4 fps use permanent erosion matting

`H:\data\common\src\Grassch6.xls`

✓ BLB
10/6/98

```
******************************************************************************
      NORTH AMERICAN GREEN - ECMDS VER.IV - CHANNEL PROTECTION - ENGLISH
                  USER SPECIFIED CHANNEL LINING ANALYSIS
******************************************************************************


PROJECT NAME: Dairyland Power                PROJECT NO.: 3081.33
COMPUTED BY: BJK                             DATE: 10-06-1998
FROM STATION/REACH: Area 1G - Fl             TO STATION/REACH:
DRAINAGE AREA:                               DESIGN FREQUENCY: 100

--------------------------------------------------------------------------------

 Channel Bottom  Side Slope Lt.  Side Slope Rt. Channel Slope
   Width (ft)     (Horz. to 1)   (Horz. to 1)     (ft/ft)
 --------------  --------------  -------------  -------------  ✓
     0.00             3.0             2.0          0.080

--------------------------------------------------------------------------------

 Discharge   Peak Flow   Velocity    Area      Hydraulic       Normal
   (cfs)   Period (hrs)  (ft/sec)   (ft^2)     Radius (ft)    Depth (ft)
 ---------- ------------ --------- --------  --------------  ------------
    15.0       2.0         5.34      2.81        0.49            1.06     ok

--------------------------------------------------------------------------------

Lining Growth Veg. Manning     Permissible   Calculated  Safety   Remark
Type   Habit  Den Coefficient Shear (lb/sf)  Shear (lb/sf) Factor
---------------- ----------- -------------- ------------ ------- --------
P300               0.049        8.00          5.29      1.51   STABLE    ✓
Staple E
Phase 3 (Mature Vegetation)
```

RMT, Inc.
Grass Channel Sizing Calculations

Site:	Dairyland Power Corp.	Date:	31-July-98
Project #:	3081.33	User:	SRC
Channel:	Ditch (1%)		
	Area 2B		VBL 10K8

I. Input Parameters.

A. Side slope, Z1 (hor/vert) = 3.000 ft/ft

B. Side slope, Z2 (hor/vert) = 2.000 ft/ft

C. Bottom width, B = 0.000 ft

D. Design channel slope, S = 0.010 ft/ft

E. Channel Peak Flow, Q = 73.000 cfs

F. Enter - 1 - for Type "C" Veg. Retardence
- 2 - for Type "D" Veg. Retardence
1 ← Summer conditions

II. Peak Flow Calculations.

A. Trial flow depth, D = 2.593 ft 0.4' freeboard
(Bisection method until Va=Vb)

B. Channel flow area, Ac = 16.814 sq ft
(.5*Z1*D^2) + (B*D) + (.5*Z2*D^2)

C. Wetted Perimeter, Pw = 14.000 ft
(D*(Z1^2+1)^.5) + B + (D*(Z2^2+1)^.5)

D. Hydraulic radius, Rh = 1.201 ft
(Ac/Pw)

E. Velocity and hydraulic radius, VR = 5.214 sfps
(Va * Rh)

F. Channel flow Manning's coeff, nc = 0.039
0

G. Trial velocity, Va = 4.342 fps
(Q/Ac)

H. Resultant velocity, Vb = 4.341 fps > 4 fps
(1.49/nc) * (Rh^.667) * (S^.5)

use permanent erosion matting

H:\data\common\src\Grassch7.xls

RMT, Inc.
Grass Channel Sizing Calculations

Site: Dairyland Power Corp.
Project #: 3081.33
Channel: Ditch (1%)
Area 2B

Date: 31-July-98
User: SRC

√RJK 10/98

==

I. Input Parameters.

A. Side slope, Z1 (hor/vert) = 3.000 ft/ft

B. Side slope, Z2 (hor/vert) = 2.000 ft/ft

C. Bottom width, B = 0.000 ft

D. Design channel slope, S = 0.010 ft/ft

E. Channel Peak Flow, Q = 73.000 cfs

F. Enter
- 1 - for Type "C" Veg. Retardence
- 2 - for Type "D" Veg. Retardence

2 ← Spring conditions

II. Peak Flow Calculations.

A. Trial flow depth, D = 2.512 ft 0.5' freeboard
(Bisection method until Va=Vb)

B. Channel flow area, Ac = 15.774 sq ft
(.5*Z1*D^2) + (B*D) + (.5*Z2*D^2)

C. Wetted Perimeter, Pw = 13.560 ft
(D*(Z1^2+1)^.5) + B + (D*(Z2^2+1)^.5)

D. Hydraulic radius, Rh = 1.163 ft
(Ac/Pw)

E. Velocity and hydraulic radius, VR = 5.383 sfps
(Va * Rh)

F. Channel flow Manning's coeff, nc = 0.036
0

G. Trial velocity, Va = 4.628 fps
(Q/Ac)

H. Resultant velocity, Vb = 4.627 fps > 4 fps
(1.49/nc) * (Rh^.667) * (S^.5)

use permanent erosion matting

H:\data\common\src\GRASSCH8.xls

√BJB
10/6/98

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******************************************************************************
     NORTH AMERICAN GREEN - ECMDS VER.IV - CHANNEL PROTECTION - ENGLISH
                   USER SPECIFIED CHANNEL LINING ANALYSIS
******************************************************************************


PROJECT NAME: Dairyland Paower Coop.        PROJECT NO.: 3081.33
COMPUTED BY: BJK                            DATE: 10-06-1998
FROM STATION/REACH: Area 2B                 TO STATION/REACH:
DRAINAGE AREA:                              DESIGN FREQUENCY: 100

-------------------------------------------------------------------------------

 Channel Bottom  Side Slope Lt.  Side Slope Rt. Channel Slope
   Width (ft)     (Horz. to 1)    (Horz. to 1)     (ft/ft)
 --------------  --------------  -------------  -------------
     0.00             3.0              2.0           0.010       ✓

-------------------------------------------------------------------------------

 Discharge   Peak Flow   Velocity   Area      Hydraulic       Normal
   (cfs)   Period (hrs)  (ft/sec)  (ft^2)    Radius (ft)     Depth (ft)
 ---------- ------------ --------- --------  --------------  ------------
    73.0        2.0        3.64     20.08        1.31             2.83    OK

-------------------------------------------------------------------------------

Lining Growth Veg. Manning   Permissible   Calculated  Safety  Remark
Type   Habit  Den Coefficient Shear (lb/sf) Shear (lb/sf) Factor
----------------- ---------- ------------- ------------ ------- --------
P300              0.049        8.00           1.77      4.52   STABLE    ✓
Staple E
Phase 3 (Mature Vegetation)
```

PROJECT / PROPOSAL NAME	PREPARED		CHECKED		PROJECT / PROPOSAL NO.
DAIRYLAND POWER COOP.	By: BJK	Date: 5/9/97	By: [illegible]	Date: 6/17/97	3081.24

Rev BLP/BJK 10/98
Rev BJK 9/00

DITCH DESIGN CALCULATIONS - DESIGN INFORMATION (25 YR-24 HR STORM)

SOUTH SPILLWAY

WIDTH = 20'
SLOPE = 20%
MIN DEPTH = 4'

PEAK FLOW - CONTRIBUTING DRAINAGE AREAS
3C + 4C + EAST + NORTHEAST + NORTH + BASIN 2 OUTFLOW ✓

18 + 11 + 445 + 68 + 194 + 10 = 746 cfs (25-YEAR)
↳ Round to 750 For Calc's

28 + 18 + 837 + 110 + 360 + 21 = 1,374 cfs (100-year) ✓

Note: All Flows @ 12.6 HRS (25 year)
and @ 12.5 HRS (100-YR Fallow)

SE DITCH (2%) & (5%)

WIDTH = 20'
SLOPE : 2%
MIN DEPTH = 5'

PEAK FLOW - CONTRIBUTING DRAINAGE AREAS
3C + 4C + EAST + NORHEAST + NORTH + BASIN 2 OUTFLOW ✓

See above = 750 cfs (25-YEAR)
= 1,374 (100-yr Fallow)

SE DITCH (1%)

SAME FLOWS AS ABOVE

WIDTH - 20'
SLOPE - 1%
MIN DEPTH - 6'

NE DITCH

WIDTH = 10'
SLOPE = 2%
MIN DEPTH = 10+'

PEAK FLOW - CONTRIBUTING DRAINAGE AREAS

4C + NORTH + BASIN 2 OUT ✓

11 + 194 + 10 = 215 CFS (25-YEAR) ✓

18 + 360 + 21 = 399 cfs (100-YEAR FALLOW)

- ALL FLOWS AT 12.6 HRS (25 yr) and AT 12.5 HRS (100-YR FALLOW)

E Ditch

width = 10'
Slope = 2%
Min Depth: 10'+

Peak Flow - Contributing Drainage Areas
4C + Northeast + North + Basin 2 out
= 18 + 110 + 360 + 21 = 509 cfs (100 yr)

PROJECT / PROPOSAL NAME	PREPARED By:	Date:	CHECKED By:	Date:	PROJECT / PROPOSAL NO.
DAIRYLAND POWER COOP.	BJK			6/17/97	3081.24

NW DITCH

WIDTH - 0' (V-NOTCH)
SLOPE - 1%
MIN DEPTH - 4 FT

PEAK FLOW - CONTRIBUTING DRAINAGE AREAS

2B - 48 CFS (25 YR) ✓

73 CFS (100 YR FALLOW)

WEST DITCH

WIDTH = 10'
SLOPE = 6%
MIN DEPTH = 6'

PEAK FLOW - CONTRIBUTING DRAINAGE AREAS

2C + WEST AREA ✓

10 + 111. = 121 CFS (25-YEAR) ✓

18 + 223 = 241 CFS (100 YEAR - FALLOW) ✓

- FLOWS @ 12.5 HRS (25-YEAR) AND AT
12.5 HRS (100-YEAR FALLOW)

SW DITCH

WIDTH = 10'
SLOPE = 2%, 5%, 7.1%
MIN DEPTH = 4' +

PEAK FLOW - CONTRIBUTING DRAINAGE AREAS

1C + 2C + WEST AREA ✓

46 + 10 + 111 = 167 CFS (25-YEAR) ✓

94 + 20 + 209 = 323 cfs (100-YEAR FALLOW) ✓

FLOWS @ 12.5 HRS (25-YEAR) AND
@ 12.4 HRS (100-YEAR FALLOW)

MAIN CHANNEL

WIDTH ~20' MIN
SLOPE ~.3%
MIN DEPTH ~ 6'

PEAK FLOW - CONTRIBUTING DRAINAGE AREAS

1C + 2C + 3C + 4C + EAST + NE + NORTH + WEST + BASIN 1 + BASIN 2 ✓

887 cfs + 8 + 10 = 905 CFS (25 YR)

1618 cfs + 21 + 21 = 1660 cfs (100-YR FALLOW) ✓

FLOWS @ 12.6 HRS (25-YEAR) AND @ 12.6 HRS
(100-YEAR FALLOW)

PROJECT / PROPOSAL NAME / LOCATION:		PROJECT / PROPOSAL NO.
SUBJECT: Dairyland Power Coop		3081.40
PREPARED BY:	DATE: 9/00	FINAL ☒
CHECKED BY:	DATE:	REVISION ☐

AREA 1G DITCH

Width - V-NOTCH
SLOPE · 8%
MIN DEPTH = 4'

PEAK FLOW - CONTRIBUTING DRAINAGE AREA

= 15 CFS FLOW FROM LF.

PHASE 2 DITCH

WIDTH: V-NOTCH
SLOPE : 6%
MIN DEPTH: 2'

PEAK FLOW - CONTRIBUTING DRAINAGE AREA

~ 1.5 ACRES OF PHASE 2 COVER
DRAINAGE AREA - 1C = 42 ACRES

$\frac{1.5}{42}$ (96 CFS) = 3.4 CFS

USE 4 CFS

EC-Design 2000 Channel Analysis Report

Analysis By:

User Information:	Generated by EC-Design:
Bernie Krantz **RMT, Inc.** **744 Heartland Trail** **Madison, WI 53717**	***SYNTHETIC INDUSTRIES*** *Geosynthetic Products Division* 4019 Industry Drive • Chattanooga, TN 37416 • USA (423) 899-0444 • (800) FIX-SOIL www.fixsoil.com

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General Information:

Project Details:	Project Notes:
Project Name: **DPC Plan of Operation** Description: **Channel Lining** State\Country: **WI** City: **La Crosse** Units: **English** Created: **01/19/99 @ 10:43**	

Disclaimer:

EC-Design 2000 Channel Analysis Report

Channel Analysis Information:

Name:

Channel Analysis Name: **South Spillway**

Channel Geometry & Hydraulics:

Design By:

Designed By: **FLOW**

Channel Side Slopes:

Left Slope (xH:1V): **2.00**
Right Slope (xH:1V): **2.00**

Flow\Velocity:

Discharge (cfs): **1374.00**
Flow Duration (hrs): **1.00**
Average Velocity (ft/s): **0.00**

Channel Geometry:

Bed Slope (ft/ft): **0.20000**
Req. Freeboard (ft): **0.00**
Channel Length (ft): **270.00**
Bottom Width (ft): **20.00**
Channel Depth (ft): **4.00**

Channel Bend:

Channel Bend: **No**
Bend Radius (ft): **1.00**
Outside Bend:

Vegetation:

Vegetated: **Yes**
Vegetation Class: **C**

Soil Filled:

Soil Filled: **No**

Factor of Safety: **1.10**

Functional Longevity: **999**

Analysis Results:

	Side	Lining Type	Manning's "n"	Velocity (ft/s) Actual	Max. Allowed	Safety Factor	Shear Stress (lbs/sqft) Actual	Max. Allowed	Safety Factor	Flow Depth (ft)	Discharge (cfs)	OK?
Analysis #1	Left:	PYRAMAT	0.0280	24.0	23.3	1.0	20.2	9.4	0.5	2.0857	1374.0	No
	Bottom:	PYRAMAT	0.0280	27.3	23.3	0.9	26.0	9.4	0.4			
	Right:	PYRAMAT	0.0280	24.0	23.3	1.0	20.2	9.4	0.5			
Analysis #2	Left:	GABIONS	0.0270	28.6	17.0	0.6	17.3	35.0	2.0	1.7968	1374.0	No
	Bottom:	GABIONS	0.0270	32.6	17.0	0.5	22.4	35.0	1.6			
	Right:	GABIONS	0.0270	28.6	17.0	0.6	17.3	35.0	2.0			
Analysis #3	Left:	ROCK RIPRAP	0.0300	26.6	50.0	1.9	18.3	45.0	2.5	1.9093	1374.0	Yes
	Bottom:	ROCK RIPRAP	0.0300	30.4	50.0	1.6	23.8	45.0	1.9			
	Right:	ROCK RIPRAP	0.0300	26.6	50.0	1.9	18.3	45.0	2.5			

Channel Calculation Results:

	Flow Area (sq ft)	Hydraulic Radius (ft)	Composite 'n'	Left Wetted Perimeter(ft)	Right Wetted Perimeter(ft)	Total Wetted Perimeter(ft)	Average Veleocity (ft/s)	Average Discharge (cfs)	Froude
Analysis #1	50.4146	1.7190	0.0351	4.6638	4.6638	29.3276	27.2540	1374.0	3.06
Analysis #2	42.3935	1.5121	0.0270	4.0178	4.0178	28.0356	32.4106	1374.0	3.94
Analysis #3	45.4772	1.5935	0.0300	4.2694	4.2694	28.5387	30.2130	1374.0	3.55

EC-Design 2000 Channel Analysis Report

Channel Analysis Information:

Name:

Channel Analysis Name: **SE Ditch (2%)**

Channel Geometry & Hydraulics:

Design By:

Designed By: **FLOW**

Channel Side Slopes:

Left Slope (xH:1V): **2.00**
Right Slope (xH:1V): **2.00**

Flow\Velocity:

Discharge (cfs): **1374.00**
Flow Duration (hrs): **1.00**
Average Velocity (ft/s): **0.00**

Channel Geometry:

Bed Slope (ft/ft): **0.02000**
Req. Freeboard (ft): **0.00**
Channel Length (ft): **200.00**
Bottom Width (ft): **20.00**
Channel Depth (ft): **5.00**

Channel Bend:

Channel Bend: **No**
Bend Radius (ft): **0.00**
Outside Bend:

Vegetation:

Vegetated: **Yes**
Vegetation Class: **C**

Soil Filled:

Soil Filled: **No**

Factor of Safety: **1.10**

Functional Longevity: **999**

Analysis Results:

	Side	Lining Type	Manning's "n"	Velocity (ft/s) Actual	Max. Allowed	Safety Factor	Shear Stress (lbs/sqft) Actual	Max. Allowed	Safety Factor	Flow Depth (ft)	Discharge (cfs)	OK?
Analysis #1	Left:	**LANDLOK TRM**	0.0250	10.0	16.5	1.6	4.2	4.7	1.1	4.2678	1374.0	No
	Bottom:	**LANDLOK TRM**	0.0250	11.3	16.5	1.5	5.3	4.7	0.9			
	Right:	**LANDLOK TRM** 435	0.0250	10.0	16.5	1.6	4.2	4.7	1.1			
Analysis #2	Left:	**LANDLOK TRM**	0.0250	10.0	16.8	1.7	4.2	6.5	1.6	4.2678	1374.0	Yes
	Bottom:	**LANDLOK TRM**	0.0250	11.3	16.8	1.5	5.3	6.5	1.2			
	Right:	**LANDLOK TRM** 450	0.0250	10.0	16.8	1.7	4.2	6.5	1.6			
Analysis #3	Left:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	0.0	No
	Bottom:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
	Right:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			

Channel Calculation Results:

	Flow Area (sq ft)	Hydraulic Radius (ft)	Composite 'n'	Left Wetted Perimeter(ft)	Right Wetted Perimeter(ft)	Total Wetted Perimeter(ft)	Average Veleocity (ft/s)	Average Discharge (cfs)	Froude
Analysis #1	121.7841	3.1158	0.0397	9.5431	9.5431	39.0862	11.2823	1374.0	.890
Analysis #2	121.7841	3.1158	0.0397	9.5431	9.5431	39.0862	11.2823	1374.0	.890
Analysis #3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	.000

Channel Analysis Information:

Name:

Channel Analysis Name: **SE Ditch (5%)**

Channel Geometry & Hydraulics:

Design By:

Designed By: **FLOW**

Channel Side Slopes:

Left Slope (xH:1V): **2.00**
Right Slope (xH:1V): **2.00**

Flow\Velocity:

Discharge (cfs): **1374.00**
Flow Duration (hrs): **1.00**
Average Velocity (ft/s): **0.00**

Channel Geometry:

Bed Slope (ft/ft): **0.05000**
Req. Freeboard (ft): **0.00**
Channel Length (ft): **750.00**
Bottom Width (ft): **20.00**
Channel Depth (ft): **5.00**

Channel Bend:

Channel Bend: **No**
Bend Radius (ft): **0.00**
Outside Bend:

Vegetation:

Vegetated: **Yes**
Vegetation Class: **C**

Soil Filled:

Soil Filled: **No**

Factor of Safety: **1.10**

Functional Longevity: **999**

Analysis Results:

				Velocity (ft/s)			Shear Stress (lbs/sqft)					
	Side	Lining Type	Manning's "n"	Actual	Max. Allowed	Safety Factor	Actual	Max. Allowed	Safety Factor	Flow Depth (ft)	Discharge (cfs)	OK?
Analysis #1	Left:	LANDLOK TRM	0.0260	14.3	19.1	1.3	7.8	7.5	1.0	3.2178	1374.0	No
	Bottom:	LANDLOK TRM	0.0260	16.2	19.1	1.2	10.0	7.5	0.8			
	Right:	LANDLOK TRM	0.0260	14.3	19.1	1.3	7.8	7.5	1.0			
Analysis #2	Left:	PYRAMAT	0.0280	14.3	23.3	1.6	7.8	9.4	1.2	3.2184	1374.0	No
	Bottom:	PYRAMAT	0.0280	16.2	23.3	1.4	10.0	9.4	0.9			
	Right:	PYRAMAT	0.0280	14.3	23.3	1.6	7.8	9.4	1.2			
Analysis #3	Left:	ROCK RIPRAP	0.0300	17.6	50.0	2.8	6.6	45.0	6.8	2.7285	1374.0	Yes
	Bottom:	ROCK RIPRAP	0.0300	19.9	50.0	2.5	8.5	45.0	5.3			
	Right:	ROCK RIPRAP	0.0300	17.6	50.0	2.8	6.6	45.0	6.8			

Channel Calculation Results:

	Flow Area (sq ft)	Hydraulic Radius (ft)	Composite 'n'	Left Wetted Perimeter(ft)	Right Wetted Perimeter(ft)	Total Wetted Perimeter(ft)	Average Velocity (ft/s)	Average Discharge (cfs)	Froude
Analysis #1	85.0635	2.4735	0.0378	7.1952	7.1952	34.3903	16.1526	1374.0	1.47
Analysis #2	85.0856	2.4739	0.0378	7.1967	7.1967	34.3933	16.1484	1374.0	1.47
Analysis #3	69.4578	2.1569	0.0280	6.1010	6.1010	32.2020	19.7818	1374.0	1.96

Channel Analysis Information:

Name:

Channel Analysis Name: **SE Ditch (1%)**

Channel Geometry & Hydraulics:

Design By:

Designed By: **FLOW**

Channel Side Slopes:

Left Slope (xH:1V): **2.00**
Right Slope (xH:1V): **2.00**

Flow\Velocity:

Discharge (cfs): **1374.00**
Flow Duration (hrs): **1.00**
Average Velocity (ft/s): **0.00**

Channel Geometry:

Bed Slope (ft/ft): **0.01000**
Req. Freeboard (ft): **0.00**
Channel Length (ft): **1000.0**
Bottom Width (ft): **20.00**
Channel Depth (ft): **6.00**

Channel Bend:

Channel Bend: **No**
Bend Radius (ft): **0.00**
Outside Bend:

Vegetation:

Vegetated: **Yes**
Vegetation Class: **C**

Soil Filled:

Soil Filled: **No**

Factor of Safety: **1.10**

Functional Longevity: **999**

Analysis Results:

	Side	Lining Type	Manning's "n"	Velocity (ft/s)			Shear Stress (lbs/sqft)			Flow Depth (ft)	Discharge (cfs)	OK?
				Actual	Max. Allowed	Safety Factor	Actual	Max. Allowed	Safety Factor			
Analysis #1	Left:	**LANDLOK TRM**	0.0250	7.7	16.5	2.2	2.6	4.7	1.8	5.2542	1374.0	Yes
	Bottom:	**LANDLOK TRM**	0.0250	8.6	16.5	1.9	3.3	4.7	1.4			
	Right:	**LANDLOK TRM** 435	0.0250	7.7	16.5	2.2	2.6	4.7	1.8			
Analysis #2	Left:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	0.0	No
	Bottom:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
	Right:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
Analysis #3	Left:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	0.0	No
	Bottom:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
	Right:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			

Channel Calculation Results:

	Flow Area (sq ft)	Hydraulic Radius (ft)	Composite 'n'	Left Wetted Perimeter(ft)	Right Wetted Perimeter(ft)	Total Wetted Perimeter(ft)	Average Veleocity (ft/s)	Average Discharge (cfs)	Froude
Analysis #1	160.2976	3.6852	0.0413	11.7488	11.7488	43.4975	8.5716	1374.0	.615
Analysis #2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	.000
Analysis #3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	.000

EC-Design 2000 Channel Analysis Report

Channel Analysis Information:

Name:

Channel Analysis Name: **NE Ditch**

Channel Geometry & Hydraulics:

Design By:

Designed By: **FLOW**

Channel Side Slopes:

Left Slope (xH:1V): **2.00**
Right Slope (xH:1V): **2.00**

Flow\Velocity:

Discharge (cfs): **399.00**
Flow Duration (hrs): **1.00**
Average Velocity (ft/s): **0.00**

Channel Geometry:

Bed Slope (ft/ft): **0.02000**
Req. Freeboard (ft): **0.00**
Channel Length (ft): **1800.0**
Bottom Width (ft): **10.00**
Channel Depth (ft): **5.00**

Channel Bend:

Channel Bend: **No**
Bend Radius (ft): **0.00**
Outside Bend:

Vegetation:

Vegetated: **Yes**
Vegetation Class: **C**

Soil Filled:

Soil Filled: **No**

Factor of Safety: 1.10

Functional Longevity: 999

Analysis Results:

				Velocity (ft/s)			Shear Stress (lbs/sqft)					
	Side	Lining Type	Manning's "n"	Actual	Max. Allowed	Safety Factor	Actual	Max. Allowed	Safety Factor	Flow Depth (ft)	Discharge (cfs)	OK?
Analysis #1	Left:	LANDLOK TRM	0.0250	7.1	16.5	2.3	3.1	4.7	1.5	3.1235	399.0	Yes
	Bottom:	LANDLOK TRM	0.0250	7.9	16.5	2.1	3.9	4.7	1.2			
	Right:	LANDLOK TRM 435	0.0250	7.1	16.5	2.3	3.1	4.7	1.5			
Analysis #2	Left:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	0.0	No
	Bottom:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
	Right:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
Analysis #3	Left:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	0.0	No
	Bottom:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
	Right:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			

Channel Calculation Results:

	Flow Area (sq ft)	Hydraulic Radius (ft)	Composite 'n'	Left Wetted Perimeter(ft)	Right Wetted Perimeter(ft)	Total Wetted Perimeter(ft)	Average Velocity (ft/s)	Average Discharge (cfs)	Froude
Analysis #1	50.7483	2.1173	0.0440	6.9844	6.9844	23.9689	7.8623	399.0	.735
Analysis #2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	.000
Analysis #3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	.000

EC-Design 2000 Channel Analysis Report

Channel Analysis Information:

Name:

Channel Analysis Name: **East Ditch**

Channel Geometry & Hydraulics:

Design By:

Designed By: **FLOW**

Channel Side Slopes:

Left Slope (xH:1V): **2.00**
Right Slope (xH:1V): **2.00**

Flow\Velocity:

Discharge (cfs): **509.00**
Flow Duration (hrs): **1.00**
Average Velocity (ft/s): **0.00**

Channel Geometry:

Bed Slope (ft/ft): **0.02000**
Req. Freeboard (ft): **0.00**
Channel Length (ft): **350.00**
Bottom Width (ft): **10.00**
Channel Depth (ft): **5.00**

Channel Bend:

Channel Bend: **Yes**
Bend Radius (ft): **200.00**
Outside Bend: **L**

Vegetation:

Vegetated: **Yes**
Vegetation Class: **C**

Soil Filled:

Soil Filled: **No**

Factor of Safety: **1.10**

Functional Longevity: **999**

Analysis Results:

				Velocity (ft/s)			Shear Stress (lbs/sqft)					
	Side	Lining Type	Manning's "n"	Actual	Max. Allowed	Safety Factor	Actual	Max. Allowed	Safety Factor	Flow Depth (ft)	Discharge (cfs)	OK?
Analysis #1	Left:	LANDLOK TRM	0.0250	7.8	16.5	2.1	3.6	4.7	1.3	3.4942	509.0	No
	Bottom:	LANDLOK TRM	0.0250	8.6	16.5	1.9	4.4	4.7	1.1			
	Right:	LANDLOK TRM	0.0250	7.8	16.5	2.1	3.6	4.7	1.3			
Analysis #2	Left:	LANDLOK TRM	0.0250	7.8	16.8	2.2	3.6	6.5	1.8	3.4942	509.0	Yes
	Bottom:	LANDLOK TRM	0.0250	8.6	16.8	1.9	4.4	6.5	1.5			
	Right:	LANDLOK TRM 450	0.0250	7.8	16.8	2.2	3.6	6.5	1.8			
Analysis #3	Left:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	0.0	No
	Bottom:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
	Right:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			

Channel Calculation Results:

	Flow Area (sq ft)	Hydraulic Radius (ft)	Composite 'n'	Left Wetted Perimeter(ft)	Right Wetted Perimeter(ft)	Total Wetted Perimeter(ft)	Average Velocity (ft/s)	Average Discharge (cfs)	Froude
Analysis #1	59.3615	2.3164	0.0429	7.8133	7.8133	25.6267	8.5746	509.0	.760
Analysis #2	59.3615	2.3164	0.0429	7.8133	7.8133	25.6267	8.5746	509.0	.760
Analysis #3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	.000

EC-Design 2000 Channel Analysis Report

Channel Analysis Information:

Name:

Channel Analysis Name: **NW Ditch**

Channel Geometry & Hydraulics:

Design By:

Designed By: **FLOW**

Channel Side Slopes:

Left Slope (xH:1V): **2.00**
Right Slope (xH:1V): **2.00**

Flow\Velocity:

Discharge (cfs): **73.00**
Flow Duration (hrs): **1.00**
Average Velocity (ft/s): **0.00**

Channel Geometry:

Bed Slope (ft/ft): **0.01000**
Req. Freeboard (ft): **0.00**
Channel Length (ft): **1000.0**
Bottom Width (ft): **0.01**
Channel Depth (ft): **4.00**

Channel Bend:

Channel Bend: **No**
Bend Radius (ft): **0.00**
Outside Bend:

Vegetation:

Vegetated: **Yes**
Vegetation Class: **C**

Soil Filled:

Soil Filled: **No**

Factor of Safety: **1.10**

Functional Longevity: **999**

Analysis Results:

	Side	Lining Type	Manning's "n"	Velocity (ft/s) Actual	Max. Allowed	Safety Factor	Shear Stress (lbs/sqft) Actual	Max. Allowed	Safety Factor	Flow Depth (ft)	Discharge (cfs)	OK?
Analysis #1	Left:	**LANDLOK TRM**	0.0250	3.4	16.5	4.8	2.1	4.7	2.3	3.2826	73.0	Yes
	Bottom:	**LANDLOK TRM**	0.0250	3.4	16.5	4.8	2.0	4.7	2.3			
	Right:	**LANDLOK TRM**	0.0250	3.4	16.5	4.8	2.1	4.7	2.3			
Analysis #2	Left:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	0.0	No
	Bottom:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
	Right:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
Analysis #3	Left:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	0.0	No
	Bottom:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
	Right:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			

Channel Calculation Results:

	Flow Area (sq ft)	Hydraulic Radius (ft)	Composite 'n'	Left Wetted Perimeter(ft)	Right Wetted Perimeter(ft)	Total Wetted Perimeter(ft)	Average Velocity (ft/s)	Average Discharge (cfs)	Froude
Analysis #1	21.5836	1.4693	0.0564	7.3401	7.3401	14.6902	3.3822	73.0	.331
Analysis #2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	.000
Analysis #3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	.000

EC-Design 2000 Channel Analysis Report

Channel Analysis Information:

Name:

Channel Analysis Name: **West Ditch**

Channel Geometry & Hydraulics:

Design By:

Designed By: **FLOW**

Channel Side Slopes:

Left Slope (xH:1V): **2.00**
Right Slope (xH:1V): **2.00**

Flow\Velocity:

Discharge (cfs): **241.00**
Flow Duration (hrs): **1.00**
Average Velocity (ft/s): **0.00**

Channel Geometry:

Bed Slope (ft/ft): **0.06000**
Req. Freeboard (ft): **0.00**
Channel Length (ft): **1020.0**
Bottom Width (ft): **10.00**
Channel Depth (ft): **6.00**

Channel Bend:

Channel Bend: **No**
Bend Radius (ft): **0.00**
Outside Bend:

Vegetation:

Vegetated: **Yes**
Vegetation Class: **C**

Soil Filled:

Soil Filled: **No**

Factor of Safety: **1.10**

Functional Longevity: **999**

Analysis Results:

	Side	Lining Type	Manning's "n"	Velocity (ft/s)			Shear Stress (lbs/sqft)			Flow Depth (ft)	Discharge (cfs)	OK?
				Actual	Max. Allowed	Safety Factor	Actual	Max. Allowed	Safety Factor			
Analysis #1	Left:	PYRAMAT	0.0280	8.9	23.3	2.6	5.1	9.4	1.8	1.7595	241.0	Yes
	Bottom:	PYRAMAT	0.0280	10.1	23.3	2.3	6.6	9.4	1.4			
	Right:	PYRAMAT	0.0280	8.9	23.3	2.6	5.1	9.4	1.8			
Analysis #2	Left:	LANDLOK TRM	0.0260	8.9	19.1	2.1	5.1	7.5	1.5	1.7684	241.0	No
	Bottom:	LANDLOK TRM	0.0260	10.1	19.1	1.9	6.6	7.5	1.1			
	Right:	LANDLOK TRM	0.0260	8.9	19.1	2.1	5.1	7.5	1.5			
Analysis #3	Left:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	0.0	No
	Bottom:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
	Right:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			

Channel Calculation Results:

	Flow Area (sq ft)	Hydraulic Radius (ft)	Composite 'n'	Left Wetted Perimeter(ft)	Right Wetted Perimeter(ft)	Total Wetted Perimeter(ft)	Average Veleocity (ft/s)	Average Discharge (cfs)	Froude
Analysis #1	23.7860	1.3312	0.0439	3.9343	3.9343	17.8685	10.1320	241.0	1.24
Analysis #2	23.9376	1.3367	0.0438	3.9541	3.9541	17.9083	10.0679	241.0	1.23
Analysis #3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	.000

EC-Design 2000 Channel Analysis Report

Channel Analysis Information:

Name:

Channel Analysis Name: **SW Ditch (7%)**

Channel Geometry & Hydraulics:

Design By:

Designed By: **FLOW**

Channel Side Slopes:

Left Slope (xH:1V): **2.00**
Right Slope (xH:1V): **2.00**

Flow\Velocity:

Discharge (cfs): **323.00**
Flow Duration (hrs): **1.00**
Average Velocity (ft/s): **0.00**

Channel Geometry:

Bed Slope (ft/ft): **0.07000**
Req. Freeboard (ft): **0.00**
Channel Length (ft): **225.00**
Bottom Width (ft): **10.00**
Channel Depth (ft): **4.00**

Channel Bend:

Channel Bend: **No**
Bend Radius (ft): **0.00**
Outside Bend:

Vegetation:

Vegetated: **Yes**
Vegetation Class: **C**

Soil Filled:

Soil Filled: **No**

Factor of Safety: **1.10**

Functional Longevity: **999**

Analysis Results:

	Side	Lining Type	Manning's "n"	Velocity (ft/s) Actual	Max. Allowed	Safety Factor	Shear Stress (lbs/sqft) Actual	Max. Allowed	Safety Factor	Flow Depth (ft)	Discharge (cfs)	OK?
Analysis #1	Left:	PYRAMAT	0.0280	10.6	23.3	2.2	6.6	9.4	1.4	1.9335	323.0	No
	Bottom:	PYRAMAT	0.0280	12.0	23.3	1.9	8.4	9.4	1.1			
	Right:	PYRAMAT	0.0280	10.6	23.3	2.2	6.6	9.4	1.4			
Analysis #2	Left:	ROCK RIPRAP	0.0300	13.4	50.0	3.7	5.5	45.0	8.2	1.6178	323.0	Yes
	Bottom:	ROCK RIPRAP	0.0300	15.2	50.0	3.3	7.1	45.0	6.4			
	Right:	ROCK RIPRAP	0.0300	13.4	50.0	3.7	5.5	45.0	8.2			
Analysis #3	Left:		0.0280	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	0.0	No
	Bottom:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
	Right:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			

Channel Calculation Results:

	Flow Area (sq ft)	Hydraulic Radius (ft)	Composite 'n'	Left Wetted Perimeter(ft)	Right Wetted Perimeter(ft)	Total Wetted Perimeter(ft)	Average Velocity (ft/s)	Average Discharge (cfs)	Froude
Analysis #1	26.8125	1.4379	0.0419	4.3235	4.3235	18.6470	12.0466	323.0	1.40
Analysis #2	21.4118	1.2424	0.0300	3.6174	3.6174	17.2348	15.0851	323.0	1.94
Analysis #3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	.000

EC-Design 2000 Channel Analysis Report

Channel Analysis Information:

Name:

Channel Analysis Name: **SW Ditch (2%)**

Channel Geometry & Hydraulics:

Design By:

Designed By: **FLOW**

Channel Side Slopes:

Left Slope (xH:1V): **2.00**
Right Slope (xH:1V): **2.00**

Flow\Velocity:

Discharge (cfs): **323.00**
Flow Duration (hrs): **1.00**
Average Velocity (ft/s): **0.00**

Channel Geometry:

Bed Slope (ft/ft): **0.02000**
Req. Freeboard (ft): **0.00**
Channel Length (ft): **300.00**
Bottom Width (ft): **10.00**
Channel Depth (ft): **4.00**

Channel Bend:

Channel Bend: **No**
Bend Radius (ft): **0.00**
Outside Bend:

Vegetation:

Vegetated: **Yes**
Vegetation Class: **C**

Soil Filled:

Soil Filled: **No**

Factor of Safety: **1.10**

Functional Longevity: **999**

Analysis Results:

	Side	Lining Type	Manning's "n"	Velocity (ft/s) Actual	Velocity (ft/s) Max. Allowed	Velocity (ft/s) Safety Factor	Shear Stress (lbs/sqft) Actual	Shear Stress (lbs/sqft) Max. Allowed	Shear Stress (lbs/sqft) Safety Factor	Flow Depth (ft)	Discharge (cfs)	OK?
Analysis #1	Left: Bottom: Right:	PYRAMAT PYRAMAT PYRAMAT	0.0280 0.0280 0.0280	6.5 7.3 6.5	23.3 23.3 23.3	3.6 3.2 3.6	2.8 3.5 2.8	9.4 9.4 9.4	3.3 2.7 3.3	2.8325	323.0	Yes
Analysis #2	Left: Bottom: Right:		0.0000 0.0000 0.0000	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0000	0.0	No
Analysis #3	Left: Bottom: Right:		0.0000 0.0000 0.0000	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0000	0.0	No

Channel Calculation Results:

	Flow Area (sq ft)	Hydraulic Radius (ft)	Composite 'n'	Left Wetted Perimeter(ft)	Right Wetted Perimeter(ft)	Total Wetted Perimeter(ft)	Average Veleocity (ft/s)	Average Discharge (cfs)	Froude
Analysis #1	44.3719	1.9575	0.0451	6.3337	6.3337	22.6675	7.2794	323.0	.709
Analysis #2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	.000
Analysis #3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	.000

EC-Design 2000 Channel Analysis Report

Channel Analysis Information:

Name:

Channel Analysis Name: **SW Ditch (5%)**

Channel Geometry & Hydraulics:

Design By:

Designed By: **FLOW**

Channel Side Slopes:

Left Slope (xH:1V): **2.00**
Right Slope (xH:1V): **2.00**

Flow\Velocity:

Discharge (cfs): **323.00**
Flow Duration (hrs): **1.00**
Average Velocity (ft/s): **0.00**

Channel Geometry:

Bed Slope (ft/ft): **0.05000**
Req. Freeboard (ft): **0.00**
Channel Length (ft): **240.00**
Bottom Width (ft): **10.00**
Channel Depth (ft): **4.00**

Channel Bend:

Channel Bend: **No**
Bend Radius (ft): **0.00**
Outside Bend:

Vegetation:

Vegetated: **Yes**
Vegetation Class: **C**

Soil Filled:

Soil Filled: **No**

Factor of Safety: **1.10**

Functional Longevity: **999**

Analysis Results:

	Side	Lining Type	Manning's "n"	Velocity (ft/s) Actual	Max. Allowed	Safety Factor	Shear Stress (lbs/sqft) Actual	Max. Allowed	Safety Factor	Flow Depth (ft)	Discharge (cfs)	OK?
Analysis #1	Left:	**PYRAMAT**	0.0280	9.3	23.3	2.5	5.2	9.4	1.8	2.1429	323.0	Yes
	Bottom:	**PYRAMAT**	0.0280	10.5	23.3	2.2	6.7	9.4	1.4			
	Right:	**PYRAMAT**	0.0280	9.3	23.3	2.5	5.2	9.4	1.8			
Analysis #2	Left:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	0.0	No
	Bottom:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
	Right:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
Analysis #3	Left:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	0.0	No
	Bottom:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
	Right:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			

Channel Calculation Results:

	Flow Area (sq ft)	Hydraulic Radius (ft)	Composite 'n'	Left Wetted Perimeter(ft)	Right Wetted Perimeter(ft)	Total Wetted Perimeter(ft)	Average Veleocity (ft/s)	Average Discharge (cfs)	Froude
Analysis #1	30.6135	1.5632	0.0427	4.7917	4.7917	19.5835	10.5509	323.0	1.17
Analysis #2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	.000
Analysis #3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	.000

Channel Analysis Information:

Name:

Channel Analysis Name: **Main Channel**

Channel Geometry & Hydraulics:

Design By:

Designed By: **FLOW**

Channel Side Slopes:

Left Slope (xH:1V): **2.00**
Right Slope (xH:1V): **2.00**

Flow\Velocity:

Discharge (cfs): **1660.00**
Flow Duration (hrs): **1.00**
Average Velocity (ft/s): **0.00**

Channel Geometry:

Bed Slope (ft/ft): **0.01300**
Req. Freeboard (ft): **0.00**
Channel Length (ft): **3500.0**
Bottom Width (ft): **20.00**
Channel Depth (ft): **6.00**

Channel Bend:

Channel Bend: **No**
Bend Radius (ft): **0.00**
Outside Bend:

Vegetation:

Vegetated: **Yes**
Vegetation Class: **C**

Soil Filled:

Soil Filled: **No**

Factor of Safety: **1.10**

Functional Longevity: **999**

Analysis Results:

	Side	Lining Type	Manning's "n"	Velocity (ft/s) Actual	Velocity (ft/s) Max. Allowed	Velocity Safety Factor	Shear Stress (lbs/sqft) Actual	Shear Stress (lbs/sqft) Max. Allowed	Shear Stress Safety Factor	Flow Depth (ft)	Discharge (cfs)	OK?
Analysis #1	Left:	LANDLOK TRM	0.0250	9.1	16.5	1.8	3.4	4.7	1.4	5.3260	1660.0	No
	Bottom:	LANDLOK TRM	0.0250	10.2	16.5	1.6	4.3	4.7	1.1			
	Right:	LANDLOK TRM	0.0250	9.1	16.5	1.8	3.4	4.7	1.4			
Analysis #2	Left:	LANDLOK TRM	0.0250	9.1	16.8	1.8	3.4	6.5	1.9	5.3260	1660.0	Yes
	Bottom:	LANDLOK TRM	0.0250	10.2	16.8	1.6	4.3	6.5	1.5			
	Right:	LANDLOK TRM	0.0250	9.1	16.8	1.8	3.4	6.5	1.9			
Analysis #3	Left:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	0.0	No
	Bottom:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
	Right:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			

Channel Calculation Results:

	Flow Area (sq ft)	Hydraulic Radius (ft)	Composite 'n'	Left Wetted Perimeter(ft)	Right Wetted Perimeter(ft)	Total Wetted Perimeter(ft)	Average Veleocity (ft/s)	Average Discharge (cfs)	Froude
Analysis #1	163.2521	3.7256	0.0400	11.9093	11.9093	43.8185	10.1683	1660.0	.723
Analysis #2	163.2521	3.7256	0.0400	11.9093	11.9093	43.8185	10.1683	1660.0	.723
Analysis #3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	.000

EC-Design 2000 Channel Analysis Report

Channel Analysis Information:

Name:

Channel Analysis Name: **Area 1G Ditch**

Channel Geometry & Hydraulics:

Design By:

Designed By: **FLOW**

Channel Side Slopes:

Left Slope (xH:1V): **2.00**
Right Slope (xH:1V): **2.00**

Flow\Velocity:

Discharge (cfs): **15.00**
Flow Duration (hrs): **1.00**
Average Velocity (ft/s): **0.00**

Channel Geometry:

Bed Slope (ft/ft): **0.08000**
Req. Freeboard (ft): **0.00**
Channel Length (ft): **140.00**
Bottom Width (ft): **0.10**
Channel Depth (ft): **4.00**

Channel Bend:

Channel Bend: **No**
Bend Radius (ft): **0.00**
Outside Bend:

Vegetation:

Vegetated: **Yes**
Vegetation Class: **C**

Soil Filled:

Soil Filled: **No**

Factor of Safety: **1.10**

Functional Longevity: **999**

Analysis Results:

	Side	Lining Type	Manning's "n"	Velocity (ft/s) Actual	Max. Allowed	Safety Factor	Shear Stress (lbs/sqft) Actual	Max. Allowed	Safety Factor	Flow Depth (ft)	Discharge (cfs)	OK?
Analysis #1	Left:	LANDLOK TRM	0.0250	4.7	16.5	3.5	6.3	4.7	0.8	1.2450	15.0	No
	Bottom:	LANDLOK TRM	0.0250	4.6	16.5	3.5	6.2	4.7	0.8			
	Right:	LANDLOK TRM	0.0250	4.7	16.5	3.5	6.3	4.7	0.8			
Analysis #2	Left:	LANDLOK TRM	0.0250	4.7	16.8	3.6	6.3	6.5	1.0	1.2450	15.0	No
	Bottom:	LANDLOK TRM	0.0250	4.6	16.8	3.6	6.2	6.5	1.1			
	Right:	LANDLOK TRM	0.0250	4.7	16.8	3.6	6.3	6.5	1.0			
Analysis #3	Left:	PYRAMAT	0.0280	4.7	23.3	5.0	6.3	9.4	1.5	1.2502	15.0	Yes
	Bottom:	PYRAMAT	0.0280	4.7	23.3	5.0	6.2	9.4	1.5			
	Right:	PYRAMAT	0.0280	4.7	23.3	5.0	6.3	9.4	1.5			

Channel Calculation Results:

	Flow Area (sq ft)	Hydraulic Radius (ft)	Composite 'n'	Left Wetted Perimeter(ft)	Right Wetted Perimeter(ft)	Total Wetted Perimeter(ft)	Average Veleocity (ft/s)	Average Discharge (cfs)	Froude
Analysis #1	3.2247	0.5689	0.0624	2.7840	2.7840	5.6680	4.6516	15.0	.737
Analysis #2	3.2247	0.5689	0.0624	2.7840	2.7840	5.6680	4.6516	15.0	.737
Analysis #3	3.2511	0.5713	0.0622	2.7956	2.7956	5.6912	4.6138	15.0	.741

Channel Analysis Information:

Name:

Channel Analysis Name: **Phase 2 Ditch**

Channel Geometry & Hydraulics:

Design By:

Designed By: **FLOW**

Channel Side Slopes:

Left Slope (xH:1V): **4.00**
Right Slope (xH:1V): **2.00**

Flow\Velocity:

Discharge (cfs): **4.00**
Flow Duration (hrs): **1.00**
Average Velocity (ft/s): **0.00**

Channel Geometry:

Bed Slope (ft/ft): **0.06000**
Req. Freeboard (ft): **0.00**
Channel Length (ft): **560.00**
Bottom Width (ft): **0.01**
Channel Depth (ft): **2.00**

Channel Bend:

Channel Bend: **No**
Bend Radius (ft): **0.00**
Outside Bend:

Vegetation:

Vegetated: **Yes**
Vegetation Class: **C**

Soil Filled:

Soil Filled: **No**

Factor of Safety: **1.10**

Functional Longevity: **999**

Analysis Results:

	Side	Lining Type	Manning's "n"	Velocity (ft/s)			Shear Stress (lbs/sqft)			Flow Depth (ft)	Discharge (cfs)	OK?
				Actual	Max. Allowed	Safety Factor	Actual	Max. Allowed	Safety Factor			
Analysis #1	Left:	LANDLOK TRM	0.0250	2.3	16.5	7.1	4.0	4.7	1.2	0.8207	4.0	Yes
	Bottom:	LANDLOK TRM	0.0250	2.0	16.5	8.1	3.1	4.7	1.5			
	Right:	LANDLOK TRM	0.0250	2.1	16.5	8.0	3.1	4.7	1.5			
Analysis #2	Left:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	0.0	No
	Bottom:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
	Right:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
Analysis #3	Left:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	0.0	No
	Bottom:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
	Right:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			

Channel Calculation Results:

	Flow Area (sq ft)	Hydraulic Radius (ft)	Composite 'n'	Left Wetted Perimeter(ft)	Right Wetted Perimeter(ft)	Total Wetted Perimeter(ft)	Average Velocity (ft/s)	Average Discharge (cfs)	Froude
Analysis #1	2.0287	0.3880	0.0955	3.3837	1.8351	5.2288	1.9717	4.0	.415
Analysis #2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	.000
Analysis #3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	.000

Suggested Vegetation for: La Crosse,WI

All Season Grasses

Species	Scentific Name	Retardance Class	Seed Rate (lbs/ac)	Height at Maturity (in)	Recommended Planting Dates
Alsike Clover	Trifolium hybridum	A - E	15		4/1 - 5/31 or8/16 - 10/15
Reed Canarygrass	Phalaris arundinacea	A- E	20		4/1 - 5/31 or 8/16 - 10/15
Colonial Bentgrass	Agrostis tenius	A - E	50		4/1 - 5/31 or 8/16 - 10/15
Creeping Bentgrass	Agrostis palustris	A - E	50		4/1 - 5/31 or 8/16 - 10/15
Poa Trivialis	Poa trivialis	A - E	50		4/1 - 5/31 or 8/16 - 10/15
Creeping Foxtrail	Alopecurus arundinaceus	A - E	50		4/1 - 5/31 or 8/16 - 10/15
Meadow Foxtail	Alopecurus pratensis	A - E	50		4/1 - 5/31 or 8/16 - 10/15
Perennial Ryegrass	Lolium perenne	A - E	240		4/1 - 5/31 or 8/16 - 10/15
RedTop	Agrostis alba	A - E	80		4/1 - 5/31 or 8/16 - 10/15
Meadow Fescue	Festuca elatior	A - E	160		4/1 - 5/31 or 8/16 - 10/15

Cold Season Grasses

Species	Scentific Name	Retardance Class	Seed Rate (lbs/ac)	Height at Maturity (in)	Recommended Planting Dates
Crested Wheatgrass	Agropyron desertorum	A		2 - 3	
Green Needlegrass	Stipa viridula	A		3 - 4	
Russian WildRye	Psathyrostachys gunceus	A		3 - 4	
Smooth Bromegrass	Bromus inermis	A		3 - 4	
Tall Fescue	Festuca arundinacea	A		3 - 4	
Tall Wheatgrass	Elytriga pontica	A		4 - 5	
Western Wheatgrass	Agropyron smithii	A		2 - 3	

Warm Season Grasses

Species	Scentific Name	Retardance Class	Seed Rate (lbs/ac)	Height at Maturity (in)	Recommended Planting Dates
Bermuda Grass	Cynodon dactylon	C		3/4 - 2	
Big Bluestem	Andropogon gerardii	B		4 - 6	
Blue grama	Boutelova gracillis	B		1 - 2	
Buffalo grass	Buchloe dactyloides	D		1/3 - 1	
Green Sprangletop	Leptochloa dubia	A		3 - 4	
Indian grass	Sorghastrum nutans	A		5 - 6	
Kleingrass	Panicum coloratum	A		3 - 4	
Little bluestem	Schizachyrium scoparium	A		3 - 4	
Plains bristlegrass	Setaria macrostachya	B		1 - 2	
Sand bluestem	Andropogon hallii	A		5 - 6	
Sideoats grama	Bouteloua curtipendula	A		2 - 3	
Switch grass	Panicum Virgatum	A		4 - 5	
Vine mesquitegrass	Panicum Obtusum	B		1 - 2	
Weeping lovegrass	Eragrostis Curvula	A		3 - 4	

Calculations – Operational Landfill Conditions

RMT
744 Heartland Trail
Madison, WI 53717-1934
Tel. (608) 831-4444 • Fax (608) 831-3334

SHEET 1 OF 1

PROJECT / PROPOSAL NAME / LOCATION: DPC - POO		PROJECT / PROPOSAL NO.	3078.40
SUBJECT: OPERATIONAL DITCH SIZING			
PREPARED BY: BJK	DATE: 10/00	FINAL	☒
CHECKED BY:	DATE:	REVISION	☐

OPERATIONAL DITCHES (SEE FIGURES K-4 to K-9, OPERATIONAL RUNOFF CALCULATIONS)

DITCH	LOCATION	100-YR FLOW	SLOPE	SHAPE
V-NOTCH DITCH A	CELL 1 ACTIVE	5 CFS	6%	V-NOTCH
DITCH B	CELL 1 ACTIVE	561 ~~583~~ CFS[1]	2%	10' FLAT
DITCH C	CELL 2A ACTIVE	6 CFS	6.3%	V-NOTCH
DITCH D	CELL 2B ACTIVE	3 CFS	12%	V-NOTCH
DITCH E	CELL 3 ACTIVE	561 ~~583~~ CFS[1] ✓	1%	10' FLAT
DITCH F	CELL 4A ACTIVE	373 ~~433~~ CFS[2]	1%	10' FLAT
DITCH G	CELL 2A ACTIVE	360 CFS[4]		

NOTES
1. FLOWS FROM PREDEVELOPMENT AREAS NORTH + WEST (See p. 96) @ 12.6 hrs
2. FLOWS FROM PREDEVELOPMENT AREAS NORTH + 2B @ 12.6 HRS (See p. 66/96)
3 PERMANANT DITCHES SIZED UNDER POST-DEVELOPMENT CALCULATIONS.
4. FLOW FROM PREDEVELOPMENT AREA NORTH (See p. 95)

SW DITCH	CELL 2A ACTIVE	561 CFS[1]	5%	10' FLAT

FORM 383A

RMT, Inc.
Grass Channel Sizing Calculations

Site: Dairyland Power Cooperative
Date: 10/00
Project #: 3081.40
User: BJK
Channel: Ditch A

==

I. Input Parameters.

A. Side slope, Z1 (hor/vert) =	3.000	ft/ft
B. Side slope, Z2 (hor/vert) =	16.000	ft/ft
C. Bottom width, B =	0.000	ft
D. Design channel slope, S =	0.060	ft/ft
E. Channel Peak Flow, Q =	5.000	cfs
F. Enter - 1 - for Type "C" Veg. Retardence - 2 - for Type "D" Veg. Retardence	2	

II. Peak Flow Calculations.

A. Trial flow depth, D = (Bisection method until Va=Vb)	**0.533**	**ft**
B. Channel flow area, Ac = (.5*Z1*D^2) + (B*D) + (.5*Z2*D^2)	2.703	sq ft
C. Wetted Perimeter, Pw = (D*(Z1^2+1)^.5) + B + (D*(Z2^2+1)^.5)	10.239	ft
D. Hydraulic radius, Rh = (Ac/Pw)	0.264	ft
E. Velocity and hydraulic radius, VR = (Va * Rh)	0.488	sfps
F. Channel flow Manning's coeff, nc = 0	0.081	
G. Trial velocity, Va = (Q/Ac)	1.850	fps
H. Resultant velocity, Vb = (1.49/nc) * (Rh^.667) * (S^.5)	**1.850**	**fps** ✓OK

Invoke Solution Macro by typing - 'ctrl' D

EC-Design 2000 Channel Analysis Report

Channel Analysis Information:

Name:

Channel Analysis Name: **Ditch B**

Channel Geometry & Hydraulics:

Design By:

Designed By: **FLOW**

Channel Side Slopes:

Left Slope (xH:1V): **3.00**
Right Slope (xH:1V): **3.00**

Flow\Velocity:

Discharge (cfs): **583.00**
Flow Duration (hrs): **1.00**
Average Velocity (ft/s): **0.00**

Channel Geometry:

Bed Slope (ft/ft): **0.02000**
Req. Freeboard (ft): **0.00**
Channel Length (ft): **530.00**
Bottom Width (ft): **10.00**
Channel Depth (ft): **4.00**

Channel Bend:

Channel Bend: **No**
Bend Radius (ft): **0.00**
Outside Bend:

Vegetation:

Vegetated: **No**
Vegetation Class:

Soil Filled:

Soil Filled: **Yes**

Factor of Safety: **1.00**

Functional Longevity: **48**

Analysis Results:

	Side	Lining Type	Manning's "n"	Velocity (ft/s)			Shear Stress (lbs/sqft)			Flow Depth (ft)	Discharge (cfs)	OK?
				Actual	Max. Allowed	Safety Factor	Actual	Max. Allowed	Safety Factor			
Analysis #1	Left:	LANDLOK TRM	0.0250	13.4	16.5	1.2	2.5	6.2	2.5	2.3594	583.0	Yes
	Bottom:	LANDLOK TRM	0.0250	14.5	16.5	1.1	2.9	6.2	2.1			
	Right:	LANDLOK TRM 450	0.0250	13.4	16.5	1.2	2.5	6.2	2.5			
Analysis #2	Left:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	0.0	No
	Bottom:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
	Right:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
Analysis #3	Left:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	0.0	No
	Bottom:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
	Right:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			

Channel Calculation Results:

	Flow Area (sq ft)	Hydraulic Radius (ft)	Composite 'n'	Left Wetted Perimeter(ft)	Right Wetted Perimeter(ft)	Total Wetted Perimeter(ft)	Average Veloocity (ft/s)	Average Discharge (cfs)	Froude
Analysis #1	40.2945	1.6168	0.0200	7.4611	7.4611	24.9222	14.4685	583.0	1.58
Analysis #2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	.000
Analysis #3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	.000

RMT, Inc.
Grass Channel Sizing Calculations

Site: Dairyland Power Cooperative Date: 10/00
Project #: 3081.40 User: BJK
Channel: Ditch C

==

I. Input Parameters.

A. Side slope, Z1 (hor/vert) = 3.000 ft/ft

B. Side slope, Z2 (hor/vert) = 16.000 ft/ft

C. Bottom width, B = 0.000 ft

D. Design channel slope, S = 0.063 ft/ft

E. Channel Peak Flow, Q = 6.000 cfs

F. Enter - 1 - for Type "C" Veg. Retardence 2
- 2 - for Type "D" Veg. Retardence

II. Peak Flow Calculations.

A. Trial flow depth, D = 0.550 ft
(Bisection method until Va=Vb)
B. Channel flow area, Ac = 2.870 sq ft
(.5*Z1*D^2) + (B*D) + (.5*Z2*D^2)
C. Wetted Perimeter, Pw = 10.549 ft
(D*(Z1^2+1)^.5) + B + (D*(Z2^2+1)^.5)
D. Hydraulic radius, Rh = 0.272 ft
(Ac/Pw)
E. Velocity and hydraulic radius, VR = 0.569 sfps
(Va * Rh)
F. Channel flow Manning's coeff, nc = 0.075
0
G. Trial velocity, Va = 2.091 fps
(Q/Ac)
H. Resultant velocity, Vb = 2.091 fps ✓OK
(1.49/nc) * (Rh^.667) * (S^.5)

Invoke Solution Macro by typing - 'ctrl' D

RMT, Inc.

Grass Channel Sizing Calculations

Site:	Dairyland Power Cooperative	Date:	10/00
Project #:	3081.40	User:	BJK
Channel:	Ditch D		

==

I. Input Parameters.

A. Side slope, Z1 (hor/vert) =	3.000	ft/ft
B. Side slope, Z2 (hor/vert) =	3.000	ft/ft
C. Bottom width, B =	0.000	ft
D. Design channel slope, S =	0.120	ft/ft
E. Channel Peak Flow, Q =	3.000	cfs
F. Enter - 1 - for Type "C" Veg. Retardence - 2 - for Type "D" Veg. Retardence	2	

II. Peak Flow Calculations.

A. Trial flow depth, D = (Bisection method until Va=Vb)	**0.547**	**ft**	
B. Channel flow area, Ac = (.5*Z1*D^2) + (B*D) + (.5*Z2*D^2)	0.897	sq ft	
C. Wetted Perimeter, Pw = (D*(Z1^2+1)^.5) + B + (D*(Z2^2+1)^.5)	3.459	ft	
D. Hydraulic radius, Rh = (Ac/Pw)	0.259	ft	
E. Velocity and hydraulic radius, VR = (Va * Rh)	0.867	sfps	
F. Channel flow Manning's coeff, nc = 0	0.063		
G. Trial velocity, Va = (Q/Ac)	3.344	fps	
H. Resultant velocity, Vb = (1.49/nc) * (Rh^.667) * (S^.5)	**3.344**	**fps**	✓ ok

Invoke Solution Macro by typing - 'ctrl' D

Channel Analysis Information:

Name:

Channel Analysis Name: **Ditch E**

Channel Geometry & Hydraulics:

Design By:

Designed By: **FLOW**

Channel Side Slopes:

Left Slope (xH:1V): **3.00**
Right Slope (xH:1V): **10.00**

Flow\Velocity:

Discharge (cfs): **583.00**
Flow Duration (hrs): **1.00**
Average Velocity (ft/s): **0.00**

Channel Geometry:

Bed Slope (ft/ft): **0.01000**
Req. Freeboard (ft): **0.00**
Channel Length (ft): **1000.0**
Bottom Width (ft): **10.00**
Channel Depth (ft): **3.00**

Channel Bend:

Channel Bend: **No**
Bend Radius (ft): **0.00**
Outside Bend:

Vegetation:

Vegetated: **No**
Vegetation Class:

Soil Filled:

Soil Filled: **Yes**

Factor of Safety: **1.00**

Functional Longevity: **60**

Analysis Results:

				Velocity (ft/s)			Shear Stress (lbs/sqft)			Flow Depth (ft)	Discharge (cfs)	OK?
	Side	Lining Type	Manning's "n"	Actual	Max. Allowed	Safety Factor	Actual	Max. Allowed	Safety Factor			
Analysis #1	Left:	LANDLOK TRM	0.0250	8.9	16.5	1.9	1.3	6.2	4.9	2.3865	583.0	Yes
	Bottom:	LANDLOK TRM	0.0250	9.6	16.5	1.7	1.5	6.2	4.2			
	Right:	LANDLOK TRM	0.0250	9.3	16.5	1.8	1.4	6.2	4.5			
Analysis #2	Left:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	0.0	No
	Bottom:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
	Right:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
Analysis #3	Left:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	0.0	No
	Bottom:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			
	Right:		0.0000	0.0	0.0	0.0	0.0	0.0	0.0			

Channel Calculation Results:

	Flow Area (sq ft)	Hydraulic Radius (ft)	Composite 'n'	Left Wetted Perimeter(ft)	Right Wetted Perimeter(ft)	Total Wetted Perimeter(ft)	Average Veleocity (ft/s)	Average Discharge (cfs)	Froude
Analysis #1	60.8850	1.4660	0.0200	7.5468	23.9840	41.5308	9.5754	583.0	1.06
Analysis #2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	.000
Analysis #3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	.000

Channel Analysis Information:

Name:

Channel Analysis Name: **Ditch F**

Channel Geometry & Hydraulics:

Design By:

Designed By: **FLOW**

Channel Side Slopes:

Left Slope (xH:1V): **3.00**
Right Slope (xH:1V): **5.00**

Flow\Velocity:

Discharge (cfs): **433.00**
Flow Duration (hrs): **1.00**
Average Velocity (ft/s): **0.00**

Channel Geometry:

Bed Slope (ft/ft): **0.01000**
Req. Freeboard (ft): **0.00**
Channel Length (ft): **750.00**
Bottom Width (ft): **10.00**
Channel Depth (ft): **3.00**

Channel Bend:

Channel Bend: **No**
Bend Radius (ft): **0.00**
Outside Bend:

Vegetation:

Vegetated: **No**
Vegetation Class:

Soil Filled:

Soil Filled: **Yes**

Factor of Safety: **1.00**

Functional Longevity: **0**

Analysis Results:

				Velocity (ft/s)			Shear Stress (lbs/sqft)					
	Side	Lining Type	Manning's "n"	Actual	Max. Allowed	Safety Factor	Actual	Max. Allowed	Safety Factor	Flow Depth (ft)	Discharge (cfs)	OK?
Analysis #1	Left:	**LANDLOK TRM**	**0.0250**	**9.1**	**16.5**	**1.8**	**1.2**	**6.2**	**5.1**	**2.2978**	**433.0**	**Yes**
	Bottom:	**LANDLOK TRM**	**0.0250**	**9.9**	**16.5**	**1.7**	**1.4**	**6.2**	**4.4**			
	Right:	**LANDLOK TRM**	**0.0250**	**9.5**	**16.5**	**1.7**	**1.3**	**6.2**	**4.7**			
Analysis #2	Left:		**0.0000**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0000**	**0.0**	**No**
	Bottom:		**0.0000**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**			
	Right:		**0.0000**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**			
Analysis #3	Left:		**0.0000**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0000**	**0.0**	**No**
	Bottom:		**0.0000**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**			
	Right:		**0.0000**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**			

Channel Calculation Results:

	Flow Area (sq ft)	Hydraulic Radius (ft)	Composite 'n'	Left Wetted Perimeter(ft)	Right Wetted Perimeter(ft)	Total Wetted Perimeter(ft)	Average Velocity (ft/s)	Average Discharge (cfs)	Froude
Analysis #1	**44.0967**	**1.5215**	**0.0200**	**7.2662**	**11.7164**	**28.9826**	**9.8193**	**433.0**	**1.10**
Analysis #2	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0**	**.000**
Analysis #3	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0**	**.000**

EC-DESIGN(R) 2000 Channel Analysis Report

Project Information

Project Name:	**DPC**	**Last Update:**	8/25/2003 10:58:10 A
Description:	Cell 2A operational Calcs	**Units:**	English
		Nearest City:	

Notes: Calculated for 1% slope section
Backwater from culvert / will
Protect 5% slope section

Channel Design

Channel Name: **SW Ditch - Operational 100 yr** **Units:** English **Design life:** 1,200 months

Design Criteria

Flow Rate (Q)

Vegetation and Soil

Vegetated	Yes
Vegetation Class	B
Soil Filled	No

Channel Geometry

Bed Slope (ft/ft)	0.010
Req. Freeboard (ft)	0.000
Channel Length (ft)	475.000
Bottom Width (ft)	10.000
Channel Depth (ft)	6.000

Flow/Velocity

Discharge (cf/s)	561.000
Flow Duration (hrs)	1.000
Avg. Velocity (ft/s)	5.490

Channel Side Slopes

Left (H:1 V)	2.000
Right (H:1 V)	2.000

Channel Bend No

Bend Radius (ft)	0.000
Outside Bend	

Required Factor of Safety 1.00

Results

Lining Materials		Velocity (ft/s)			Shear Stress (lbs/sqft)		
		Computed	Max Allowed	Safety Factor	Computed	Max Allowed	Safety Factor
Left	PYRAMAT	5.100	23.340	4.580	2.720	9.400	3.460
Bottom	PYRAMAT	5.510	23.340	4.240	3.170	9.400	2.970
Right	PYRAMAT	5.100	23.340	4.580	2.720	9.400	3.460

Avg. Flow Depth (ft) 5.070

Calculation Results:

Flow Depth (ft)	5.070	**Left Wetted Perimeter (ft)**	11.350
Flow Area (ft)	102.230	**Bottom Wetted Perimeter (ft)**	9.990
		Right Wetted Perimeter (ft)	11.350
		Total Wetted Perimeter (ft)	32.690
Hydraulic Radius (ft)	3.130	**Avg. Velocity (ft/s)**	5.490
Composite 'n'	0.0580	**Avg. Discharge (cf/s)**	561.000

EC-DESIGN(R) 2000 Channel Analysis Report

Project Information

roject Name:	DPC	**Last Update:**	8/25/2003 10:53:12 A
Description:	Cell 2A operational Calcs	**Units:**	English
		Nearest City:	

Notes: FOR 5% SLOPE
SECTION 25-YR STORM

Channel Design

Channel Name: SW Ditch - Operational 25 yr **Units:** English **Design life:** 48 months

Design Criteria

Flow Rate (Q)

Vegetation and Soil

Vegetated	Yes
Vegetation Class	B
Soil Filled	No

Channel Geometry

Bed Slope (ft/ft)	0.050
Req. Freeboard (ft)	0.000
Channel Length (ft)	450.000
Bottom Width (ft)	10.000
Channel Depth (ft)	4.000

Flow/Velocity

Discharge (cf/s)	355.000
Flow Duration (hrs)	1.000
Avg. Velocity (ft/s)	8.940

Channel Side Slopes

Left (H:1 V)	2.000
Right (H:1 V)	2.000

Channel Bend No

Bend Radius (ft)	0.000
Outside Bend	

Required Factor of Safety 1.00

Results

Lining Materials		**Velocity (ft/s)**			**Shear Stress (lbs/sqft)**		
		Computed	**Max Allowed**	**Safety Factor**	**Computed**	**Max Allowed**	**Safety Factor**
Left	PYRAMAT	8.030	23.340	2.910	6.450	9.400	1.460
Bottom	PYRAMAT	9.020	23.340	2.590	8.140	9.400	1.150
Right	PYRAMAT	8.030	23.340	2.910	6.450	9.400	1.460

Avg. Flow Depth (ft) 2.610

Calculation Results:

Flow Depth (ft)	2.610	**Left Wetted Perimeter (ft)**	5.830
Flow Area (ft)	39.690	**Bottom Wetted Perimeter (ft)**	10.000
		Right Wetted Perimeter (ft)	5.830
		Total Wetted Perimeter (ft)	21.660
Hydraulic Radius (ft)	1.830	**Avg. Velocity (ft/s)**	8.940
Composite 'n'	0.0554	**Avg. Discharge (cf/s)**	355.000

EC-DESIGN(R) 2000 Channel Analysis Report

Project Information

roject Name:	**DPC**	**Last Update:**	8/25/2003 11:00:48 A
Description:	Cell 2A operational Calcs	**Units:**	English
		Nearest City:	

Notes:

Channel Design

Channel Name: **Phase III South Slope Ditch** **Units:** English **Design life:** 24 months

Design Criteria

Flow Rate (Q)

Vegetation and Soil

Vegetated	No
Vegetation Class	
Soil Filled	Yes

Channel Geometry

Bed Slope (ft/ft)	0.060
Req. Freeboard (ft)	0.000
Channel Length (ft)	500.000
Bottom Width (ft)	1.000
Channel Depth (ft)	1.500

Flow/Velocity

Discharge (cf/s)	4.000
Flow Duration (hrs)	1.000
Avg. Velocity (ft/s)	6.280

Channel Side Slopes

eft (H:1 V)	2.000
ight (H:1 V)	3.000

Channel Bend No

Bend Radius (ft)	0.000
Outside Bend	

Required Factor of Safety 1.00

Results

Lining Materials		Velocity (ft/s) Computed	Max Allowed	Safety Factor	Shear Stress (lbs/sqft) Computed	Max Allowed	Safety Factor
Left	LANDLOK TRM 450	6.080	16.490	2.710	1.050	6.250	5.950
Bottom	LANDLOK TRM 450	6.730	16.490	2.450	1.280	6.250	4.880
Right	LANDLOK TRM 450	6.350	16.490	2.600	1.140	6.250	5.480

Avg. Flow Depth (ft) 0.340

Calculation Results:

Flow Depth (ft)	0.340	**Left Wetted Perimeter (ft)**	0.770
Flow Area (ft)	0.640	**Bottom Wetted Perimeter (ft)**	1.000
		Right Wetted Perimeter (ft)	1.080
		Total Wetted Perimeter (ft)	2.850
Hydraulic Radius (ft)	0.220	**Avg. Velocity (ft/s)**	6.280
Composite 'n'	0.0200	**Avg. Discharge (cf/s)**	4.000

EC-DESIGN(R) 2000 Channel Analysis Report

Project Information

Project Name:	**DPC**	**Last Update:**	8/25/2003 11:00:48 A
Description:	Cell 2A operational Calcs	**Units:**	English
		Nearest City:	

Notes:

Channel Design

Channel Name: **Ditch G** **Units:** English **Design life:** 48 months

Design Criteria

Flow Rate (Q)

Vegetation and Soil

Vegetated	No
Vegetation Class	
Soil Filled	No

Channel Geometry

Bed Slope (ft/ft)	0.015
Req. Freeboard (ft)	0.000
Channel Length (ft)	1.000
Bottom Width (ft)	10.000
Channel Depth (ft)	4.000

Flow/Velocity

Discharge (cf/s)	360.000
Flow Duration (hrs)	1.000
Avg. Velocity (ft/s)	10.930

Channel Side Slopes

Left (H:1 V)	3.000
Right (H:1 V)	3.000

Channel Bend **No**

Bend Radius (ft)	0.000
Outside Bend	

Required Factor of Safety 1.00

Results

Lining Materials		**Velocity (ft/s)**			**Shear Stress (lbs/sqft)**			**Avg. Flow Depth (ft)**
		Computed	**Max Allowed**	**Safety Factor**	**Computed**	**Max Allowed**	**Safety Factor**	2.040
Left	LANDLOK TRM 450	10.170	16.490	1.620	1.610	6.250	3.880	
Bottom	LANDLOK TRM 450	11.090	16.490	1.490	1.910	6.250	3.270	
Right	LANDLOK TRM 450	10.170	16.490	1.620	1.610	6.250	3.880	

Calculation Results:

Flow Depth (ft)	2.040	**Left Wetted Perimeter (ft)**	6.460
Flow Area (ft)	32.920	**Bottom Wetted Perimeter (ft)**	9.990
		Right Wetted Perimeter (ft)	6.460
		Total Wetted Perimeter (ft)	22.910
Hydraulic Radius (ft)	1.440	**Avg. Velocity (ft/s)**	10.930
Composite 'n'	0.0210	**Avg. Discharge (cf/s)**	360.000

Reference Information

roughness) varies with VR. The term VR is the product of velocity and the hydraulic radius. This relationship will be referred to as the "n-VR relationship", which is the recommended basis for vegetated channel design.

The five general retardance curves, designated as A, B, C, D, and E in Exhibit 7-1, have been developed for various cover conditions. The vegetal conditions under which the various retardance values apply are shown in Exhibit 7-2. These cover classifications are based on tests in experimental channels when the covers were green and generally uniform.

Most of the vegetation used in waterways does not exceed 18 inches in height and may be much shorter at times during the year. Therefore, it is recommended that when designing the channel for safe velocity, a retardance not greater than "D" be used. After designing the channel for safe velocity, it must be checked for capacity to accommodate the peak flow under conditions where vegetation gives the highest retardance. The retardance used in this instance is the curve corresponding to the expected vegetal cover and, in most cases, it will be retardance "C", though curve "B" may be used where considered appropriate.

All pertinent design data and computations should be recorded.

DESIGN DATA

The following information is required for designing a waterway:

1. Watershed area in acres, together with the soil characteristics, cover and topography. This information is used to estimate runoff by the procedures set forth in Chapter 2 of this manual.
2. Grade of the proposed waterway in percent slope (this is the fall in feet per 100 feet of length).
3. Vegetal cover adapted to site conditions.
4. Erodibility of the soil in the waterway.
5. Expected height at which vegetative cover will be maintained.
6. The permissible velocity for the conditions encountered.
7. Allowance for space that will be occupied by the vegetative lining.
8. Allowance for freeboard, if required by State Standards and Specifications.

NON-EROSIVE VELOCITY OF FLOW

In designing grassed waterways, care must be taken to insure that the design velocity is well within the limits of permissible velocities given in Exhibit 7-3. These values apply to average, uniform stands of each type of cover.

Source: U.S. Department of Agriculture, Soil Conservation Service. Engineering Field Manual. November 1986.

Cover	Slope range 2/ (percent)	Permissible velocity 1/	
		Erosion resistant soils (ft.per sec.)	Easily eroded soils (ft.per sec.)
Bermudagrass	0-5 5-10 over 10	8 7 6	6 5 4
Bahia Buffalograss Kentucky bluegrass Smooth brome Blue grama Tall fescue	0-5 5-10 over 10	7 6 5	5 4 3
Grass mixtures Reed canarygrass	2/ 0-5 5-10	5 4	4 3
Lespedeza sericea Weeping lovegrass Yellow bluestem Redtop Alfalfa Red fescue	3/ 0-5	3.5	2.5
Common lespedeza 4/ Sudangrass 4/	5/ 0-5	3.5	2.5

use 4fps max

1/ Use velocities exceeding 5 feet per second only where good covers and proper maintenance can be obtained.

2/ Do not use on slopes steeper than 10 percent except for vegetated side slopes in combination with a stone, concrete, or highly resistant vegetative center section.

3/ Do not use on slopes steeper than 5 percent except for vegetated side slopes in combination with a stone, concrete, or highly resistant vegetative center section.

4/ Annuals--use on mild slopes or as temporary protection until permanent covers are established.

5/ Use on slopes steeper than 5 percent is not recommended.

Exhibit 7-3. Permissible velocities for channels lined with vegetation

Source: U.S. Department of Agriculture, Soil Conservation Service. Engineering Field Manual. November 1986.

Culvert/Downslope Flume Design Calculations

Purpose/Methodology/Assumptions/Results/References

RMT®

COMPUTATION SHEET

SHEET 1 OF 2

744 Heartland Trail (53717-8923) P. O. Box 8923 (53708-8923) 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	BJK	9/00	RAA	10/00	3081.40

CULVERT DESIGN CALCULATIONS

Purpose

To determine the appropriate culvert and downslope flume sizes for the anticipated peak flows resulting from the 100-year, 24-hour storm at the proposed Dairyland Power Cooperative Landfill.

Methodologies

Culvert design involves the process of selecting an appropriate culvert size capable of allowing the estimated peak storm water runoff to pass through it without creating surface water breaching (i.e., berm overflow) or excessive backwater levels. Culvert sizing was performed using design charts developed by the U.S. Department of Transportation Federal Highway Administration.

Downslope flumes will convey flow from the final cover diversion berms to the sedimentation basin. Downslope flumes were also sized using design charts developed by the U.S. Department of Transportation Federal Highway Administration. The energy dissipater for the downslope flume was sized using design guidance from the US Department of the Interior, Bureau of Reclamation.

Assumptions

The following assumptions were used in the culvert and downslope flume sizing analysis:

1. Culvert and downslope flume layout and allowable headwater levels are shown on the accompanying plan set.
2. Tailwater depths were assumed based on anticipated flows within the ditching. For culverts discharging into sedimentation basins, the tailwater elevation in the basin from the routing calculations.
3. Culverts are assumed to be corrugated metal culvert pipes or concrete box culverts.
4. Culverts were designed to maintain a minimum 1 to 2 feet of freeboard, depending on the location.

PROJECT/PROPOSAL NAME	PREPARED By:	Date:	CHECKED By:	Date:	PROJECT/PROPOSAL NO.
Dairyland Power Cooperative	BJK	9/00	RAA	10/00	3081.40

Results

The table below summarizes the results of the culvert pipe sizing analyses:

CULVERT	SLOPE (%)	LENGTH (ft)	100-YR. FLOW (cfs)	SIZE
Culvert #1	7.0	96	323	4′x 7′ Box
Culvert #2	7.7	126	323	4′x 7′ Box
Culvert #3	11.2	125	15	30″ CMP
Culvert #4	9.3	75	15	30″ CMP
Culvert #5	5	85	323	4′ x 7′ Box

Note:
Culvert lengths to be adjusted based on available culvert section lengths.

Downslope pipe and energy dissipater sizing are shown on the engineering details included in the Plan Set.

References

U.S. Department of Transportation. Hydraulics charts for the selection of highway culverts. Hydraulic engineering circular no. 5. December 1965.

U.S. Department of the Interior, Bureau of Reclamation. Hydraulic Design of Stilling Basins and Energy Dissipaters. Engineering Nomograph No. 25. May 1984.

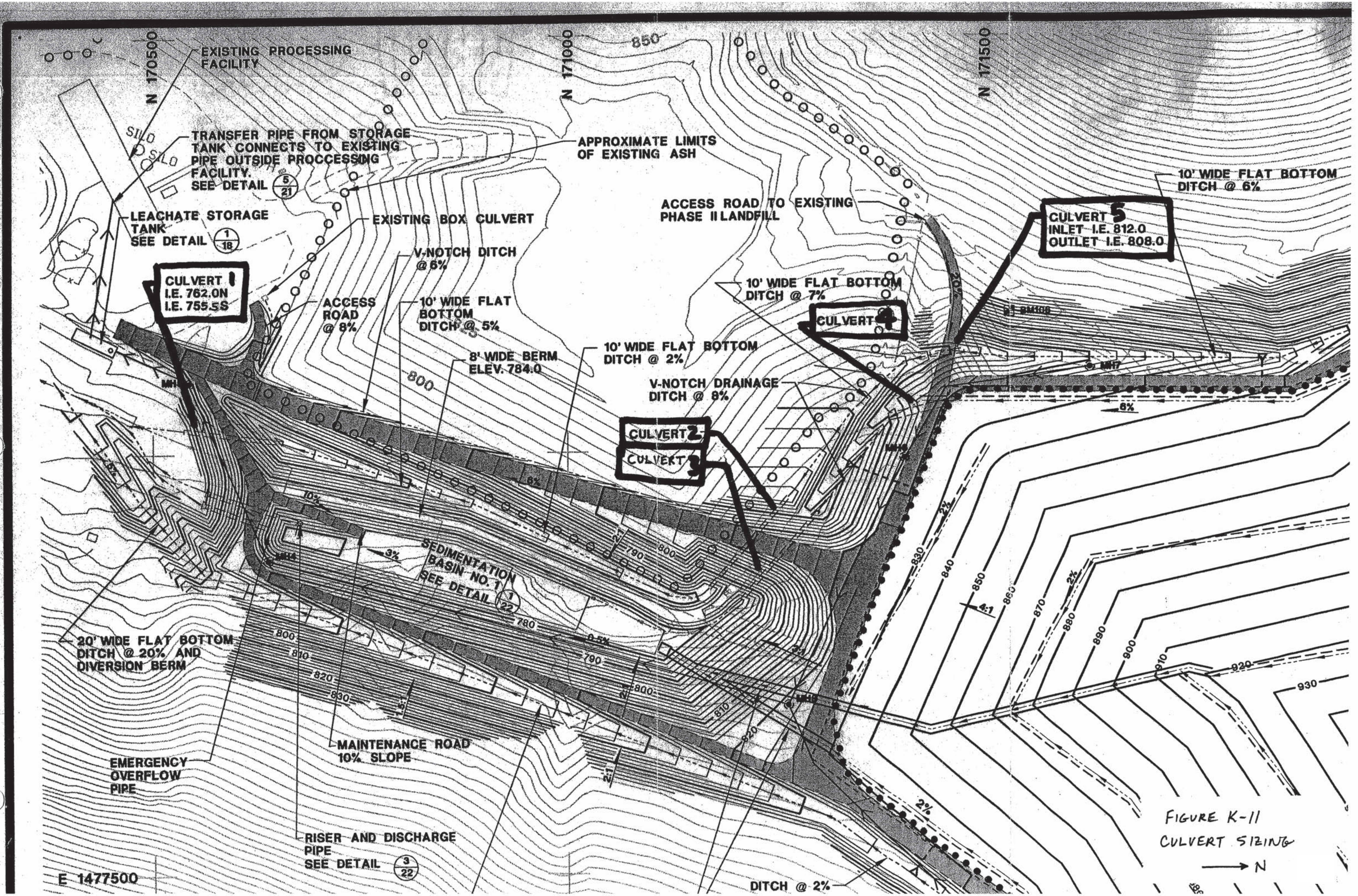

FIGURE K-11
CULVERT SIZING
→ N

Calculations – Post-closure Landfill Conditions

COMPUTATION SHEET

RMT INC.

SHEET ______ OF ______

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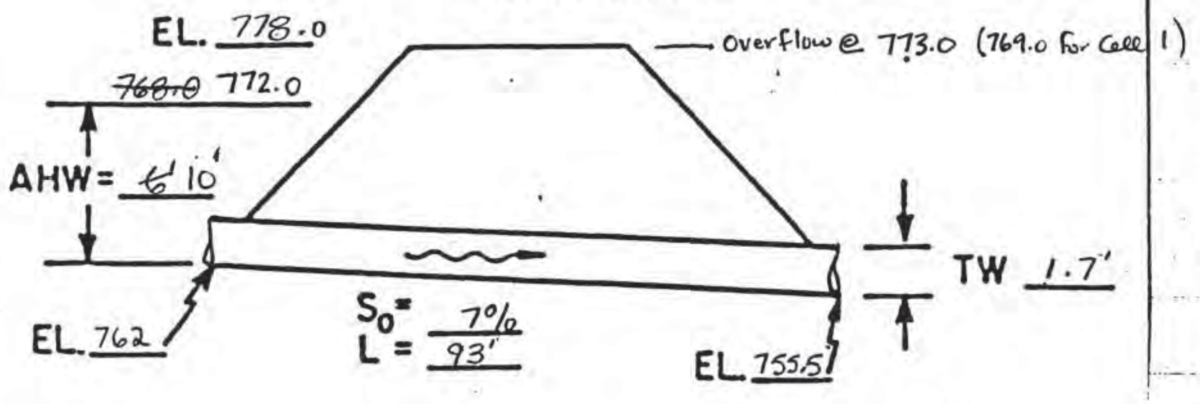
PROJECT / PROPOSAL NAME	PREPARED By:	Date:	CHECKED By:	Date:	PROJECT/PROPOSAL NO.
DPC - PLAN OF OPERATION	BJK	9/00			3081.40

Rev. 7/03
BJK

SKETCH

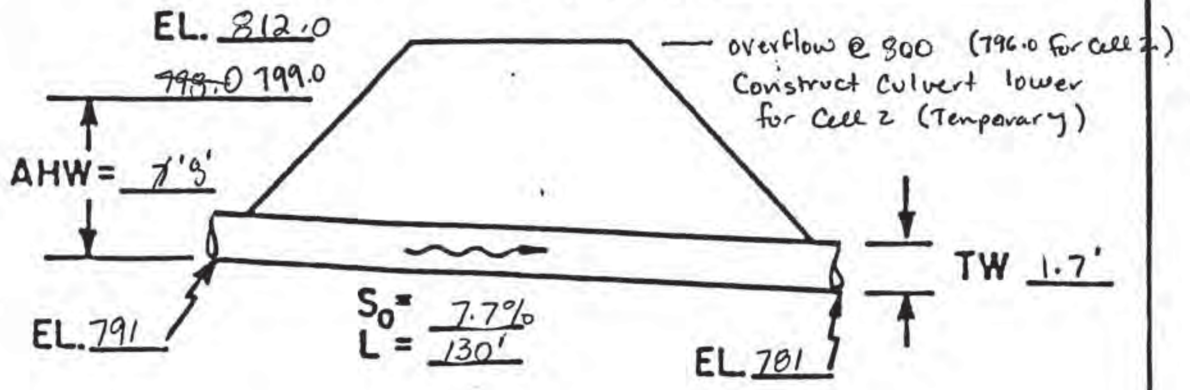
STATION: CULVERT #1



MAX. STREAM FLOW= 323 cfs

SKETCH

STATION: CULVERT #2



MAX. STREAM FLOW= 323 cfs

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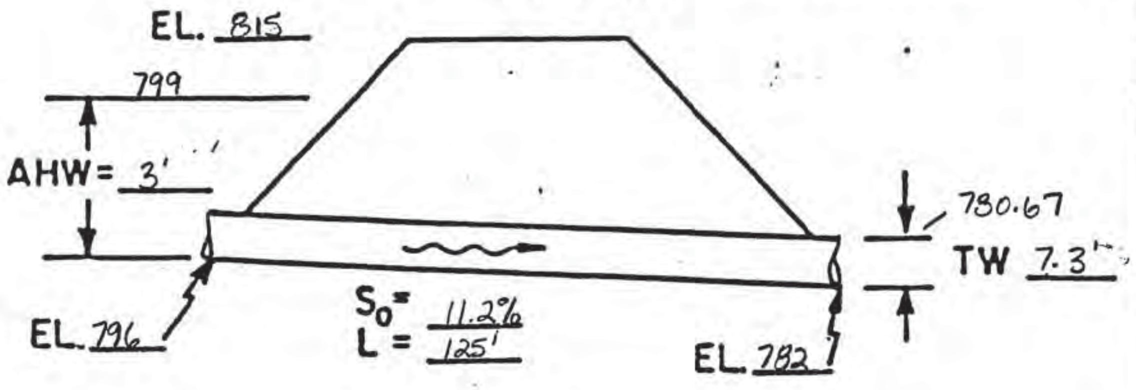
COMPUTATION SHEET

SHEET ______ OF ______

PROJECT / PROPOSAL NAME	PREPARED		CHECKED		PROJECT/PROPOSAL NO.
DPC · PLAN OF OPERATION	By: BJN	Date: 9/00	By:	Date:	30[illegible]1.40

SKETCH

STATION: CULVERT #3



EL. 815

799

AHW = 3'

780.67

TW 7.3'

EL. 796

S_0 = 11.2%

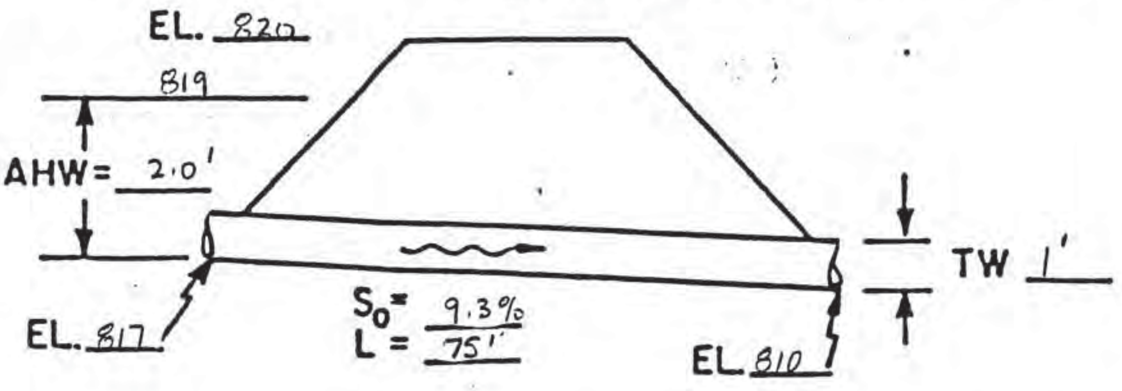
L = 125'

EL. 782

MAX. STREAM FLOW = 15 cfs

SKETCH

STATION: CULVERT #4



EL. 820

819

AHW = 2.0'

TW 1'

EL. 817

S_0 = 9.3%

L = 75'

EL. 810

MAX. STREAM FLOW = 15 cfs

COMPUTATION SHEET

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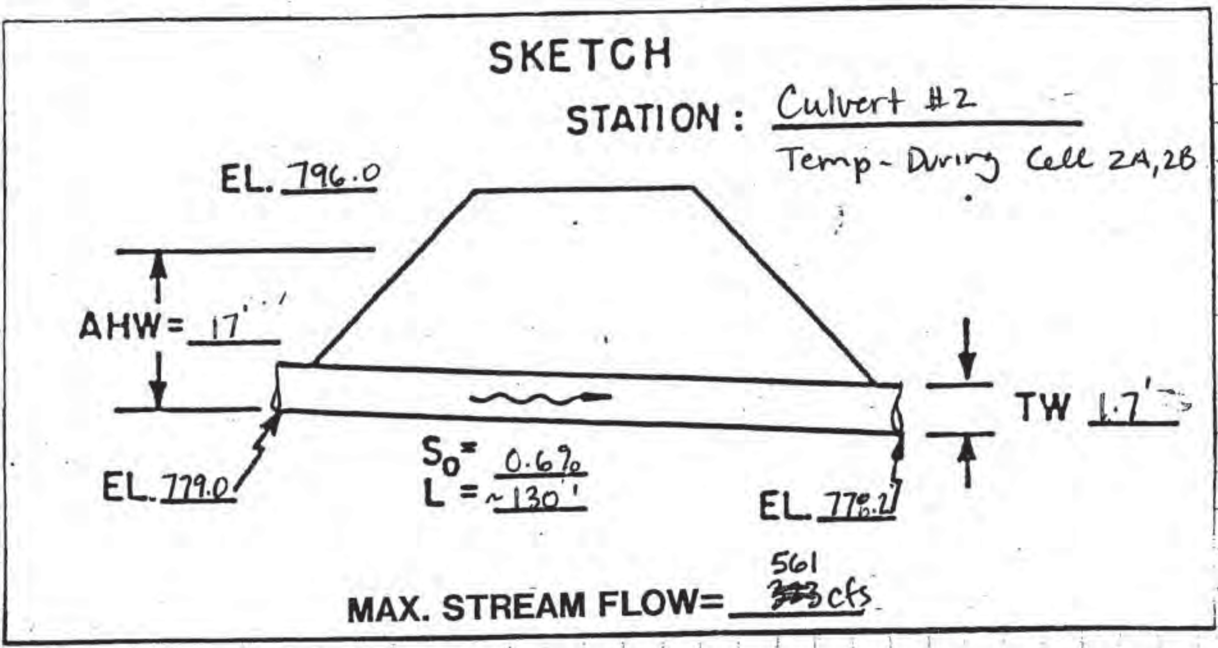
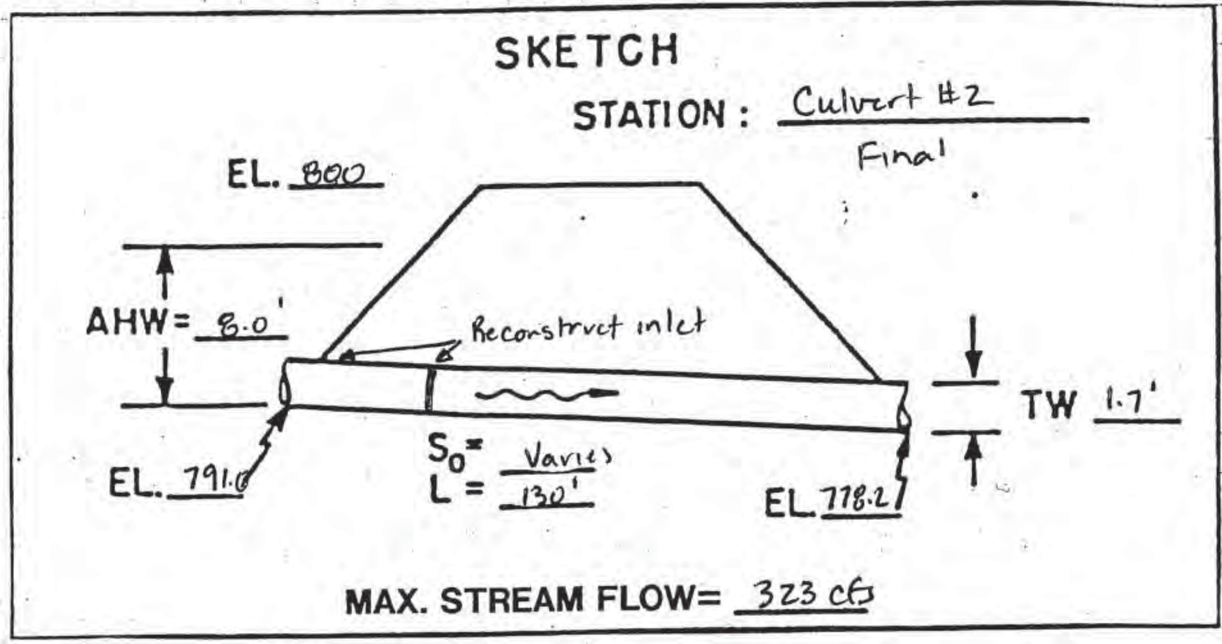
SHEET ______ OF ______

PROJECT / PROPOSAL NAME	PREPARED		CHECKED		PROJECT/PROPOSAL NO.
Dairyland Power – Phase IV	By: BJH	Date: 7/03	By:	Date:	3081.56





Culvert Calculator Report
Culvert 2 - Operational

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	796.00 ft	Headwater Depth/ Height	3.86
Computed Headwater Elevation	794.45 ft	Discharge	561.00 cfs
Inlet Control HW Elev	792.30 ft	Tailwater Elevation	779.90 ft
Outlet Control HW Elev	794.45 ft	Control Type	Outlet Control

Grades

Upstream Invert	779.00 ft	Downstream Invert	778.20 ft
Length	130.00 ft	Constructed Slope	0.006154 ft/ft

Hydraulic Profile

Profile	Pressure	Depth, Downstream	4.00 ft
Slope Type	N/A	Normal Depth	N/A ft
Flow Regime	N/A	Critical Depth	4.00 ft
Velocity Downstream	20.04 ft/s	Critical Slope	0.022277 ft/ft

Section

Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	7.00 ft
Section Size	7 x 4 ft	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev	794.45 ft	Upstream Velocity Head	6.24 ft
Ke	0.50	Entrance Loss	3.12 ft

Inlet Control Properties

Inlet Control HW Elev	792.30 ft	Flow Control	Submerged
Inlet Type	18 to 33.7 ° wingwall flare, d=0.0830	Area Full	28.0 ft²
K	0.48600	HDS 5 Chart	9
M	0.66700	HDS 5 Scale	2
C	0.02490	Equation Form	2
Y	0.83000		

Culvert Calculator Report
Culvert 2 - Final

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	799.00 ft	Headwater Depth/ Height	1.78
Computed Headwater Elevation	798.10 ft	Discharge	323.00 cfs
Inlet Control HW Elev	797.44 ft	Tailwater Elevation	779.90 ft
Outlet Control HW Elev	798.10 ft	Control Type	Entrance Control

Grades

Upstream Invert	791.00 ft	Downstream Invert	778.20 ft
Length	130.00 ft	Constructed Slope	0.098462 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	1.60 ft
Slope Type	Steep	Normal Depth	1.32 ft
Flow Regime	Supercritical	Critical Depth	4.00 ft
Velocity Downstream	28.87 ft/s	Critical Slope	0.007385 ft/ft

Section

Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	7.00 ft
Section Size	7 x 4 ft	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev	798.10 ft	Upstream Velocity Head	2.07 ft
Ke	0.50	Entrance Loss	1.03 ft

Inlet Control Properties

Inlet Control HW Elev	797.44 ft	Flow Control	Submerged
Inlet Type	18 to 33.7 ° wingwall flare, d=0.0830	Area Full	28.0 ft²
K	0.48600	HDS 5 Chart	9
M	0.66700	HDS 5 Scale	2
C	0.02490	Equation Form	2
Y	0.83000		

RMT INC.

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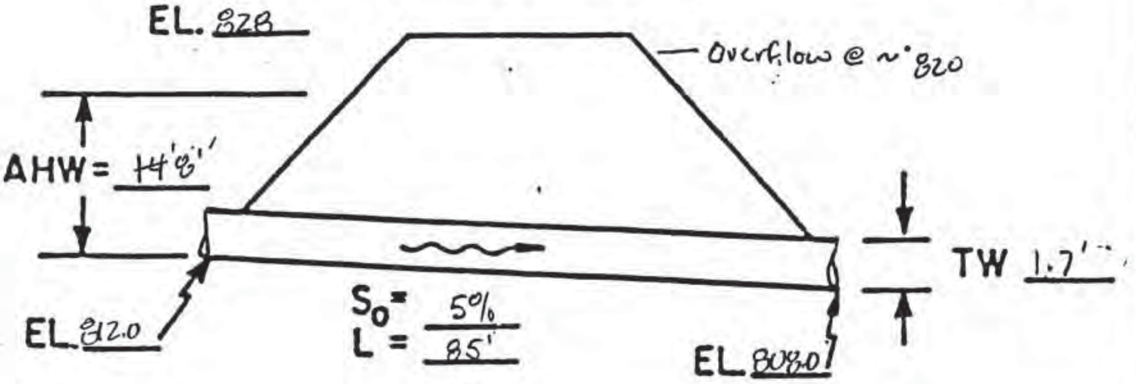
COMPUTATION SHEET

SHEET ____ OF ____

PROJECT / PROPOSAL NAME	PREPARED By:	Date:	CHECKED By:	Date:	PROJECT/PROPOSAL NO.
OPC POO	BJR	9/02			3091.40

SKETCH

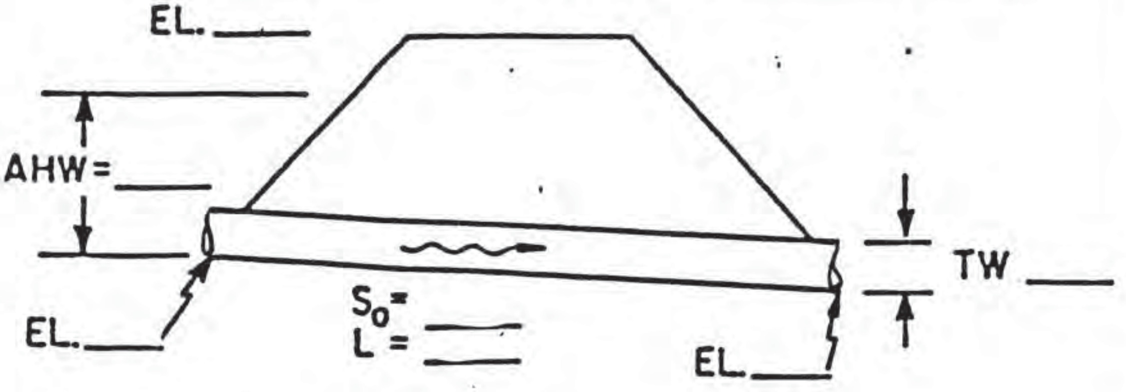
STATION : CULVERT # 5



MAX. STREAM FLOW= 323

SKETCH

STATION : ____



MAX. STREAM FLOW= ____

PROJECT: DPC POO

DESIGNER: BJK

DATE: 9/2000

HYDROLOGIC AND CHANNEL INFORMATION

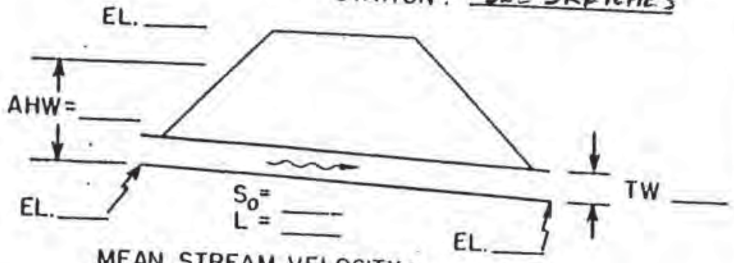
Q_1 = SEE SKETCHES TW_1 = ____

Q_2 = ____ TW_2 = ____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : SEE SKETCHES



MEAN STREAM VELOCITY = ____

MAX. STREAM VELOCITY = ____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
			INLET CONT.		OUTLET CONTROL $HW=H+h_o-LS_o$											
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW				
CULVERT #1 CMP	162 EA	2 - 60"	1.2	6'												Not Rec.
CULVERT #1 BOX CULVERT	323 46/ft	7' x 4'	~~1.45~~ 1.95	~~5.8~~ 7.8	0.4	3.8'	4.0'	4.0'	1.7'	4.0	6.5'	1.3	~~5.8~~ 7.8			Recommended
CULVERT #2 BOX CULVERT	323 46/ft	7' x 4'	~~1.45~~ 1.95	~~5.8'~~ 7.8	0.4	3.8	4.0'	4.0'	1.7	4.0	10'	—	~~5.8~~ 7.8			Recommended
CULVERT #3 CMP	15	24"	1.15	2.3'	0.5	2.8'	1.4	1.7	7.3'	7.3'	6'	4.1				Not Rec.
CULVERT #3 CMP	15	30"	0.77	1.9	0.5	0.8	1.3	1.9	7.3'	7.3'	6'	2.1				Recommended

SUMMARY & RECOMMENDATIONS:

ACTUAL LENGTHS OF CULVERTS #1 & 2 = 96' and 126' RESPECTIVELY
BASED ON 6' CULVERT SECTION LENGTHS

Figure 7

PROJECT: DPC - POO

DESIGNER: BJK

DATE: 9/2000

HYDROLOGIC AND CHANNEL INFORMATION

Q_1 = SEE SKETCHES

Q_2 = ______

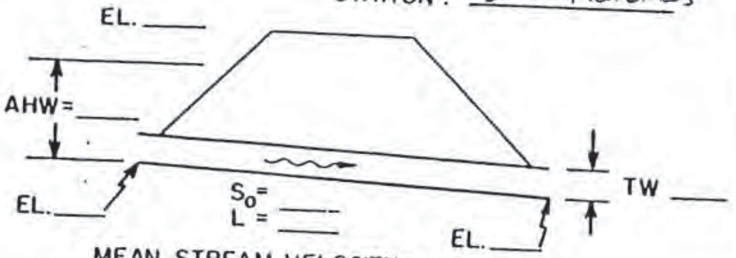
TW_1 = ______

TW_2 = ______

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : SEE SKETCHES



MEAN STREAM VELOCITY = ______

MAX. STREAM VELOCITY = ______

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
			INLET CONT.		OUTLET CONTROL HW=H + h_o − LS_o											
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW				
CULVERT #4 CMP	15	30"	0.77	1.9'	0.5	0.7	1.3	1.9	1.0	1.9	7'	—	1.9'			Recommended
CULVERT # 5 BOX CULVERT	323 46/ft	7'x 4'	~~1.45~~ 1.95	~~5.8~~ 7.8	0.4	3.8	4.0	4.0	1.7	4.0	4'	3.8	~~5.8~~ 7.8			Recommended

SUMMARY & RECOMMENDATIONS:

Figure 7

TABLE 1 - ENTRANCE LOSS COEFFICIENTS

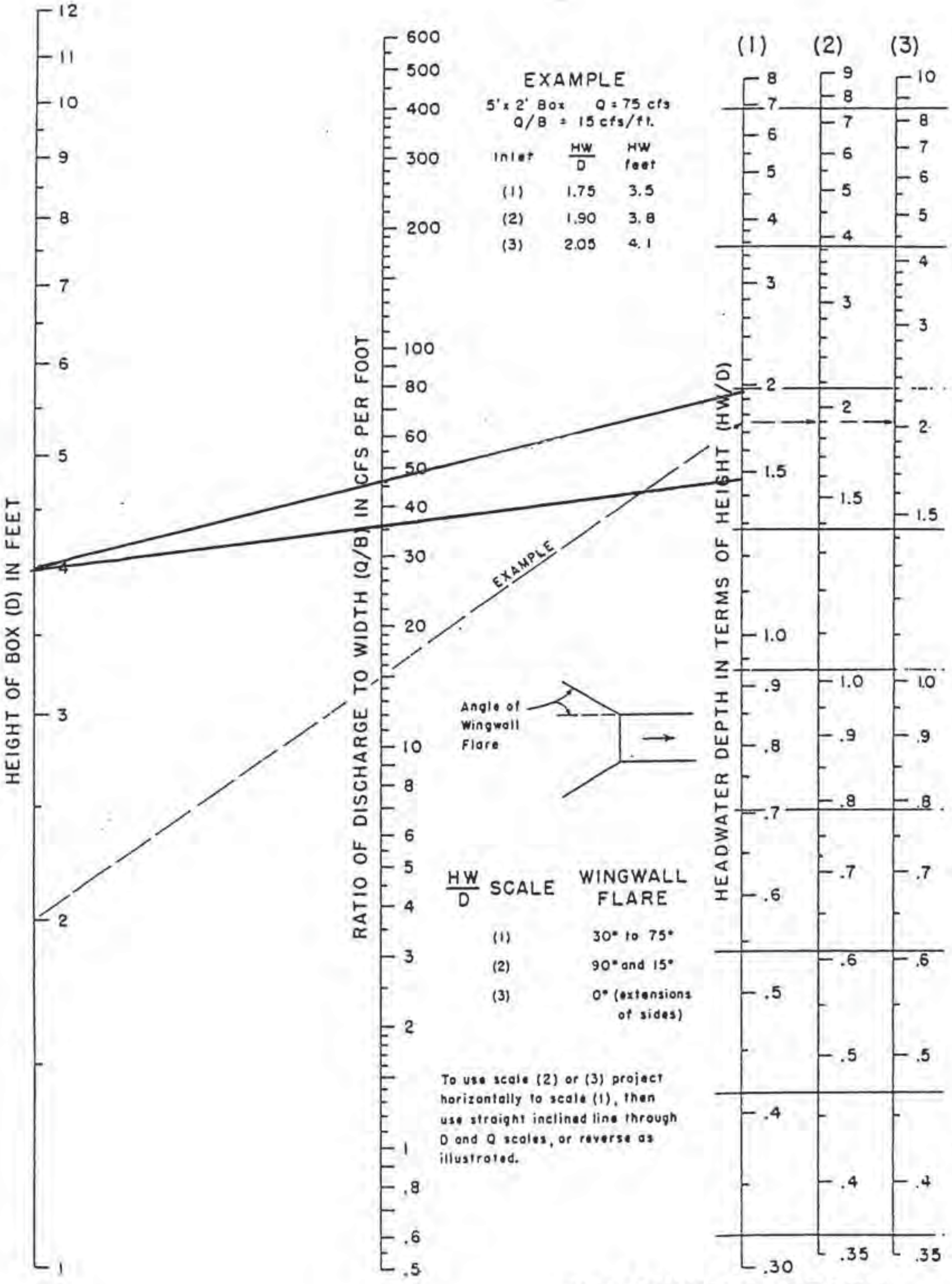
Outlet Control, Full or Partly Full

Entrance head loss $H_e = k_e \frac{V^2}{2g}$

Type of Structure and Design of Entrance	Coefficient k_e
Pipe, Concrete	
Projecting from fill, socket end (groove-end)	0.2
Projecting from fill, sq. cut end	0.5
Headwall or headwall and wingwalls	
Socket end of pipe (groove-end)	0.2
Square-edge	0.5
Rounded (radius = 1/12D)	0.2
Mitered to conform to fill slope	0.7
*End-Section conforming to fill slope	0.5
Beveled edges, 33.7° or 45° bevels	0.2
Side-or slope-tapered inlet	0.2
Pipe, or Pipe-Arch, Corrugated Metal	
Projecting from fill (no headwall)	0.9
Headwall or headwall and wingwalls square-edge	0.5
Mitered to conform to fill slope, paved or unpaved slope	0.7
*End-Section conforming to fill slope	0.5 ← CULVERTS 3,4
Beveled edges, 33.7° or 45° bevels	0.2
Side-or slope-tapered inlet	0.2
Box, Reinforced Concrete	
Headwall parallel to embankment (no wingwalls)	
Square-edged on 3 edges	0.5
Rounded on 3 edges to radius of 1/12 barrel dimension, or beveled edges on 3 sides	0.2
Wingwalls at 30° to 75° to barrel	
Square-edged at crown	0.4 ← CULVERTS 1,2
Crown edge rounded to radius of 1/12 barrel dimension, or beveled top edge	0.2
Wingwall at 10° to 25° to barrel	
Square-edged at crown	0.5
Wingwalls parallel (extension of sides)	
Square-edged at crown	0.7
Side-or slope-tapered inlet	0.2

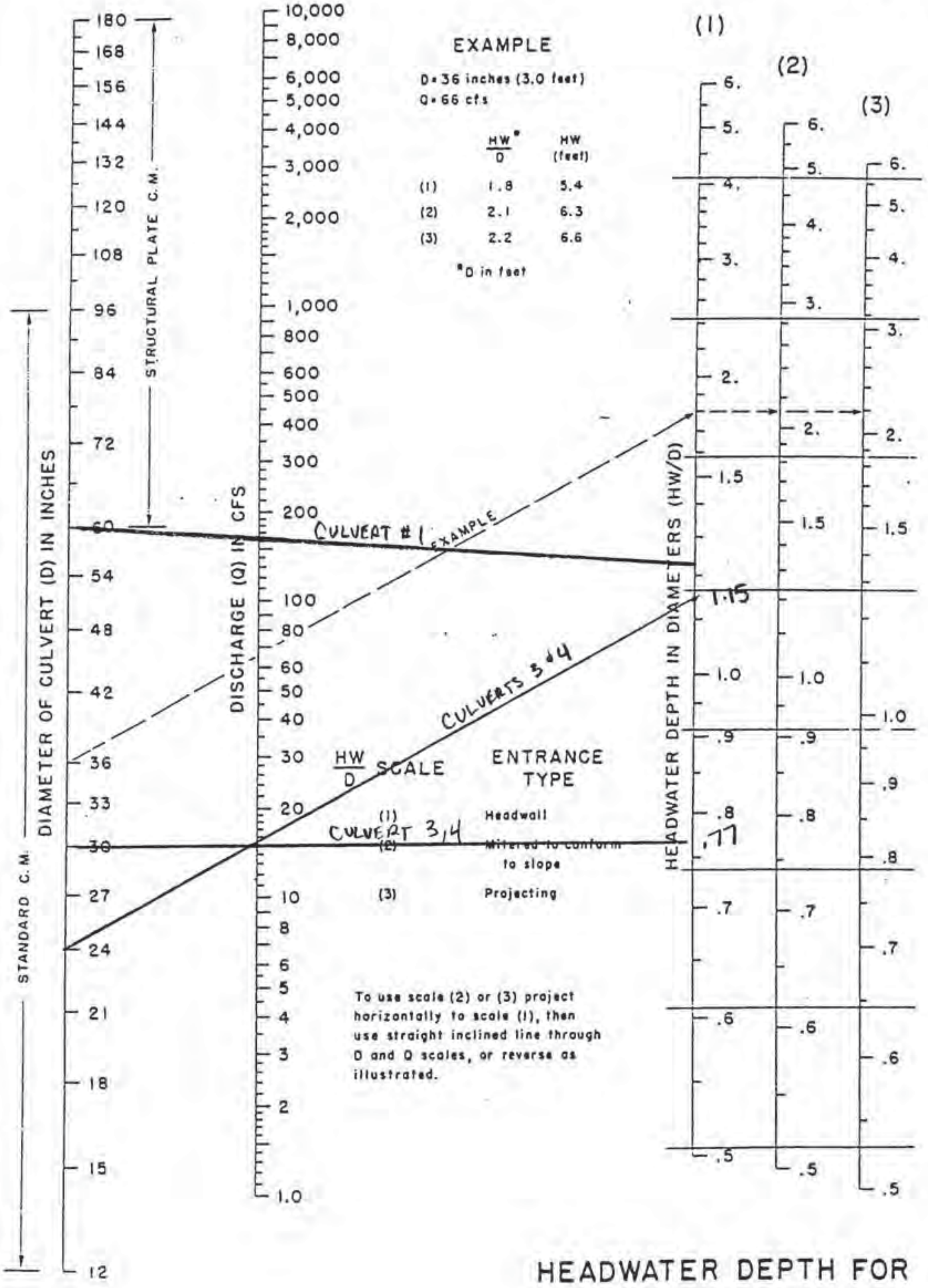
*Note: "End Section conforming to fill slope," made of either metal or concrete, are the sections commonly available from manufacturers. From limited hydraulic tests they are equivalent in operation to a headwall in both inlet and outlet control. Some end sections, incorporating a closed taper in their design have a superior hydraulic performance. These latter sections can be designed using the information given for the beveled inlet, p. 5-13.

CHART I



HEADWATER DEPTH
FOR BOX CULVERTS
WITH INLET CONTROL

CHART 5



EXAMPLE

D = 36 inches (3.0 feet)
Q = 66 cfs

	$\frac{HW^*}{D}$	HW (feet)
(1)	1.8	5.4
(2)	2.1	6.3
(3)	2.2	6.6

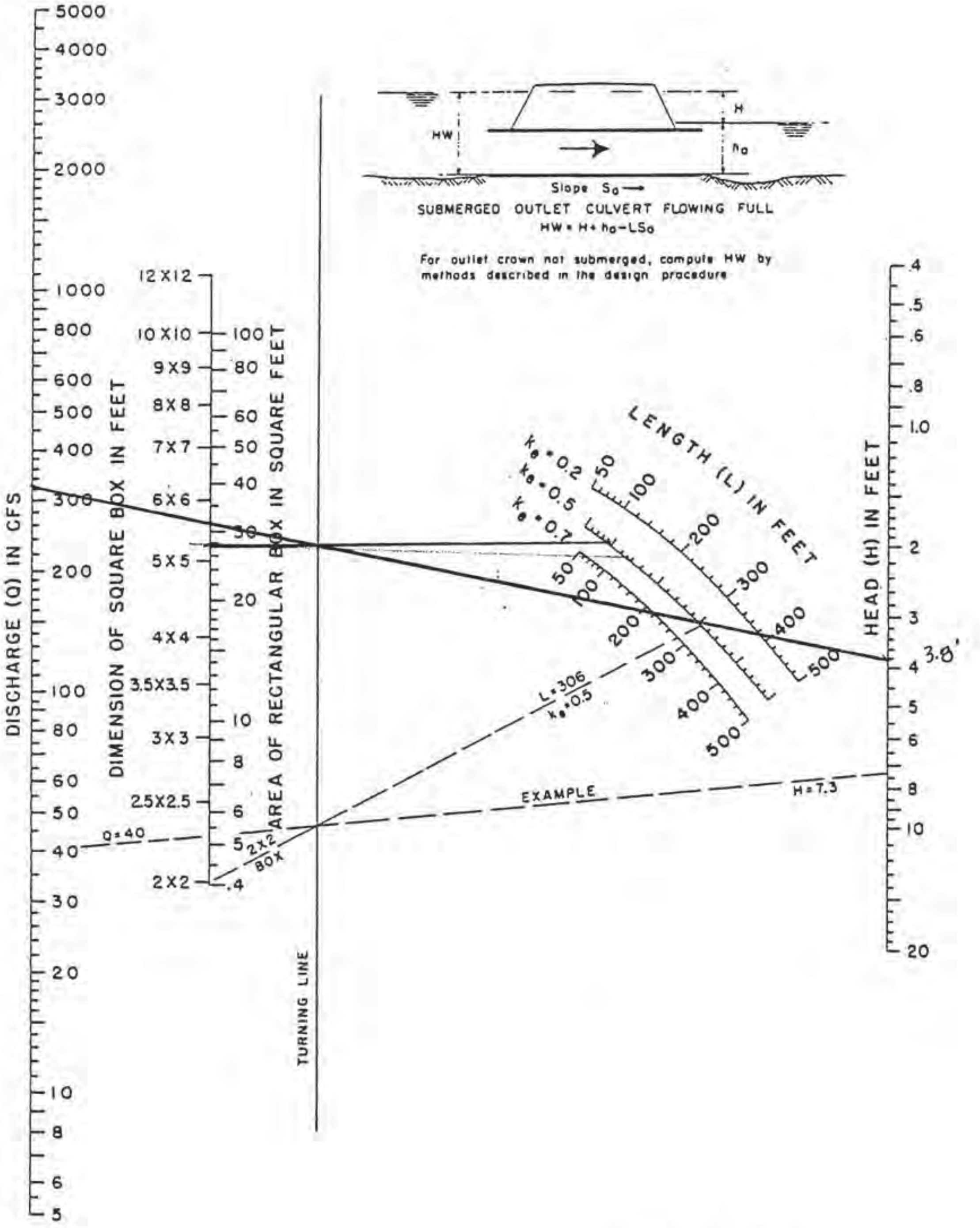
*D in feet

$\frac{HW}{D}$ SCALE	ENTRANCE TYPE
(1)	Headwall
(2)	Mitered to conform to slope
(3)	Projecting

To use scale (2) or (3) project horizontally to scale (1), then use straight inclined line through D and Q scales, or reverse as illustrated.

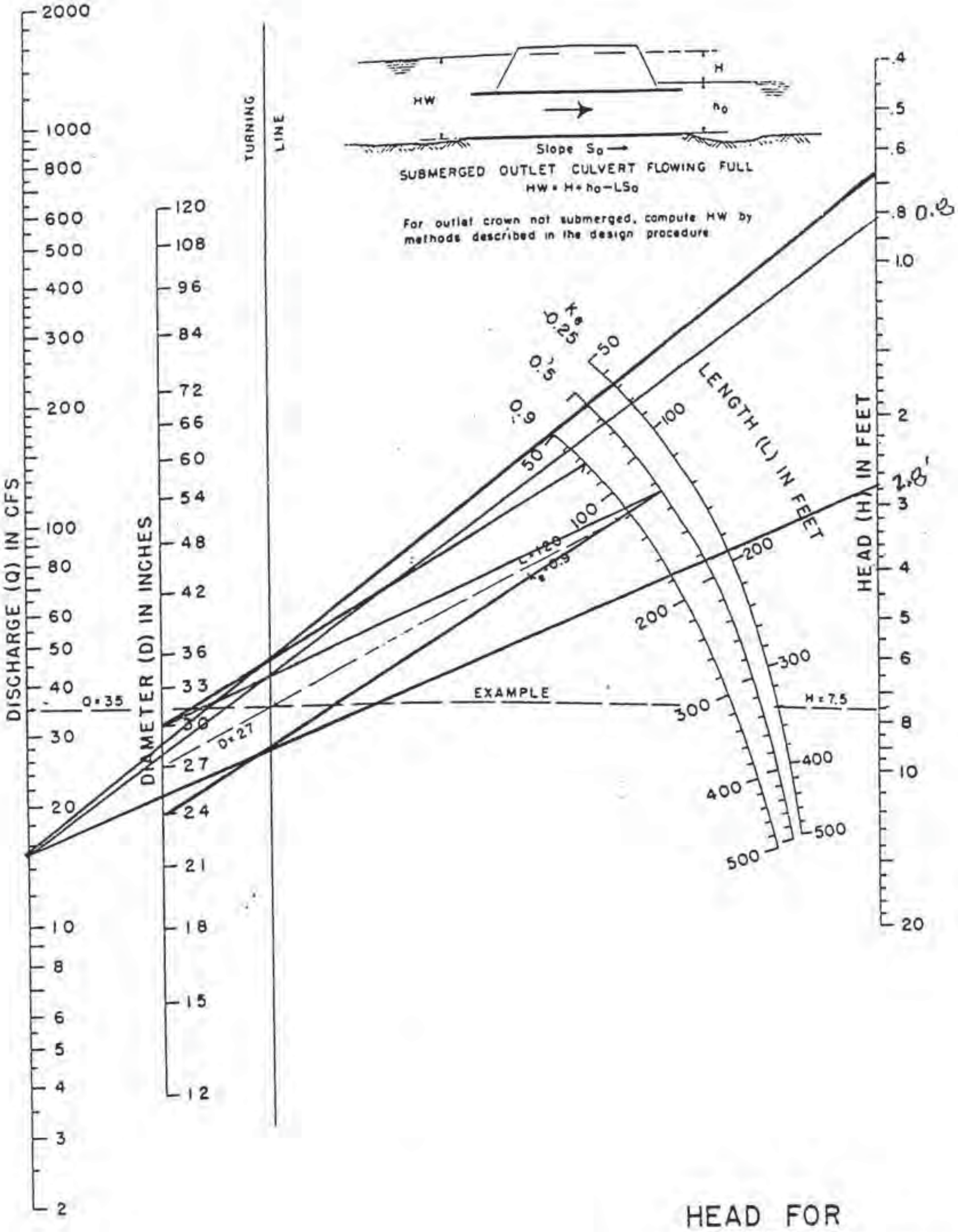
HEADWATER DEPTH FOR
C. M. PIPE CULVERTS
WITH INLET CONTROL

CHART 8



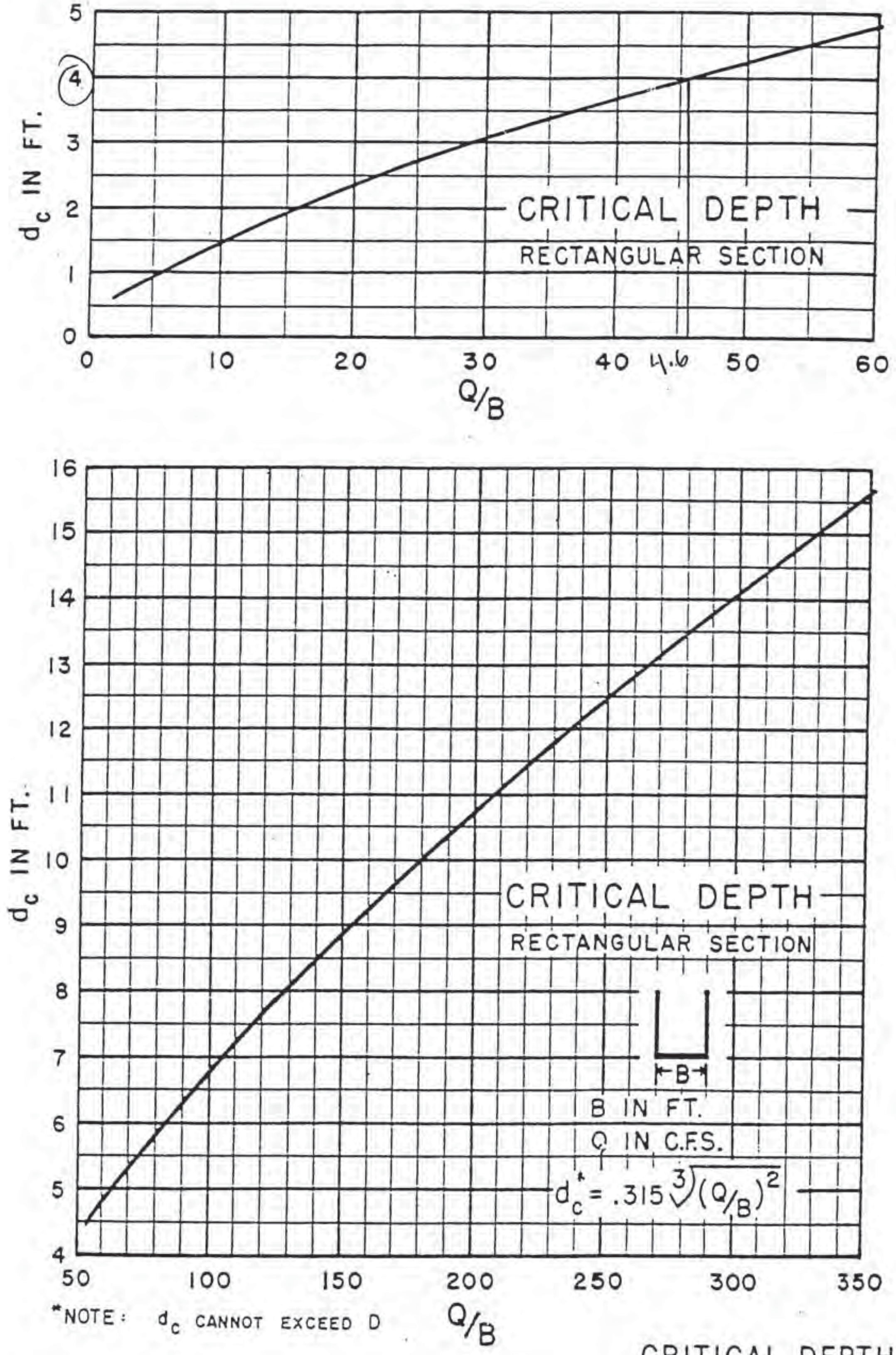
HEAD FOR CONCRETE BOX CULVERTS FLOWING FULL n = 0.012

CHART 11



HEAD FOR STANDARD C. M. PIPE CULVERTS FLOWING FULL n = 0.024

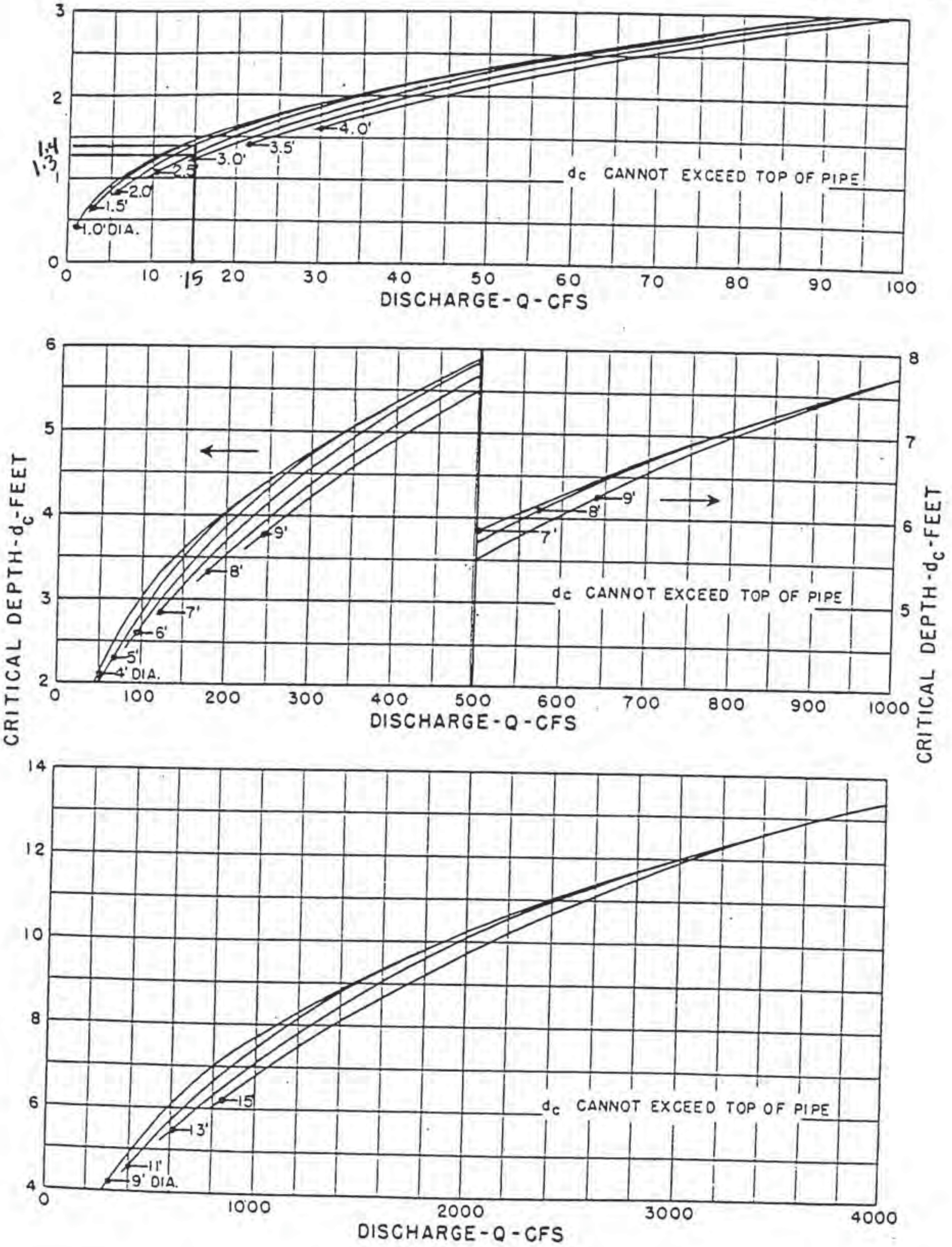
Chart 15



*NOTE: d_c CANNOT EXCEED D

CRITICAL DEPTH
RECTANGULAR SECTION

CHART 16

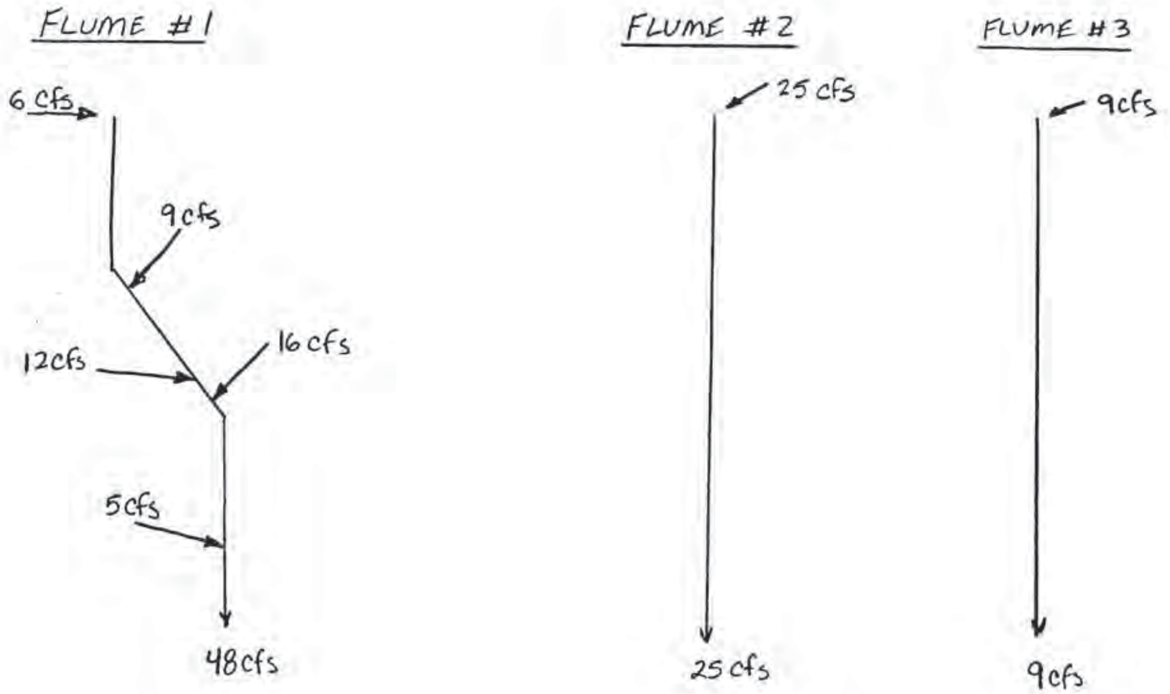


CRITICAL DEPTH
CIRCULAR PIPE

PROJECT / PROPOSAL NAME / LOCATION: DAIRYLAND POWER - POO		PROJECT / PROPOSAL NO.
SUBJECT: FLUME SIZING		3081.40
PREPARED BY: B.J.K	DATE: 9/00	FINAL ☐
CHECKED BY:	DATE:	REVISION ☐

DOWNSLOPE FLUME SIZING

1. SIZE INLET PIPES

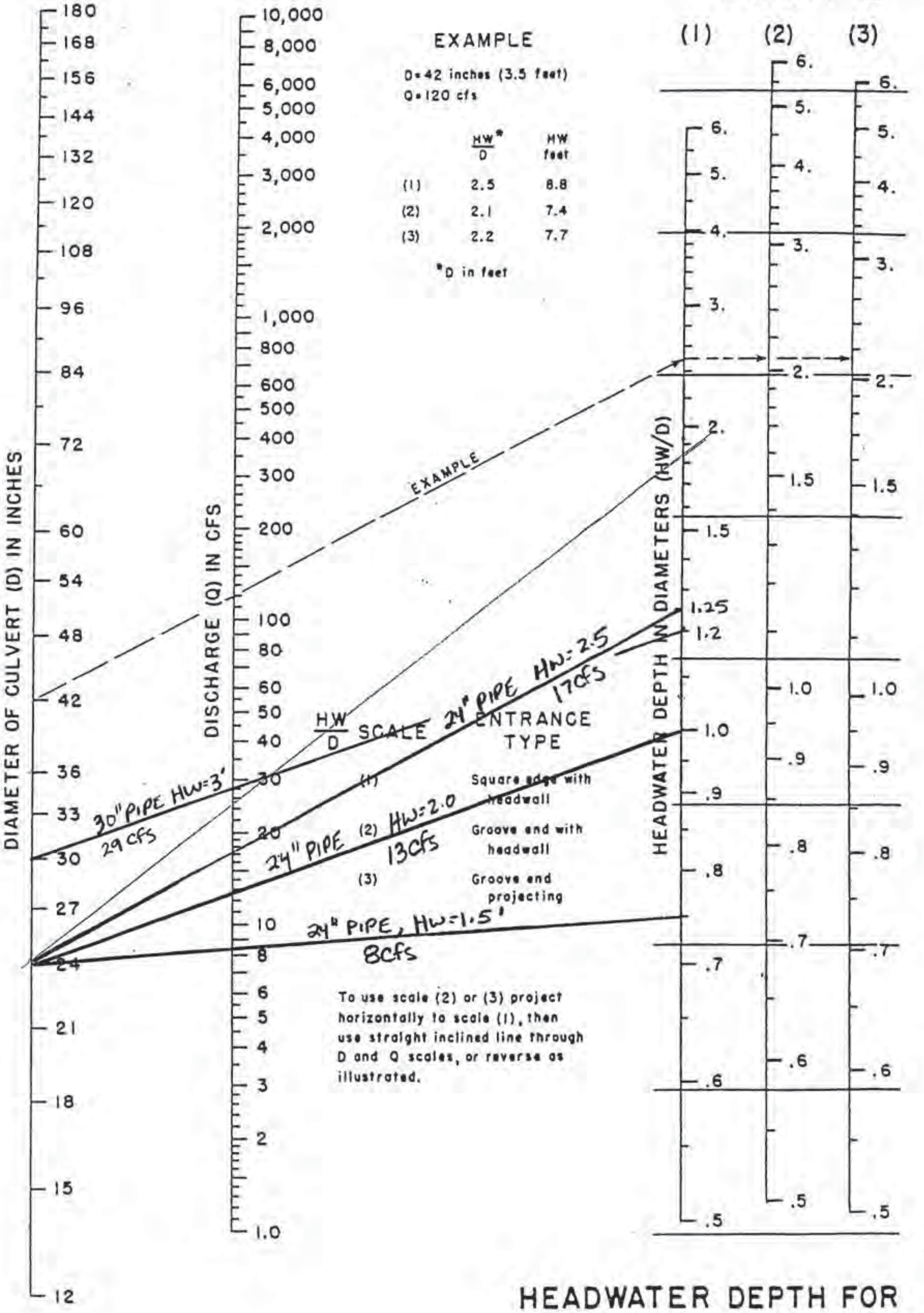


NOTE: PEAK FLOWS OBTAINED FROM RUNOFF CALCULATIONS
PEAK FLOWS ADDED TO OBTAIN TOTALS (CONSERVATIVE)

ESTABLISH INLET PIPE SIZES AND BERM HEIGHTS USING INLET CONTROL NOMOGRAPHS:

FLOW RANGE	INLET PIPE SIZE	HW	REQ'D BERM HEIGHT
0-8 cfs	24"	1.5'	2.5'
9-13 cfs	24"	2.0'	2.5'
14-17 cfs	24"	2.5'	3.0'
18-29 cfs	30"	3.0'	3.5'

CHART 2



EXAMPLE

D=42 inches (3.5 feet)
Q=120 cfs

	HW*/D	HW feet
(1)	2.5	8.8
(2)	2.1	7.4
(3)	2.2	7.7

*D in feet

SCALE	ENTRANCE TYPE
(1)	Square edge with headwall
(2)	Groove end with headwall
(3)	Groove end projecting

To use scale (2) or (3) project horizontally to scale (1), then use straight inclined line through D and Q scales, or reverse as illustrated.

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

PROJECT / PROPOSAL NAME / LOCATION: DAIRYLAND POWER - POO		PROJECT / PROPOSAL NO. 308140
SUBJECT: FLUME SIZING		
PREPARED BY: BJK	DATE: 9/00	FINAL ☐
CHECKED BY:	DATE:	REVISION ☐

CHECK STRAIGHT PIPE FLUME SIZING

WORST-CASE FLOW - FLUME #1

SLOPE = 20% (AT RIDGE)
PIPE DIA = 1.5'
MAX FLOW = 48 cfs

FULL PIPE FLOW:

$$Q = \frac{1.49}{n} R^{2/3} S^{1/2} A$$

n = 0.010 for HDPE PIPE
$R = D/4 = 1.5/4 = 0.375$
$S = 0.20$ ft/ft
$A = \pi D^2/4 = \pi (1.5)^2/4 = 1.77 \text{ ft}^2$

$$Q_{FULL} = \frac{1.49}{0.01} (0.375)^{2/3} (0.20)^{1/2} (1.77)$$

$$= 61 \text{ cfs} > 48 \text{ cfs}$$ ok ✓

A WATER RESOURCES TECHNICAL PUBLICATION

Engineering Monograph No. 25

Hydraulic Design of Stilling Basins and Energy Dissipators

By A. J. PETERKA

Denver, Colorado

March 3, 1849

United States Department of the Interior

BUREAU OF RECLAMATION

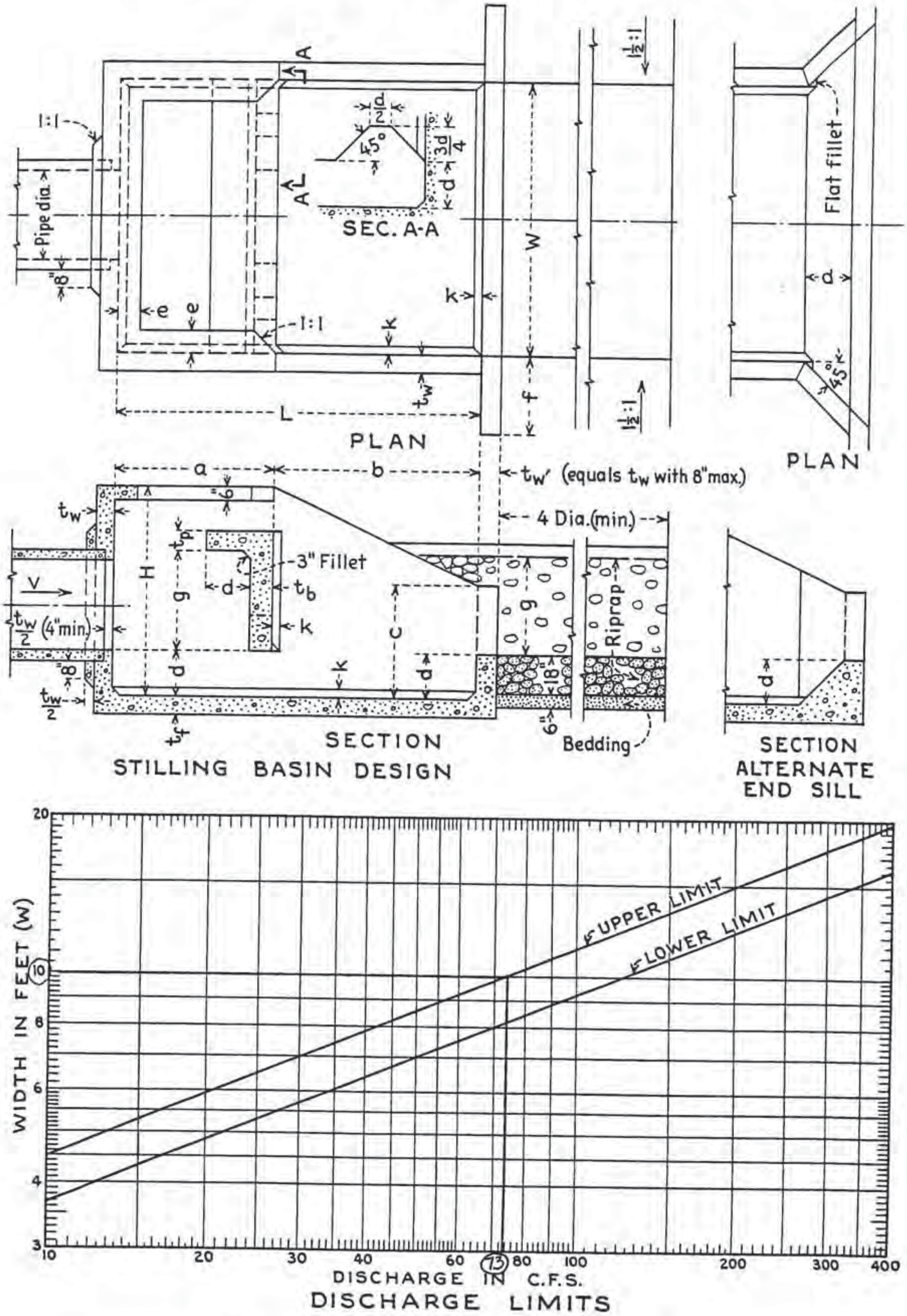


FIGURE 42.—*Impact-type energy dissipator (Basin VI).*

TABLE 11.—*Stilling basin dimensions (Basin VI). Impact-type energy dissipator.*

Suggested pipe size [1]		Max discharge Q	Feet and inches										Inches					
Dia in. (1)	Area (sq ft) (2)	(3)	W (4)	H (5)	L (6)	a (7)	b (8)	c (9)	d (10)	e (11)	f (12)	g (13)	t_w (14)	t_f (15)	t_b (16)	t_p (17)	K (18)	Suggested riprap size (19) [3]
18	1. 77	[2] 21	5–6	4–3	7–4	3–3	4–1	2–4	0–11	0–6	1–6	2–1	6	6½	6	6	3	4. 0
24	3. 14	38	6–9	5–3	9–0	3–11	5–1	2–10	1–2	0–6	2–0	2–6	6	6½	6	6	3	7. 0
30	4. 91	59	8–0	6–3	10–8	4–7	6–1	3–4	1–4	0–8	2–6	3–0	6	6½	7	7	3	8. 5
73cfs → 36	7. 07	85	9–3	7–3	12–4	5–3	7–1	3–10	1–7	0–8	3–0	3–6	7	7½	8	8	3	9. 0
42	9. 62	115	10–6	8–0	14–0	6–0	8–0	4–5	1–9	0–10	3–0	3–11	8	8½	9	8	4	9. 5
48	12. 57	151	11–9	9–0	15–8	6–9	8–11	4–11	2–0	0–10	3–0	4–5	9	9½	10	8	4	10. 5
54	15. 90	191	13–0	9–9	17–4	7–4	10–0	5–5	2–2	1–0	3–0	4–11	10	10½	10	8	4	12. 0
60	19. 63	236	14–3	10–9	19–0	8–0	11–0	5–11	2–5	1–0	3–0	5–4	11	11½	11	8	6	13. 0
72	28. 27	339	16–6	12–3	22–0	9–3	12–9	6–11	2–9	1–3	3–0	6–2	12	12½	12	8	6	14. 0

[1] Suggested pipe will run full when velocity is 12 feet per second or half full when velocity is 24 feet per second. Size may be modified for other velocities by Q=AV, but relation between Q and basin dimensions shown must be maintained.

[2] For discharges less than 21 second-feet, obtain basin width from curve of Fig. 42. Other dimensions proportional to W; $H=\frac{3W}{4}$, $L=\frac{4W}{3}$, $d=\frac{W}{6}$, etc.

[3] Determination of riprap size explained in Sec. 10.

Calculations – Temporary Culverts, Operational Conditions

COMPUTATION SHEET

RMT INC.

744 Heartland Trail P.O. Box 8923 Madison, WI 53708-8923 (608) 831-4444 FAX: (608) 831-3334

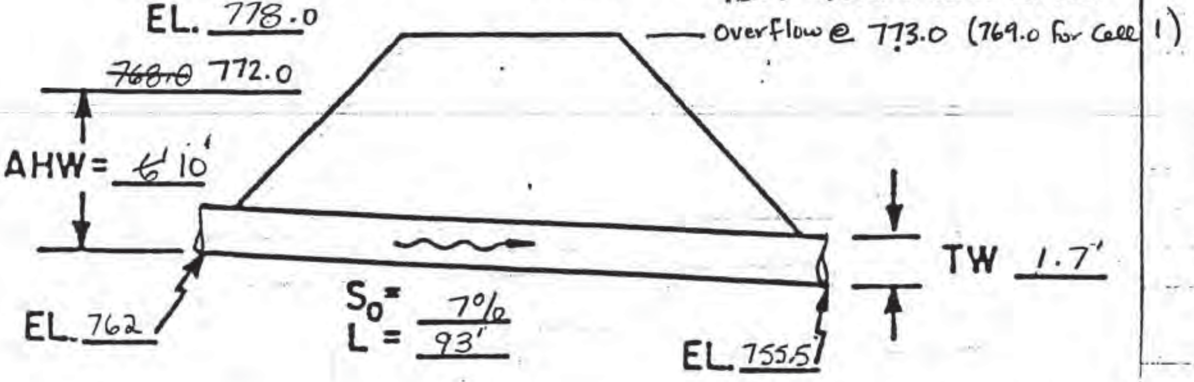
SHEET ____ OF ____

PROJECT / PROPOSAL NAME	PREPARED		CHECKED		PROJECT/PROPOSAL NO.
DPC - PLAN OF OPERATION	By: BJK	Date: 9/00	By:	Date:	3081.40

REV BJK 7/03

SKETCH

STATION : CULVERT # 1
TEMP - DURING CELL 2A & 2B



MAX. STREAM FLOW = ~~323 CFS~~ 355 CFS (25 yr)
561 CFS (100 yr)

Flows for Areas North + West - See Pages 92 & 96
From POO Apx K

Culvert Calculator Report
Culvert 1 - Operational (25-Year)

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	773.00 ft	Headwater Depth/ Height	1.94
Computed Headwater Elevation	769.75 ft	Discharge	355.00 cfs
Inlet Control HW Elev	769.18 ft	Tailwater Elevation	757.20 ft
Outlet Control HW Elev	769.75 ft	Control Type	Entrance Control

Grades

Upstream Invert	762.00 ft	Downstream Invert	755.50 ft
Length	93.00 ft	Constructed Slope	0.069892 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	2.10 ft
Slope Type	Steep	Normal Depth	1.58 ft
Flow Regime	Supercritical	Critical Depth	4.00 ft
Velocity Downstream	24.17 ft/s	Critical Slope	0.008921 ft/ft

Section

Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	7.00 ft
Section Size	7 x 4 ft	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev	769.75 ft	Upstream Velocity Head	2.50 ft
Ke	0.50	Entrance Loss	1.25 ft

Inlet Control Properties

Inlet Control HW Elev	769.18 ft	Flow Control	Submerged
Inlet Type	18 to 33.7 ° wingwall flare, d=0.0830	Area Full	28.0 ft^2
K	0.48600	HDS 5 Chart	9
M	0.66700	HDS 5 Scale	2
C	0.02490	Equation Form	2
Y	0.83000		

Culvert Calculator Report
Culvert 1 - Operational (100-Year)

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	773.00 ft	Headwater Depth/ Height	3.34
Computed Headwater Elevation	775.36 ft	Discharge	561.00 cfs
Inlet Control HW Elev	775.18 ft	Tailwater Elevation	757.20 ft
Outlet Control HW Elev	775.36 ft	Control Type	Entrance Control

Grades

Upstream Invert	762.00 ft	Downstream Invert	755.50 ft
Length	93.00 ft	Constructed Slope	0.069892 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	2.93 ft
Slope Type	Steep	Normal Depth	2.18 ft
Flow Regime	Supercritical	Critical Depth	4.00 ft
Velocity Downstream	27.37 ft/s	Critical Slope	0.022277 ft/ft

Section

Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	7.00 ft
Section Size	7 x 4 ft	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev	775.36 ft	Upstream Velocity Head	6.24 ft
Ke	0.50	Entrance Loss	3.12 ft

Inlet Control Properties

Inlet Control HW Elev	775.18 ft	Flow Control	Submerged
Inlet Type	18 to 33.7 ° wingwall flare, d=0.0830	Area Full	28.0 ft²
K	0.48600	HDS 5 Chart	9
M	0.66700	HDS 5 Scale	2
C	0.02490	Equation Form	2
Y	0.83000		

COMPUTATION SHEET

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SHEET ________ OF ________

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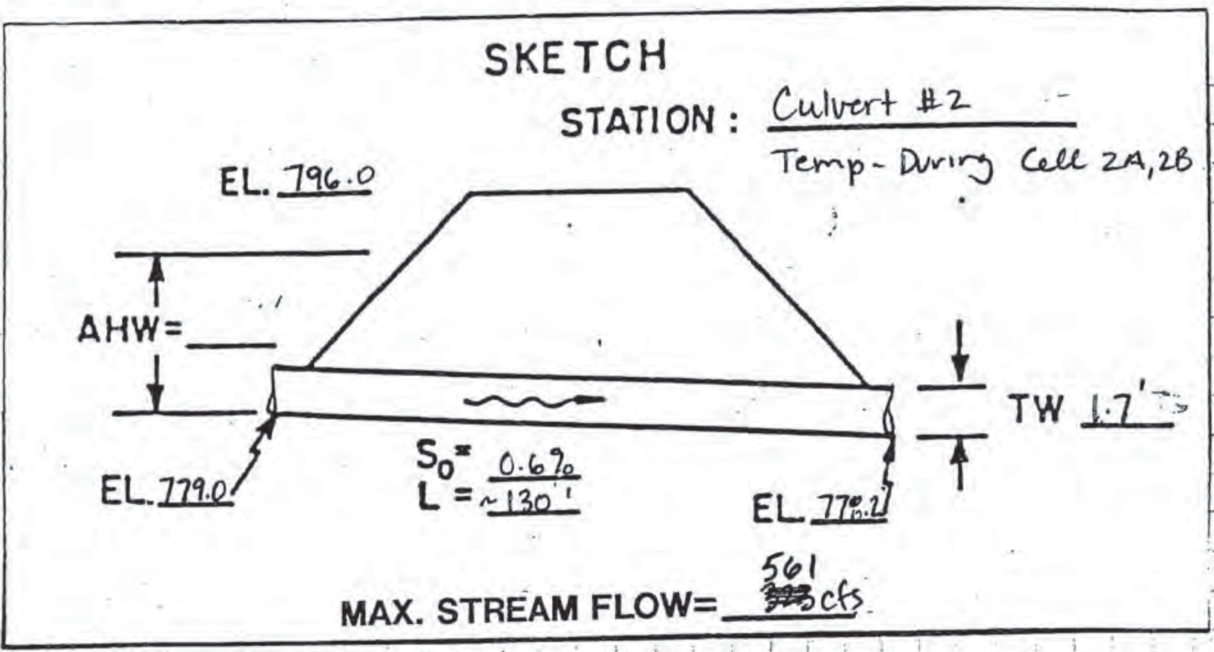
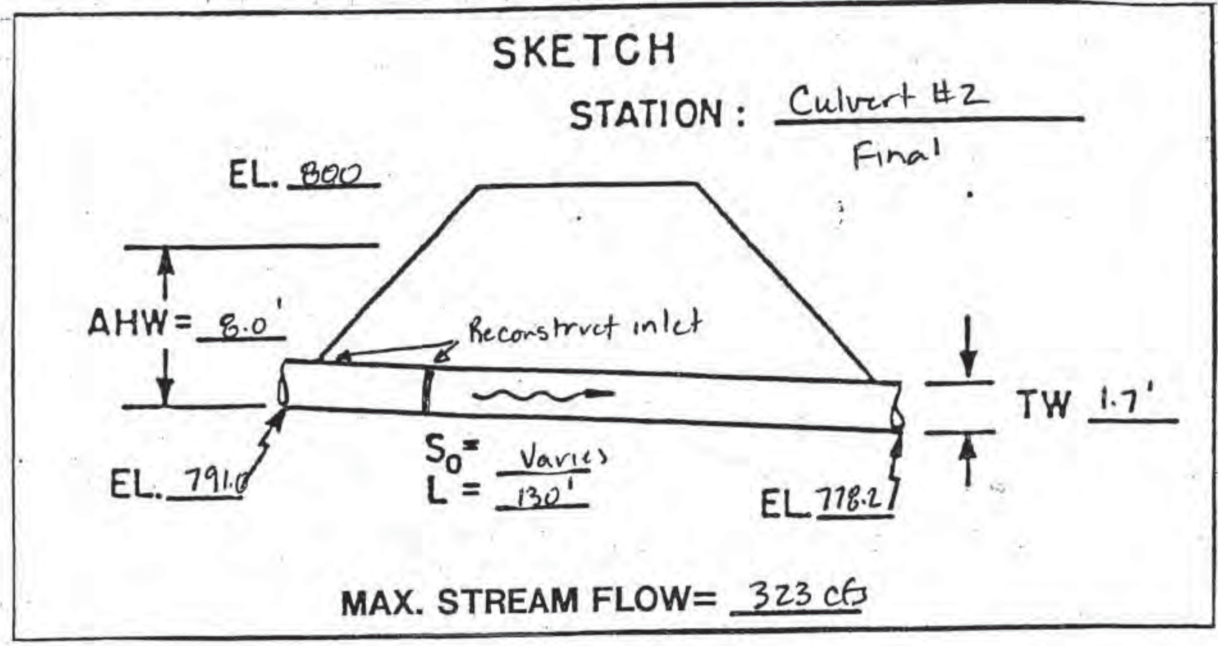
PROJECT / PROPOSAL NAME	PREPARED		CHECKED		PROJECT/PROPOSAL NO.
Dairyland Power - Phase IV	By: BJH	Date: 7/03	By:	Date:	3081.56





Culvert Calculator Report
Culvert 2 - Operational

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	796.00 ft	Headwater Depth/ Height	3.86
Computed Headwater Elevation	794.45 ft	Discharge	561.00 cfs
Inlet Control HW Elev	792.30 ft	Tailwater Elevation	779.90 ft
Outlet Control HW Elev	794.45 ft	Control Type	Outlet Control

Grades			
Upstream Invert	779.00 ft	Downstream Invert	778.20 ft
Length	130.00 ft	Constructed Slope	0.006154 ft/ft

Hydraulic Profile			
Profile	Pressure	Depth, Downstream	4.00 ft
Slope Type	N/A	Normal Depth	N/A ft
Flow Regime	N/A	Critical Depth	4.00 ft
Velocity Downstream	20.04 ft/s	Critical Slope	0.022277 ft/ft

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	7.00 ft
Section Size	7 x 4 ft	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	794.45 ft	Upstream Velocity Head	6.24 ft
Ke	0.50	Entrance Loss	3.12 ft

Inlet Control Properties			
Inlet Control HW Elev	792.30 ft	Flow Control	Submerged
Inlet Type	18 to 33.7 ° wingwall flare, d=0.0830	Area Full	28.0 ft²
K	0.48600	HDS 5 Chart	9
M	0.66700	HDS 5 Scale	2
C	0.02490	Equation Form	2
Y	0.83000		

Culvert Calculator Report
Culvert 2 - Final

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	799.00 ft	Headwater Depth/ Height	1.78
Computed Headwater Elevation	798.10 ft	Discharge	323.00 cfs
Inlet Control HW Elev	797.44 ft	Tailwater Elevation	779.90 ft
Outlet Control HW Elev	798.10 ft	Control Type	Entrance Control

Grades

Upstream Invert	791.00 ft	Downstream Invert	778.20 ft
Length	130.00 ft	Constructed Slope	0.098462 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	1.60 ft
Slope Type	Steep	Normal Depth	1.32 ft
Flow Regime	Supercritical	Critical Depth	4.00 ft
Velocity Downstream	28.87 ft/s	Critical Slope	0.007385 ft/ft

Section

Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	7.00 ft
Section Size	7 x 4 ft	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev	798.10 ft	Upstream Velocity Head	2.07 ft
Ke	0.50	Entrance Loss	1.03 ft

Inlet Control Properties

Inlet Control HW Elev	797.44 ft	Flow Control	Submerged
Inlet Type	18 to 33.7 ° wingwall flare, d=0.0830	Area Full	28.0 ft²
K	0.48600	HDS 5 Chart	9
M	0.66700	HDS 5 Scale	2
C	0.02490	Equation Form	2
Y	0.83000		

COMPUTATION SHEET

RMT INC.

744 Heartland Trail P.O. Box 8923 Madison, WI 53708-8923 (608) 831-4444 FAX: (608) 831-3334

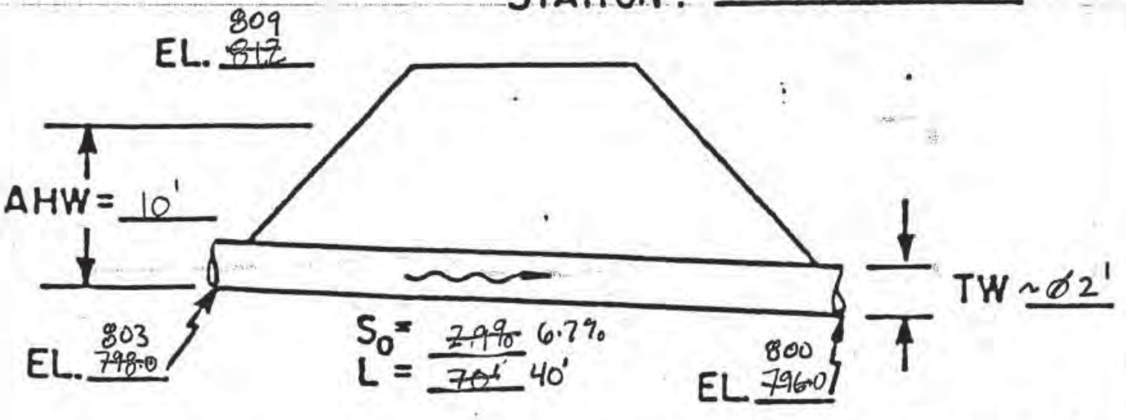
SHEET ____ OF ____

PROJECT / PROPOSAL NAME	PREPARED By:	PREPARED Date:	CHECKED By:	CHECKED Date:	PROJECT/PROPOSAL NO.
DPC - PLAN OF OPERATION	KAA	9/29/00			3081.4C

Rev BJK 8/03

SKETCH

STATION: CULVERT D



MAX. STREAM FLOW = ~~583 cfs~~ 228 CFS (25-YR) 360 CFS (100-YR)

Culvert Calculator Report
Culvert D - 25 Year

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	809.00 ft	Headwater Depth/ Height	1.40
Computed Headwater Elevation	808.61 ft	Discharge	228.00 cfs
Inlet Control HW Elev	807.84 ft	Tailwater Elevation	802.00 ft
Outlet Control HW Elev	808.61 ft	Control Type	Entrance Control

Grades

Upstream Invert	803.00 ft	Downstream Invert	800.00 ft
Length	45.00 ft	Constructed Slope	0.066667 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	1.74 ft
Slope Type	Steep	Normal Depth	1.19 ft
Flow Regime	Supercritical	Critical Depth	3.21 ft
Velocity Downstream	18.70 ft/s	Critical Slope	0.003975 ft/ft

Section

Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	7.00 ft
Section Size	7 x 4 ft	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev	808.61 ft	Upstream Velocity Head	1.60 ft
Ke	0.50	Entrance Loss	0.80 ft

Inlet Control Properties

Inlet Control HW Elev	807.84 ft	Flow Control	Submerged
Inlet Type	18 to 33.7 ° wingwall flare, d=0.0830	Area Full	28.0 ft²
K	0.48600	HDS 5 Chart	9
M	0.66700	HDS 5 Scale	2
C	0.02490	Equation Form	2
Y	0.83000		

Culvert Calculator Report
Culvert D - 100 Year

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	809.00 ft	Headwater Depth/ Height	1.96
Computed Headwater Elevation	810.85 ft	Discharge	360.00 cfs
Inlet Control HW Elev	810.30 ft	Tailwater Elevation	802.00 ft
Outlet Control HW Elev	810.85 ft	Control Type	Entrance Control

Grades

Upstream Invert	803.00 ft	Downstream Invert	800.00 ft
Length	45.00 ft	Constructed Slope	0.066667 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	2.52 ft
Slope Type	Steep	Normal Depth	1.63 ft
Flow Regime	Supercritical	Critical Depth	4.00 ft
Velocity Downstream	20.38 ft/s	Critical Slope	0.009174 ft/ft

Section

Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	7.00 ft
Section Size	7 x 4 ft	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev	810.85 ft	Upstream Velocity Head	2.57 ft
Ke	0.50	Entrance Loss	1.28 ft

Inlet Control Properties

Inlet Control HW Elev	810.30 ft	Flow Control	Submerged
Inlet Type	18 to 33.7 ° wingwall flare, d=0.0830	Area Full	28.0 ft²
K	0.48600	HDS 5 Chart	9
M	0.66700	HDS 5 Scale	2
C	0.02490	Equation Form	2
Y	0.83000		

Culvert Calculator Report
Flume MH

Solve For: Headwater Elevation

Culvert Summary

→ 827.5, adjacent pipe inlet

Allowable HW Elevation	8.00 ft	Headwater Depth/ Height	1.98
Computed Headwater Elevation	825.18 ft	Discharge	73.00 cfs
Inlet Control HW Elev	825.18 ft	Tailwater Elevation	780.67 ft
Outlet Control HW Elev	824.72 ft	Control Type	Inlet Control

Grades

Upstream Invert	819.25 ft	Downstream Invert	779.00 ft
Length	185.00 ft	Constructed Slope	0.217568 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	0.91 ft
Slope Type	Steep	Normal Depth	0.86 ft
Flow Regime	Supercritical	Critical Depth	2.70 ft
Velocity Downstream	40.57 ft/s	Critical Slope	0.006248 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.010
Section Material	PVC	Span	3.00 ft
Section Size	36 inch	Rise	3.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev	824.72 ft	Upstream Velocity Head	1.85 ft
Ke	0.50	Entrance Loss	0.92 ft

Inlet Control Properties

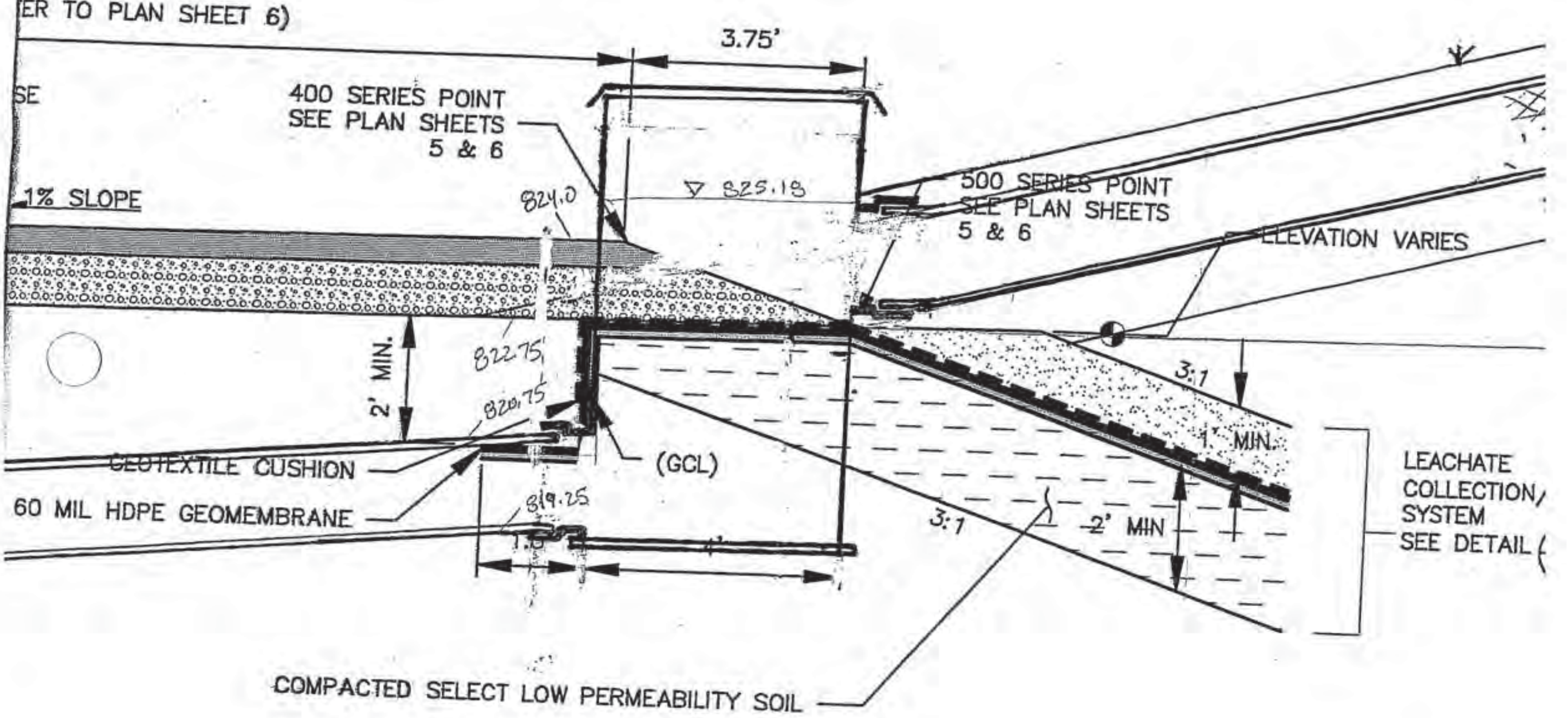
Inlet Control HW Elev	825.18 ft	Flow Control	Submerged
Inlet Type	Square edge w/headwall	Area Full	7.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

B[illegible]d flange
lid add $500

TUCKER SUPPLY
LARRY WOOD
262-255-3030
5/27/03

$65/VF × 7 VF BARREL
PLATE 1"

2,200 - 2,500 (incl. $500 for lid)

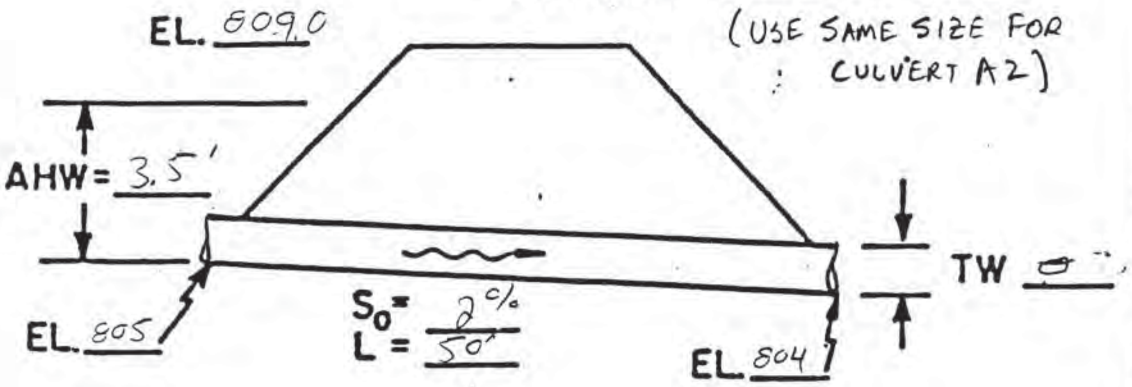


PROJECT / PROPOSAL NAME	PREPARED		CHECKED		PROJECT/PROPOSAL NO.
DPC - PLAN OF OPERATION	By: SAA	Date: 9/29/00	By: BJK	Date:	3CE1.40

SKETCH

STATION : CULVERT A1/A2

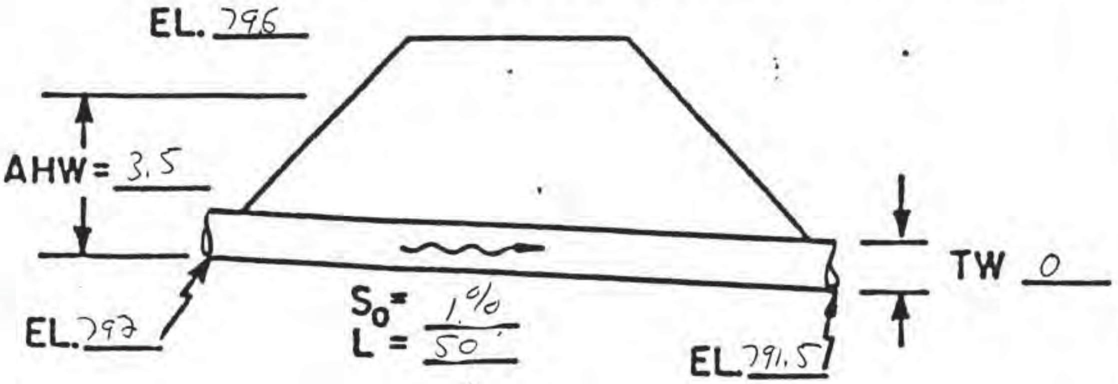
(USE SAME SIZE FOR CULVERT A2)



MAX. STREAM FLOW = 14 cfs.

SKETCH

STATION : CULVERT B



MAX. STREAM FLOW = 11 cfs

COMPUTATION SHEET

RMT INC.

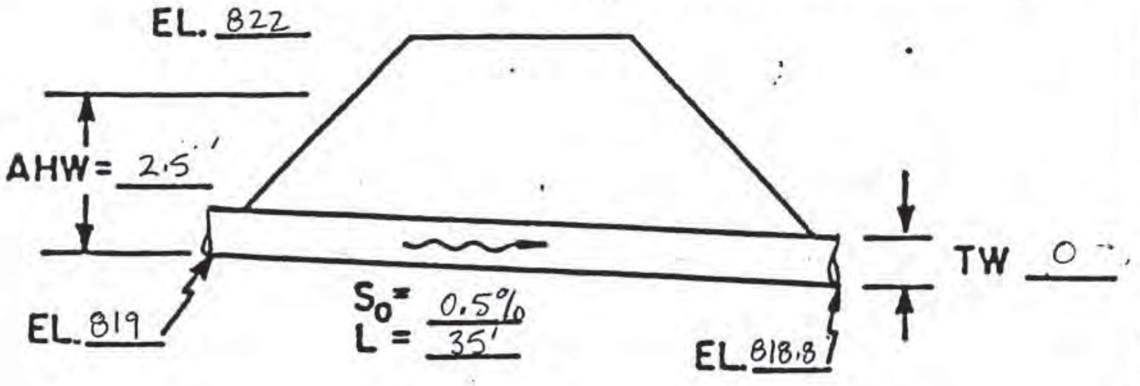
SHEET ______ OF ______

744 Heartland Trail P.O. Box 8923 Madison, WI 53708-8923 (608) 831-4444 FAX: (608) 831-3334

PROJECT / PROPOSAL NAME	PREPARED By:	PREPARED Date:	CHECKED By:	CHECKED Date:	PROJECT/PROPOSAL NO.
DPC- PLAN OF OPERATION	KAA	9/29/00			30E1.4C

SKETCH

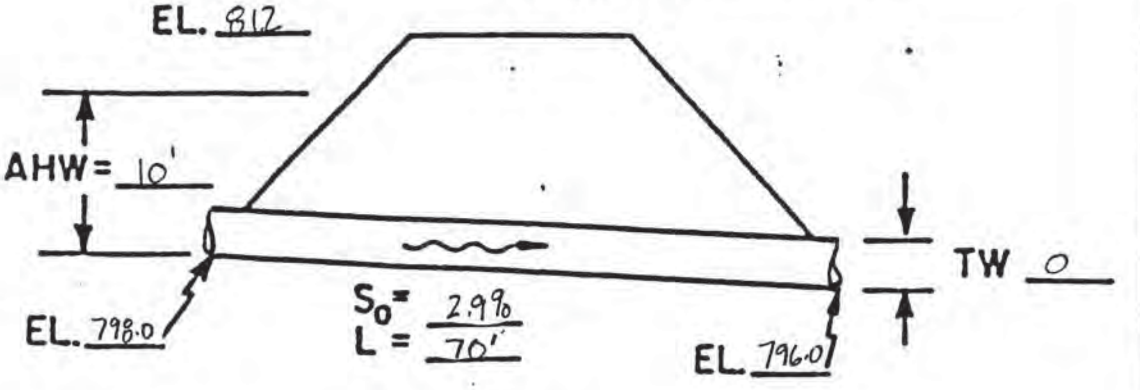
STATION : CULVERT C



MAX. STREAM FLOW= 6 cfs

SKETCH

STATION : CULVERT D



MAX. STREAM FLOW= 583 cfs

COMPUTATION SHEET

RMT INC.

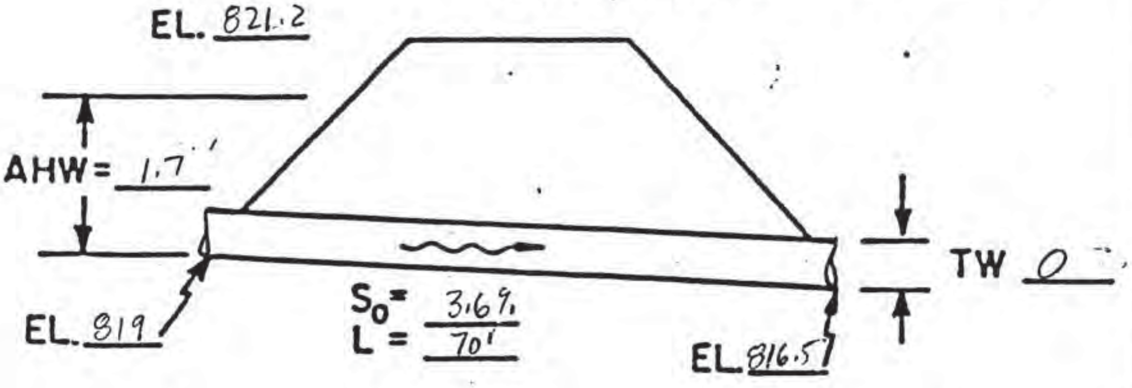
744 Heartland Trail P.O. Box 8923 Madison, WI 53708-8923 (608) 831-4444 FAX: (608) 831-3334

SHEET ______ OF ______

PROJECT / PROPOSAL NAME	PREPARED By:	PREPARED Date:	CHECKED By:	CHECKED Date:	PROJECT/PROPOSAL NO.
DPC - PLAN OF OPERATION	BAA	9/29/00			3C81.4C

SKETCH

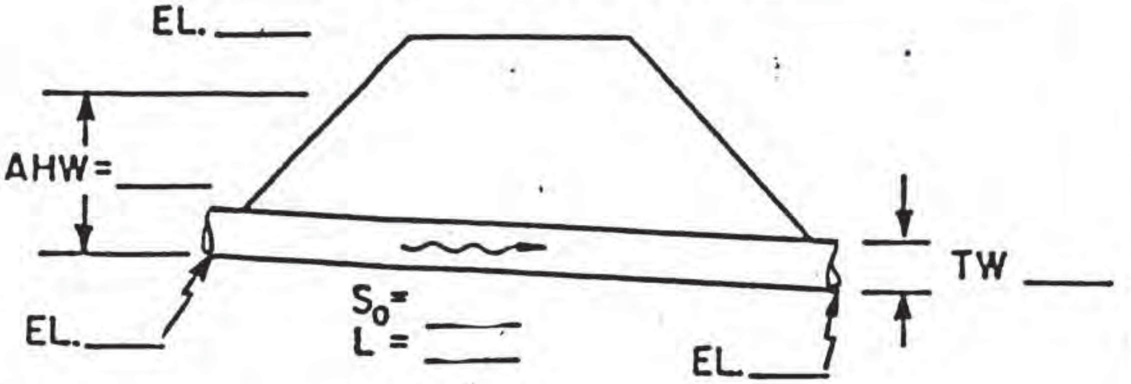
STATION: CULVERT E



MAX. STREAM FLOW = 7 cfs

SKETCH

STATION: ______



MAX. STREAM FLOW = ______

PROJECT: DPC PCO

DESIGNER: BAA

DATE: 9/29/60

HYDROLOGIC AND CHANNEL INFORMATION

Q_1 = SEE SKETCHES

Q_2 = ______

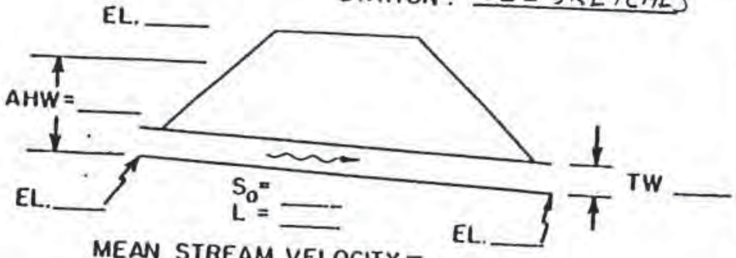
TW_1 = ______

TW_2 = ______

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: SEE SKETCHES



MEAN STREAM VELOCITY = ______

MAX. STREAM VELOCITY = ______

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
			INLET CONT.		OUTLET CONTROL $HW = H + h_o - LS_o$											
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c + D}{2}$	TW	h_o	LS_o	HW				
CULVERT A CMP-PROJECTING	14	24"	1.15	2.3	0.9	1.3	1.4	1.7		1.7	1	2	2.3			OK
CULVERT A CONCRETE	14	18"	2	3	0.2	2.1	1.4	1.45		1.45	1	2.55				OK
CULVERT B CMP	11	24"	1.0	2.0	0.9	0.8	1.2	1.6	0	1.6	1.0	1.4				RECOMMENDED
CULVERT C	6	24"	.65	1.3	0.9	0.4	0.8	1.4	0	1.4	0.2	1.6				OK

SUMMARY & RECOMMENDATIONS:

Figure 7

PROJECT: DPC P00

DESIGNER: BAA

DATE: 9/29/00

HYDROLOGIC AND CHANNEL INFORMATION

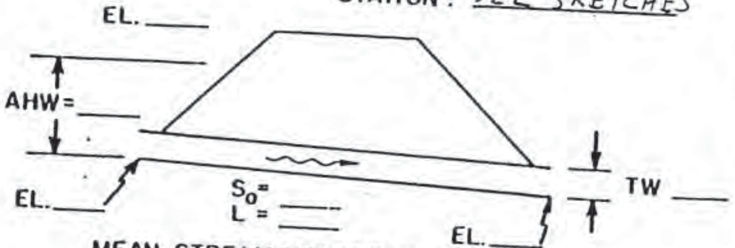
Q_1 = SEE SKETCHES
Q_2 = ______

TW_1 = ______
TW_2 = ______

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: SEE SKETCHES



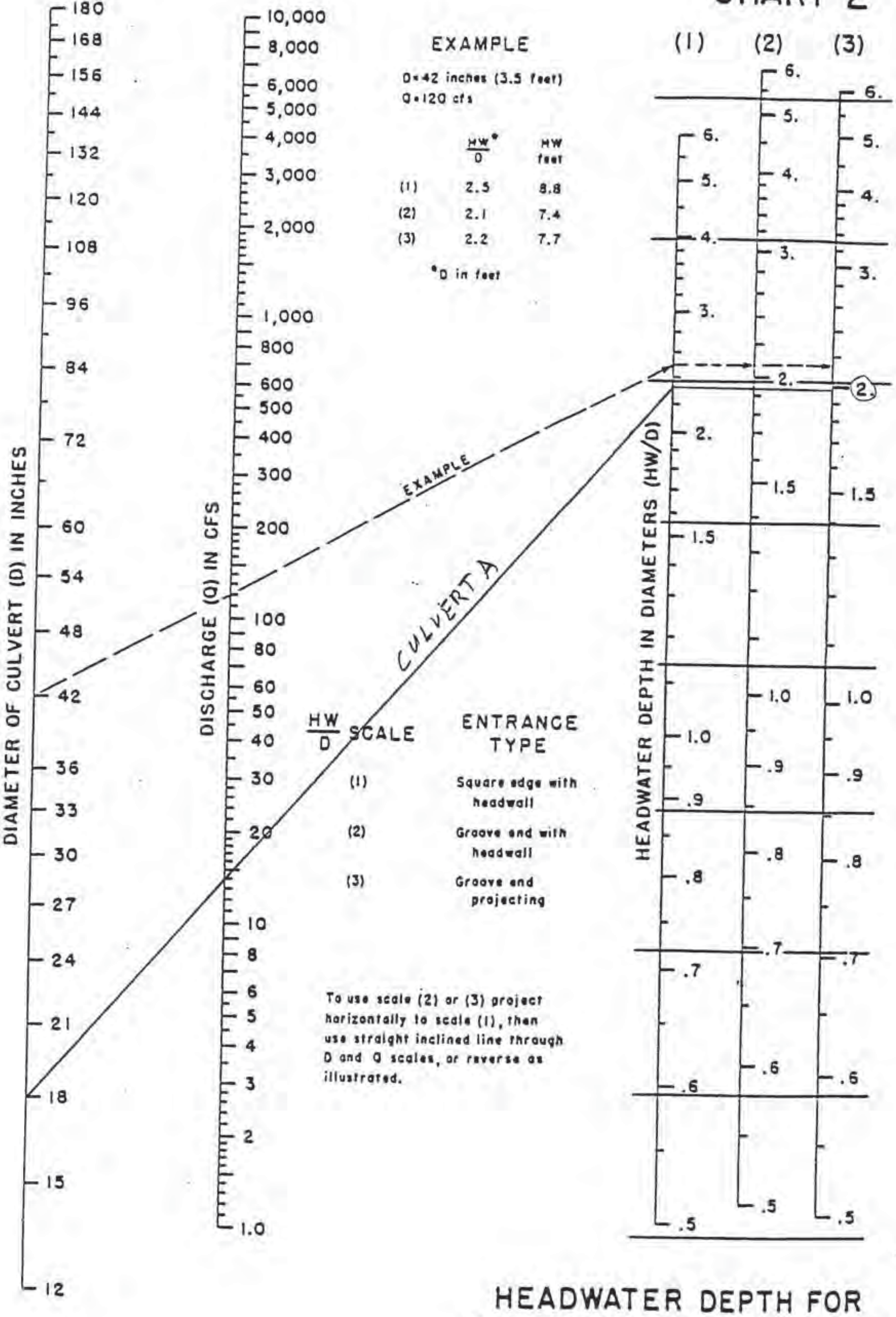
MEAN STREAM VELOCITY = ______
MAX. STREAM VELOCITY = ______

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
			INLET CONT.		OUTLET CONTROL $HW = H + h_o - LS_o$											
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW				
CULVERT E CMP-PROJECTING	7	24"	0.7	1.4	0.9	0.4	0.8	1:4	0	1.4	2.5	—	1.4			OK
CULVERT D 7'X4' BOX	583	SAME FLOW AS PERMANENT CULVERTS 1, 2, and 5.														

SUMMARY & RECOMMENDATIONS:

Figure 7

CHART 2



EXAMPLE

D=42 inches (3.5 feet)
Q=120 cfs

	$\frac{HW}{D}$*	HW feet
(1)	2.5	8.8
(2)	2.1	7.4
(3)	2.2	7.7

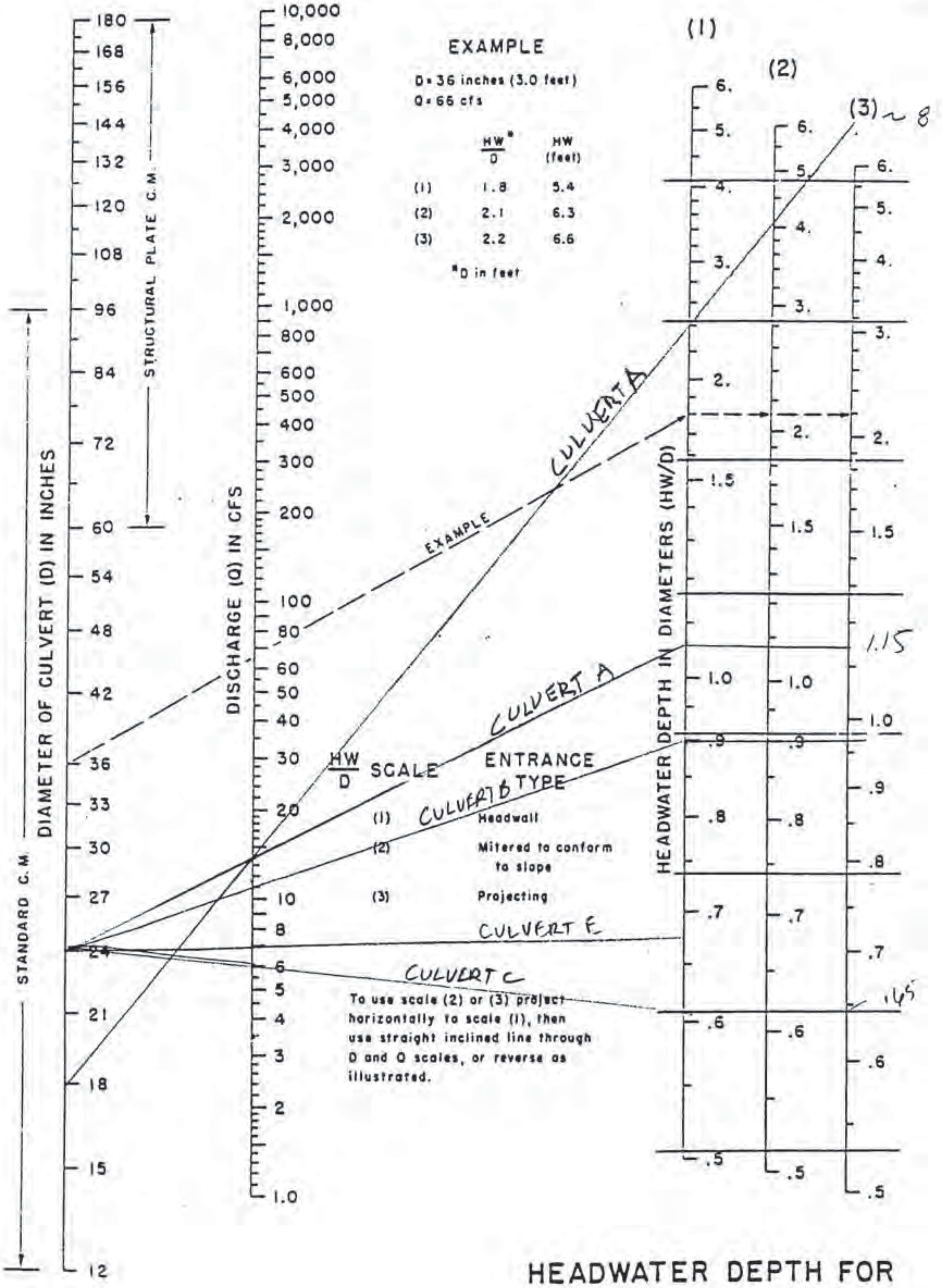
*D in feet

$\frac{HW}{D}$ SCALE	ENTRANCE TYPE
(1)	Square edge with headwall
(2)	Groove end with headwall
(3)	Groove end projecting

To use scale (2) or (3) project horizontally to scale (1), then use straight inclined line through D and Q scales, or reverse as illustrated.

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

CHART 5



EXAMPLE

D = 36 inches (3.0 feet)
Q = 66 cfs

	$\frac{HW}{D}$*	HW (feet)
(1)	1.8	5.4
(2)	2.1	6.3
(3)	2.2	6.6

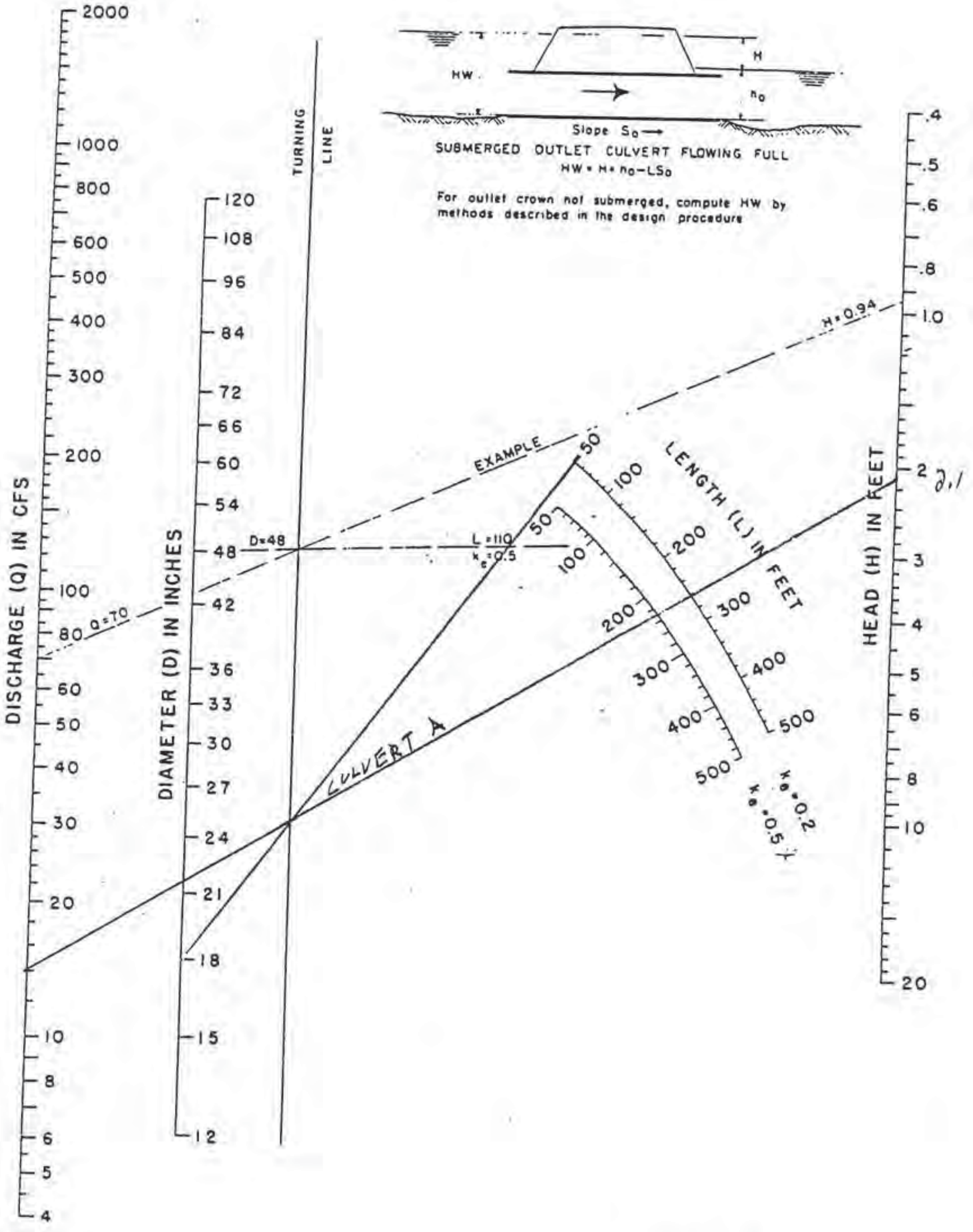
*D in feet

	ENTRANCE TYPE
(1)	Headwall
(2)	Mitered to conform to slope
(3)	Projecting

To use scale (2) or (3) project horizontally to scale (1), then use straight inclined line through D and Q scales, or reverse as illustrated.

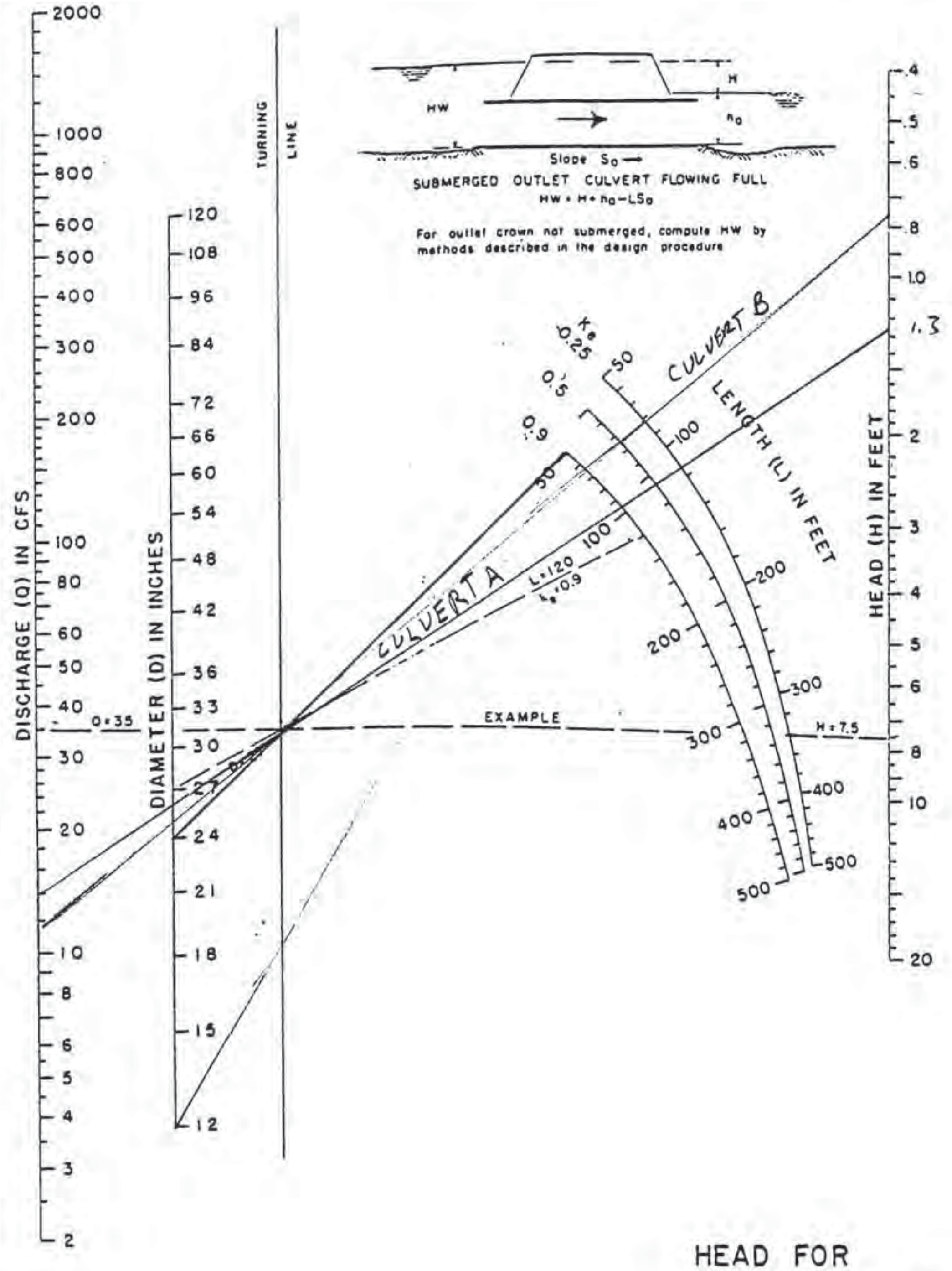
HEADWATER DEPTH FOR
C. M. PIPE CULVERTS
WITH INLET CONTROL

CHART 9

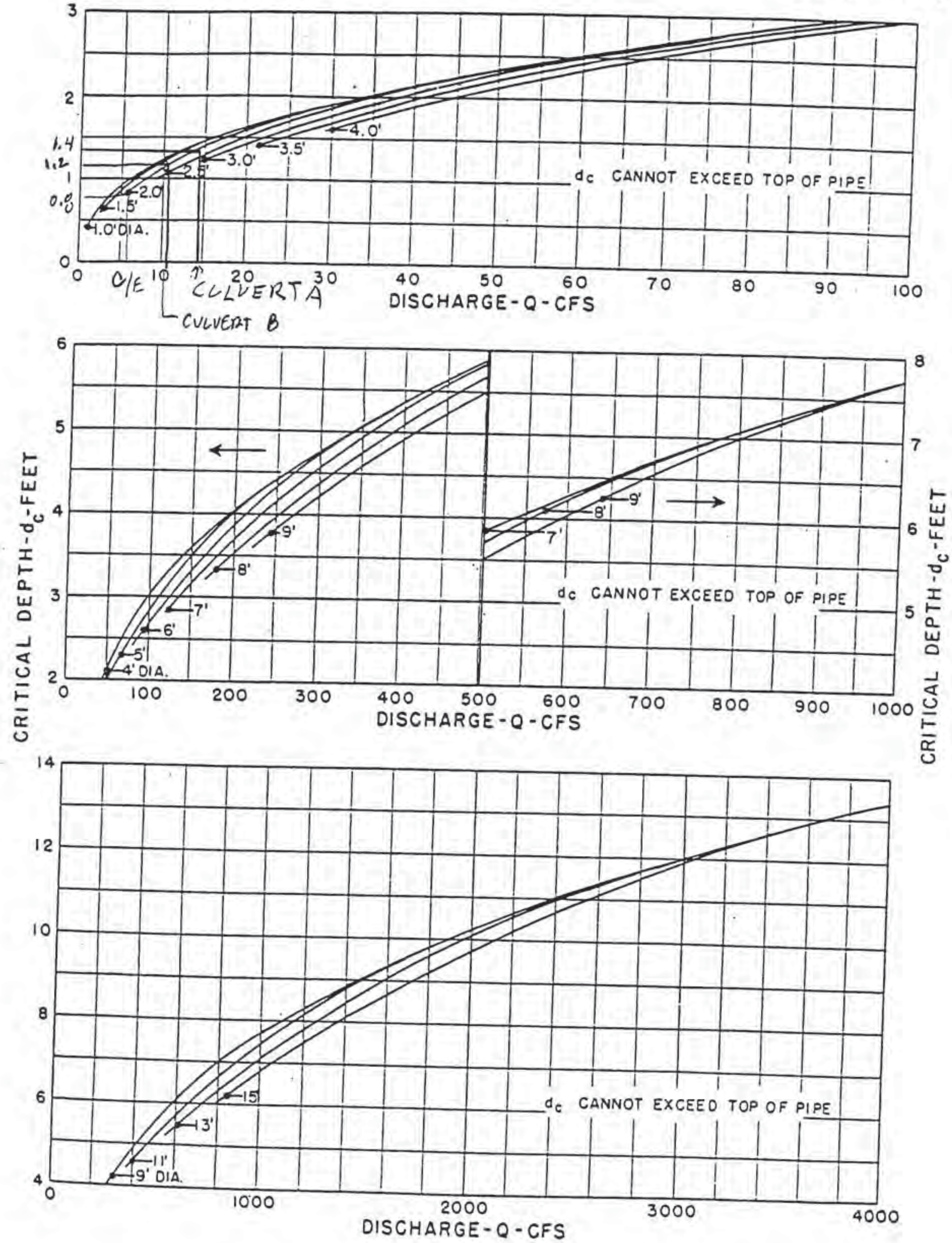


HEAD FOR
CONCRETE PIPE CULVERTS
FLOWING FULL
n = 0.012

CHART 11



HEAD FOR
STANDARD
C. M. PIPE CULVERTS
FLOWING FULL
n = 0.024



CRITICAL DEPTH
CIRCULAR PIPE

TABLE 1 - ENTRANCE LOSS COEFFICIENTS

Outlet Control, Full or Partly Full

Entrance head loss $H_e = k_e \frac{V^2}{2g}$

Type of Structure and Design of Entrance	Coefficient k_e
Pipe, Concrete	
Projecting from fill, socket end (groove-end)	0.2
Projecting from fill, sq. cut end	0.5
Headwall or headwall and wingwalls	
Socket end of pipe (groove-end)	0.2
Square-edge	0.5
Rounded (radius = 1/12D)	0.2
Mitered to conform to fill slope	0.7
*End-Section conforming to fill slope	0.5
Beveled edges, 33.7° or 45° bevels	0.2
Side-or slope-tapered inlet	0.2
Pipe, or Pipe-Arch, Corrugated Metal	
Projecting from fill (no headwall)	0.9
Headwall or headwall and wingwalls square-edge	0.5
Mitered to conform to fill slope, paved or unpaved slope	0.7
*End-Section conforming to fill slope	0.5
Beveled edges, 33.7° or 45° bevels	0.2
Side-or slope-tapered inlet	0.2
Box, Reinforced Concrete	
Headwall parallel to embankment (no wingwalls)	
Square-edged on 3 edges	0.5
Rounded on 3 edges to radius of 1/12 barrel dimension, or beveled edges on 3 sides	0.2
Wingwalls at 30° to 75° to barrel	
Square-edged at crown	0.4
Crown edge rounded to radius of 1/12 barrel dimension, or beveled top edge	0.2
Wingwall at 10° to 25° to barrel	
Square-edged at crown	0.5
Wingwalls parallel (extension of sides)	
Square-edged at crown	0.7
Side-or slope-tapered inlet	0.2

*Note: "End Section conforming to fill slope," made of either metal or concrete, are the sections commonly available from manufacturers. From limited hydraulic tests they are equivalent in operation to a headwall in both inlet and outlet control. Some end sections, incorporating a closed taper in their design have a superior hydraulic performance. These latter sections can be designed using the information given for the beveled inlet, p. 5-13.

Vegetation Information

√ BLB
10/6/98

```
***************************************************************************
       NORTH AMERICAN GREEN - ECMDS VER.IV - SLOPE PROTECTION - ENGLISH
              USER SPECIFIED - PERMANENT PROTECTION RESULTS
***************************************************************************


PROJECT NAME: Dairyland Power Coop.        PROJECT NO.: 3081.33
COMPUTED BY: BJK                           DATE: 10-06-1998
SLOPE DESCRIPTION: 2:1 Slopes

-------------------------------------------------------------------------

Slope Gradient: 2.00:1 ✓                         Slope Length: 50  feet ✓
Soil Type: Clay Loam (K= 0.21) ✓                 Annual R Factor:  125.0 ✓

Slope Reach    Material    Type  Density   LS    C
  feet

  0 -   30     Est. Veg.   Mix   75-95%   4.10 .020
 30 -   50     P300        Mix   75-95%   7.35 .002

Slope Reach    Material    Type  Density ASLbare ASLmat   SLT  Sf  Recommend

  feet                                   inch    inch    inch

  0 -   30     Est. Veg.   Mix   75-95%  0.641   0.013  0.03  2.3  STABLE
 30 -   50     P300        Mix   75-95%  1.149   0.002  0.03 13.1  STABLE
=========================================================================
  0 -   50     Composite                 0.844   0.009

Vegetation Density=Percentage of soil coverage provided by vegetation
C=Cover material performance factor (Fraction of soil loss of unprotected)
ASLbare=Average Soil Loss potential of unprotected soil (uniform inches)
ASLmat=Average Soil Loss potential w/material (uniform inches)
SLT=Soil Loss Tolerance for slope segment (uniform inches)
Sf=Safety Factor
Composite=Average soil loss from total slope length (uniform inches)
-------------------------------------------------------------------------
```

← For Slope's 0'-30' Use Mix No. 20 Vegetation

For slopes >30', use permanant erosion matting on bottom Portion of slope (below 30') And No. 20 Vegetation on upper portion

- See Attached For Vegetation Types

Species Common Name	Species Botanical Name	Acceptable Varieties
Kentucky Bluegrass	Poa pratensis	
Red Fescue	Festuca rubra	Creeping
Hard Fescue	Festuca ovina var. duriuscula	Improved
Tall Fescue	Festuca arundinacea	Improved turf type
Salt Grass	Puccinella distans	Fult's
Redtop	Agrostis alba	
Timothy	Phleum pratense	
Little Bluestem*	Andropogon scoparius	
Sideoats Grama*	Bouteloua curtipendula	
Canada Wild Rye*	Elymus canadensis	
Perennial Ryegrass	Lolium perenne	
Perennial Ryegrass	Lolium perenne	Improved Fine
Annual Ryegrass	Lolium multiflorum	
Alsike Clover	Trifolium hybridum	
Red Clover	Trifolium pratense	
White Clover	Trifolium repens	
Birdsfoot Trefoil	Lotus corniculatus	Empire
Japanese Millet	Echinochola crusgalli var. frumentacea	
Annual Oats	Avena sativa	
Alfalfa	Medicago sativa	
Bromegrass	Bromus inermis	
Orchardgrass	Dactylis glomerata	
Ladino Clover	Trifolium repens var. latum	Ladino
Agricultural Rye	Secale cereale	
Winter Wheat	Triticum aestivum	

*Pure Live Seed

Ditches Slopes

Species	Purity Min. %	Germination min.%	Mixture Proportions, Percent						
			No. 10	No. 20	No. 30	No. 40	No. 50	No. 60	No. 70
Kentucky Bluegrass	85	80	40	6	10	35			
Red Fescue	97	85	25		30	20			
Hard Fescue	97	85		24	25	20			10
Tall Fescue	98	85		40					25
Salt Grass	98	85			10				
Redtop	92	85	5						
Timothy	98	90						12	
Little Bluestem		PLS*							15
Sideoats Grama		PLS*							15
Canada Wild Rye		PLS*						12	5
Perennial Ryegrass	97	90	20	30					30
Improved Fine Perennial Ryegrass	96	85			15	25			
Annual Ryegrass	97	90						35	
Alsike Clover	97	90						4	
Red Clover	98	90						4	
White Clover	95	90	10						
Birdsfoot Trefoil	95	80			10		100		
Japenese Millet	97	85						8	
Annual Oats*	98	90						25	

* Substitute winter wheat for annual oats in fall plantings started after September 1.

630.2.1.5.1.1.2 Mixture to be Used. The selection of the seed mixture or mixtures for use on the project shall meet with the approval of the engineer, and unless otherwise provided in the contract, shall be in accordance with the following:

Seed Mixture No. 10 is intended for use on projects where average loam, heavy clay or moist soils predominate.

Seed Mixture No. 20 is intended for use on projects where light, dry, well-drained, sandy or gravelly soils predominate and shall be used for all high cut and fill slopes (generally exceeding 1.8 to 2.4 m), except where No. 70 is used.

STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION

STANDARD SPECIFICATIONS

FOR

HIGHWAY AND STRUCTURE CONSTRUCTION

1996 EDITION

****
*****   VEGETATION SELECTION   *****
*****   North American Green   *****
****

Region Number: 1

Predominant Soil Type: Clay - Clay Loam

Moisture Regime Conditions: Normal Moisture

Planned Maintenance: Medium - High Maintenance

	Longevity	Growth Habit	Seed Rate lb/ac	Seed Rate kg/ha	
Grasses					
Tall Fescue (Festuca arundinacea)	P	B	200	224	(No. 20)
Chewings Fescue (Festuca rubra, commutata)	P	B	120	134	(No. 10)
Kentucky Bluegrass (Poa pratensis)	P	S	80	90	(No 10, No. 20)
Perennial Ryegrass (Lolium perenne)	P	B	160	179	(No. 10, No 20)
Annual Ryegrass (Lolium multiflorum)	A	B	160	179	
Orchardgrass (Dactylis glomerata)	P	B	40	45	
Timothy (Phleum pratense)	P	B	80	90	
Creeping Red Fescue (Festuca rubra)	P	S	120	134	
Legumes					
Alsike Clover (Trifolium hybridum)	P		15	17	
White Dutch Clover (Trifolium repens)	P		5	6	
White Sweet Clover (Melilotus alba)	P		15	17	

Appendix B: Surface Water Run-Off Control System Calculations

- Leachate Storage Capacity for the 25-Year 24-Hour Storm Event
- References

Leachate Storage Capacity for the 25-Year 24-Hour Storm Event

PROJECT / LOCATION: DPC: Alma Offsite Disposal Facility, Phase IV Landfill		PROJECT / PROPOSAL NO.
SUBJECT: Active Area Leachate Disposal Capacity		421717.0000
PREPARED BY: B. Kahnk	DATE: 4/27/2021	FINAL X
CHECKED BY: J. Hotstream	DATE: 4/29/2021	REVISION X

Purpose: Determine the leachate storage capacity from a 25 year, 24-hour storm event during the critical leachate generation scenario.

Assumptions:

1. Critical leachate generation scenario occurs during the current condition with approximately 12.7 acres are operational (Portions of Cell 2 and the entirety of Cell 3) and approximately 7.6 acres have final cover. (See Figure 1 for this scenario).

2. The 25 year, 24-hour storm event is 5.40 inches (refer to attached sheet).

3. No portion of the leachate drainage layer within the open area is saturated.

4. The leachate drainage sand has a porosity of 30 percent. The bottom ash has a porosity of 25 percent.

5. The minimum thickness of the drainage layer is 1.0 foot.

6. A minimum of 1 foot of bottom ash was installed above the drainage layer in Cell 2A over an area of approximately 2.3 acres.

7.A minimum of 4 feet of bottom ash was installed above the drainage layer during the Cell 3A construction. Using a maximum elevation of 820 feet, this bottom ash covers an area of approximately 2.75 acres.

Method:

1. Determine the volume of rain collected in the open areas during the critical condition from a 25 year, 24-hour storm event.

2. Calculate the available storage volume for leachate in the drainage layer. Due to the slope of the landfill perimeter berm, the capacity of the drainage layer is based on the area of the drainage layer at or below an elevation of 820 feet. Elevation 820 represents the lowest top of berm base grade elevation documented during construction of Cell 3A (refer to attached base grades sheet).

3. The available storage volume within the pipe trenches, transfer piping, and leachate collection tank is ignored.

4. Calculate the available storage volume for leachate in the 4 feet of bottom ash placed above the drainage layer during Cell 3A construction and 1 foot of bottom ash placed above the drainage layer during Cell 2A construction.

5. Calculate the volume of storage required for the 25 year, 24-hour storm event.

PROJECT / LOCATION: DPC: Alma Offsite Disposal Facility, Phase IV Landfill		PROJECT / PROPOSAL NO.
SUBJECT: Active Area Leachate Disposal Capacity		421717.0000
PREPARED BY: B. Kahnk	DATE: 4/27/2021	FINAL X
CHECKED BY: J. Hotstream	DATE: 4/29/2021	REVISION ☐

Step 1. Determine volume of run-off collected during the 25 year, 24-hour storm event

Area: 12.7 acres - Area open (portions of Cell 2 and the entirety of Cell 3)

Rain Event: 5.43 inches

$$Runoff\ Volume(ft^3): Rain\ Event\ (inches) \times \frac{1ft}{12\ inches} \times Area\ (acres) \times \frac{43{,}560\ ft^2}{1\ acre}$$

Runoff Volume: 250,328 cubic feet

Step 2. Calculate the available storage volume for leachate in the drainage layer.

Area: 9.2 acres - see attached base grades plan
Thickness: 1 foot
Porosity: 0.3

$$Storage\ Capacity(ft^3): Area\ (acres) \times \frac{43{,}560\ ft^2}{1\ acre} \times Thickness\ (foot) \times Porosity$$

Storage Capacity: 120,226 cubic feet

Step 3. Ignore storage in pipe trenches, transfer piping and leachate collection tank

Step 4. Calculate the available storage volume in the bottom ash placed above the drainage layer

Cell 2A:		Cell 3A:	
Area:	2.3 acre(s)	Area:	2.75 acre(s)
Thickness:	1 feet	Thickness:	4 feet
Porosity:	0.25	Porosity:	0.25

$$Storage\ Capacity(ft^3): Area\ (acres) \times \frac{43{,}560\ ft^2}{1\ acre} \times Thickness\ (foot) \times Porosity$$

Cell 2A:		Cell 3A:	
Storage Capacity:	25,047 cubic feet	Storage Capacity:	119,790 cubic feet

Total Storage Capacity (Cell 2A + Cell 3A): 144,837 cubic feet

PROJECT / LOCATION: DPC: Alma Offsite Disposal Facility, Phase IV Landfill		PROJECT / PROPOSAL NO.
SUBJECT: Active Area Leachate Disposal Capacity		421717.0000
PREPARED BY: B. Kahnk	DATE: 4/27/2021	FINAL X
CHECKED BY: J. Hotstream	DATE: 4/29/2021	REVISION ☐

Step 5. Calculate the storage required for the 25 year, 24-hour storm event.

Required Storage:

$$Required\ Storage = Run\ Off\ Volume - Drainage\ Layer\ Capacity\ - Bottom\ Ash\ Capacity$$

Run-Off Volume:	250,328	cubic feet from Step 1
Drainage Layer:	120,226	cubic feet, from Step 2
Bottom Ash:	144,837	cubic feet from Step 4

Required Storage: -14,734 cubic feet

The negative required storage calculated above indicates that there is sufficient storage capacity in the leachate collection drainage layer and the bottom ash that was placed in the cells above the drainage layer to contain the runoff from a 25 year, 24-hour storm event.

References

NOAA Atlas 14, Volume 8, Version 2
Location name: Alma, Wisconsin, US*
Latitude: 44.3657°, Longitude: -91.9171°
Elevation: 1074 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk,
Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	**2**	**5**	**10**	**25**	**50**	**100**	**200**	**500**	**1000**
5-min	**0.366** (0.300-0.455)	**0.436** (0.357-0.543)	**0.555** (0.453-0.692)	**0.657** (0.532-0.822)	**0.801** (0.626-1.03)	**0.915** (0.697-1.20)	**1.03** (0.757-1.38)	**1.16** (0.809-1.58)	**1.32** (0.887-1.85)	**1.45** (0.946-2.06)
10-min	**0.536** (0.439-0.666)	**0.639** (0.523-0.795)	**0.813** (0.663-1.01)	**0.962** (0.779-1.20)	**1.17** (0.917-1.52)	**1.34** (1.02-1.75)	**1.51** (1.11-2.02)	**1.69** (1.19-2.31)	**1.94** (1.30-2.71)	**2.13** (1.39-3.02)
15-min	**0.653** (0.535-0.812)	**0.779** (0.638-0.969)	**0.991** (0.809-1.24)	**1.17** (0.950-1.47)	**1.43** (1.12-1.85)	**1.64** (1.25-2.14)	**1.84** (1.35-2.46)	**2.06** (1.45-2.82)	**2.36** (1.58-3.31)	**2.59** (1.69-3.68)
30-min	**0.908** (0.744-1.13)	**1.09** (0.894-1.36)	**1.40** (1.14-1.74)	**1.66** (1.34-2.08)	**2.03** (1.58-2.62)	**2.32** (1.76-3.03)	**2.62** (1.92-3.49)	**2.92** (2.05-4.00)	**3.34** (2.24-4.68)	**3.66** (2.39-5.19)
60-min	**1.19** (0.978-1.48)	**1.42** (1.16-1.77)	**1.82** (1.48-2.27)	**2.17** (1.76-2.72)	**2.69** (2.12-3.51)	**3.13** (2.39-4.11)	**3.58** (2.63-4.81)	**4.07** (2.86-5.60)	**4.76** (3.20-6.70)	**5.31** (3.46-7.53)
2-hr	**1.48** (1.22-1.82)	**1.75** (1.44-2.15)	**2.23** (1.84-2.76)	**2.68** (2.19-3.33)	**3.36** (2.67-4.37)	**3.94** (3.04-5.15)	**4.55** (3.38-6.09)	**5.22** (3.70-7.15)	**6.18** (4.20-8.66)	**6.96** (4.57-9.80)
3-hr	**1.67** (1.38-2.04)	**1.95** (1.62-2.39)	**2.48** (2.05-3.05)	**2.99** (2.46-3.69)	**3.79** (3.04-4.93)	**4.48** (3.48-5.86)	**5.24** (3.92-7.00)	**6.07** (4.33-8.31)	**7.28** (4.97-10.2)	**8.28** (5.46-11.6)
6-hr	**1.96** (1.64-2.38)	**2.28** (1.91-2.77)	**2.90** (2.41-3.53)	**3.50** (2.90-4.28)	**4.47** (3.63-5.79)	**5.32** (4.18-6.93)	**6.27** (4.73-8.33)	**7.32** (5.27-9.96)	**8.86** (6.11-12.3)	**10.1** (6.74-14.1)
12-hr	**2.23** (1.88-2.68)	**2.59** (2.18-3.12)	**3.29** (2.76-3.96)	**3.96** (3.30-4.79)	**5.02** (4.10-6.43)	**5.96** (4.71-7.68)	**6.99** (5.31-9.21)	**8.13** (5.90-11.0)	**9.80** (6.81-13.5)	**11.2** (7.49-15.5)
24-hr	**2.53** (2.15-3.01)	**2.91** (2.47-3.46)	**3.63** (3.07-4.33)	**4.33** (3.64-5.09)	**5.43** (4.47-6.89)	**6.40** (5.10-8.17)	**7.46** (5.72-9.75)	**8.65** (6.33-11.6)	**10.4** (7.26-14.2)	**11.8** (7.97-16.2)
2-day	**2.94** (2.52-3.46)	**3.29** (2.81-3.87)	**3.97** (3.39-4.69)	**4.65** (3.94-5.53)	**5.76** (4.79-7.25)	**6.75** (5.44-8.56)	**7.86** (6.08-10.2)	**9.10** (6.72-12.1)	**10.9** (7.72-14.9)	**12.5** (8.48-17.0)
3-day	**3.23** (2.79-3.79)	**3.58** (3.08-4.19)	**4.26** (3.65-5.01)	**4.95** (4.21-5.84)	**6.07** (5.07-7.59)	**7.07** (5.72-8.91)	**8.19** (6.37-10.6)	**9.45** (7.01-12.5)	**11.3** (8.02-15.3)	**12.8** (8.79-17.5)
4-day	**3.48** (3.00-4.05)	**3.85** (3.32-4.49)	**4.57** (3.93-5.35)	**5.28** (4.51-6.21)	**6.42** (5.37-7.98)	**7.43** (6.03-9.31)	**8.55** (6.67-11.0)	**9.81** (7.30-12.9)	**11.6** (8.29-15.7)	**13.2** (9.04-17.9)
7-day	**4.09** (3.56-4.73)	**4.59** (3.99-5.31)	**5.48** (4.75-6.37)	**6.30** (5.42-7.35)	**7.54** (6.31-9.20)	**8.58** (6.97-10.6)	**9.70** (7.58-12.3)	**10.9** (8.15-14.2)	**12.6** (9.03-16.9)	**14.0** (9.70-19.0)
10-day	**4.64** (4.05-5.34)	**5.24** (4.57-6.03)	**6.27** (5.45-7.24)	**7.17** (6.20-8.32)	**8.50** (7.11-10.3)	**9.58** (7.80-11.7)	**10.7** (8.39-13.4)	**11.9** (8.91-15.4)	**13.6** (9.73-18.1)	**14.9** (10.4-20.1)
20-day	**6.27** (5.53-7.14)	**7.04** (6.19-8.02)	**8.32** (7.29-9.51)	**9.40** (8.19-10.8)	**10.9** (9.19-13.0)	**12.1** (9.95-14.7)	**13.4** (10.6-16.6)	**14.7** (11.0-18.7)	**16.4** (11.8-21.6)	**17.7** (12.4-23.7)
30-day	**7.70** (6.82-8.72)	**8.60** (7.61-9.75)	**10.1** (8.89-11.5)	**11.3** (9.91-12.9)	**13.0** (11.0-15.3)	**14.3** (11.8-17.2)	**15.7** (12.4-19.3)	**17.0** (12.9-21.6)	**18.8** (13.6-24.6)	**20.2** (14.2-26.9)
45-day	**9.58** (8.53-10.8)	**10.7** (9.51-12.1)	**12.5** (11.1-14.1)	**13.9** (12.3-15.8)	**15.9** (13.4-18.5)	**17.3** (14.3-20.6)	**18.8** (14.9-22.9)	**20.2** (15.3-25.3)	**21.9** (15.9-28.5)	**23.3** (16.4-30.8)
60-day	**11.2** (10.0-12.6)	**12.6** (11.2-14.1)	**14.7** (13.0-16.5)	**16.3** (14.4-18.5)	**18.5** (15.7-21.4)	**20.1** (16.6-23.7)	**21.5** (17.1-26.1)	**22.9** (17.4-28.7)	**24.7** (18.0-31.8)	**25.9** (18.4-34.2)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

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SHEET 1 OF 1

PROJECT / LOCATION: DPC: Alma Offsite Disposal Facility, Phase IV Landfill		PROJECT / PROPOSAL NO.
SUBJECT: Active Area Leachate Disposal Capacity		243332.0002
PREPARED BY: J. Hotstream	DATE: 8/31/2016	FINAL ☐
CHECKED BY:	DATE:	REVISION ☐

Volume Relationships of Sand

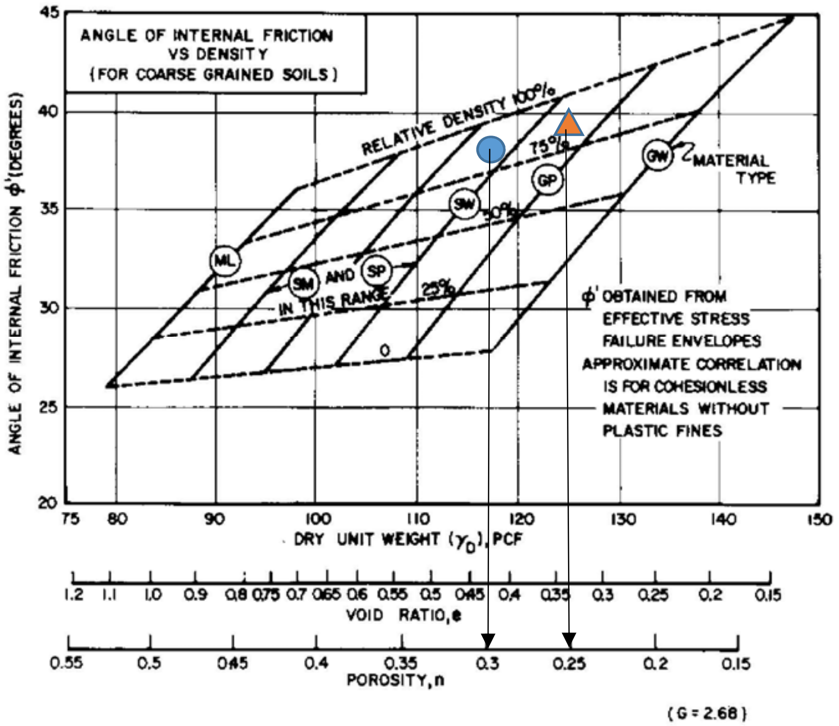
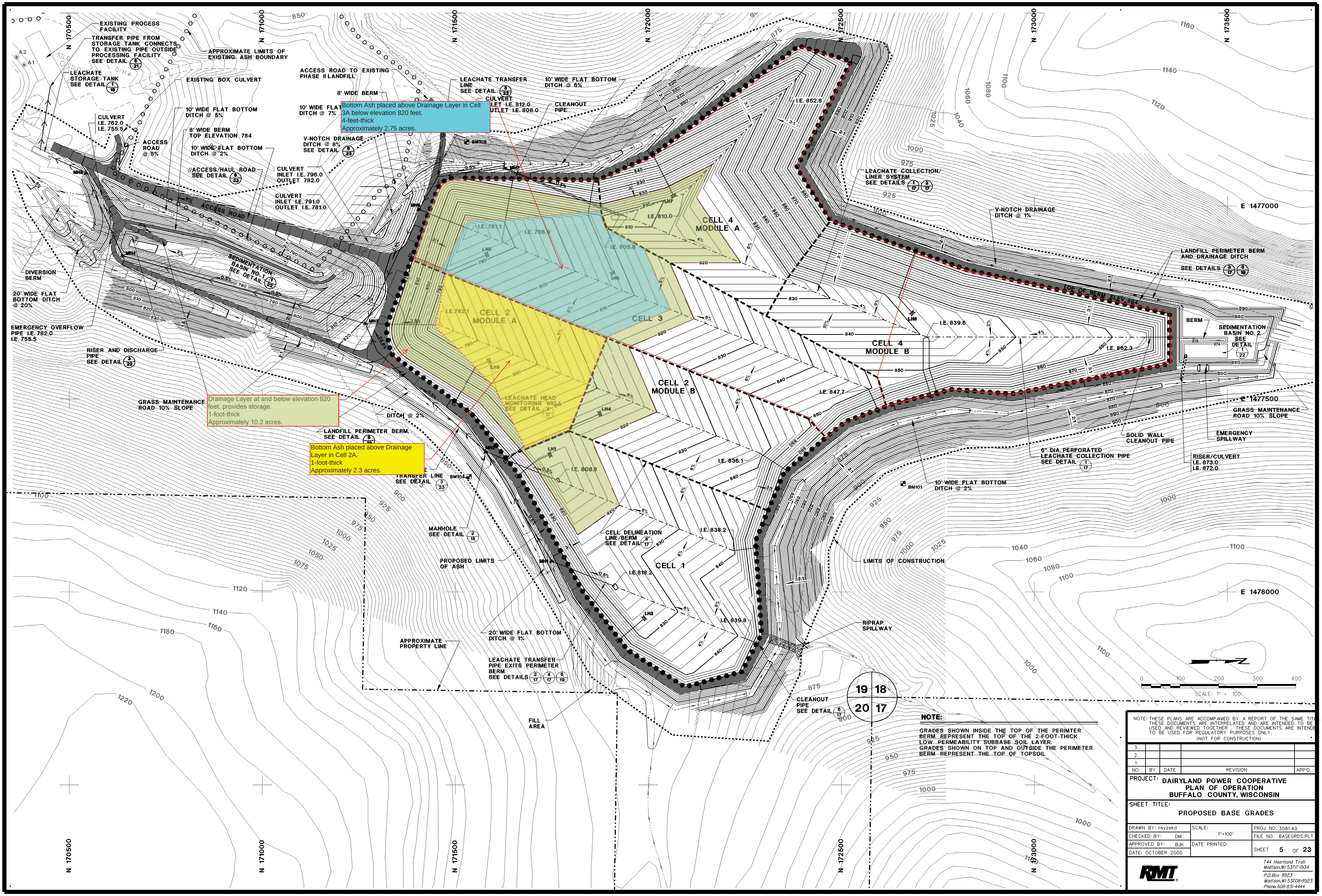


Figure from NavFac DM 7.1 (1986)

● Drainage Layer Sand - Poorly Graded Sand (SP)

▲ Bottom Ash - Poorly Graded Sand (SP) to
Poorly Graded Gravel (GP)



Bottom Ash placed above Drainage Layer in Cell 3A below elevation 820 feet.
4-feet-thick
Approximately 2.75 acres.

Drainage Layer at and below elevation 820 feet, provides storage.
1-foot-thick
Approximately 10.2 acres.

Bottom Ash placed above Drainage Layer in Cell 2A.
1-foot-thick
Approximately 2.3 acres.

NOTE:

GRADES SHOWN INSIDE THE TOP OF THE PERIMTER BERM REPRESENT THE TOP OF THE 2-FOOT-THICK LOW PERMEABILITY SUBBASE SOIL LAYER.
GRADES SHOWN ON TOP AND OUTSIDE THE PERIMETER BERM REPRESENT THE TOP OF TOPSOIL

NOTE: THESE PLANS ARE ACCOMPANIED BY A REPORT OF THE SAME TITLE. THESE DOCUMENTS ARE INTERRELATED AND ARE INTENDED TO BE USED AND REVIEWED TOGETHER . THESE DOCUMENTS ARE INTENDED TO BE USED FOR REGULATORY PURPOSES ONLY.
(NOT FOR CONSTRUCTION)

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

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

SHEET TITLE:
PROPOSED BASE GRADES

DRAWN BY: reyzekd	SCALE: 1"=100'	PROJ. NO. 3081.40
CHECKED BY: DM		FILE NO. BASEGRDS.PLT
APPROVED BY: BJK	DATE PRINTED:	SHEET **5** OF **23**
DATE: OCTOBER 2000		

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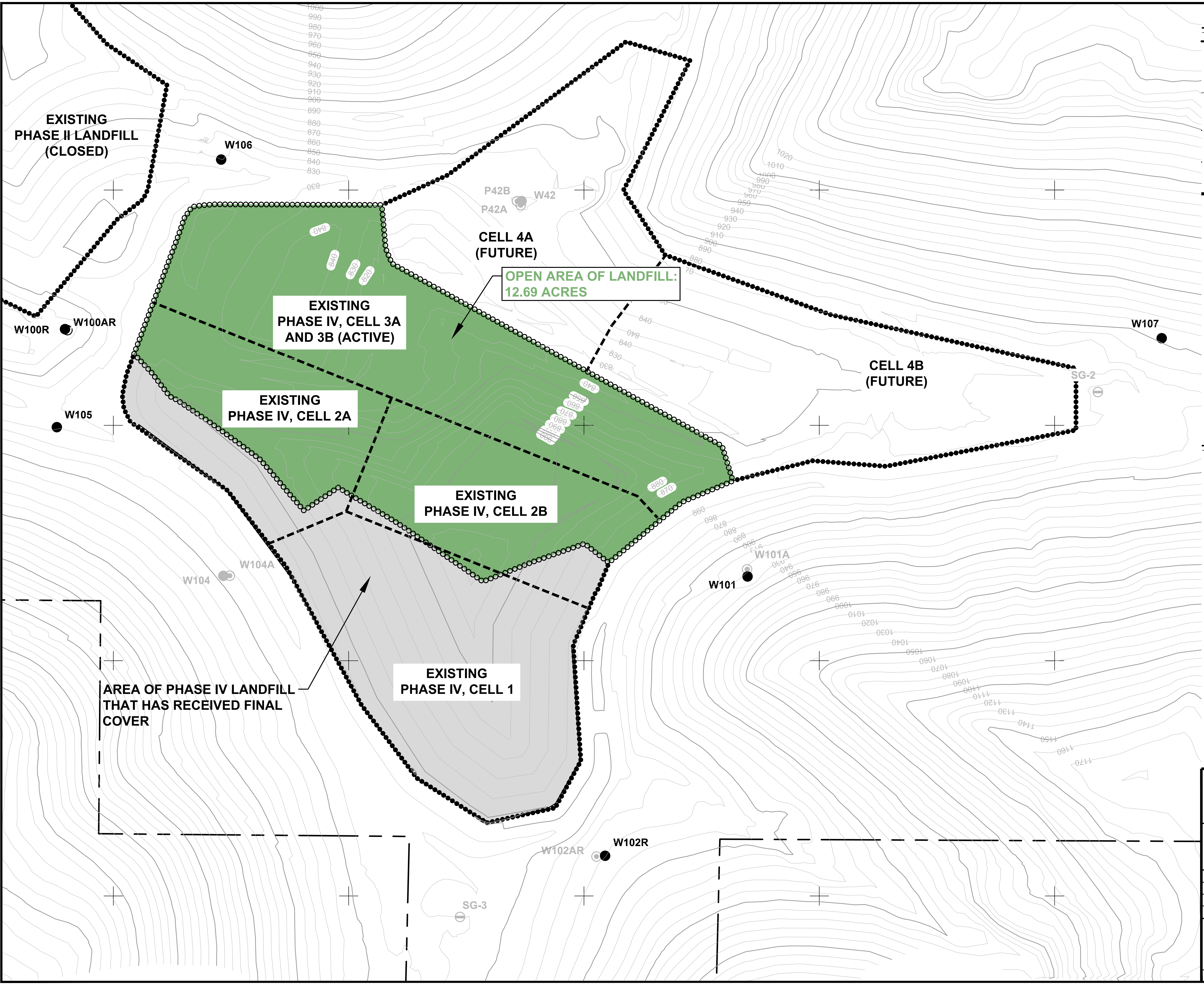

LEGEND

— - —	APPROXIMATE PROPERTY BOUNDARY
+	GRID LOCATION
890	EXISTING 10' CONTOUR
x 895.7	EXISTING SPOT ELEVATION
●●●●●●●●●●●	LIMITS OF PERMITTED LANDFILL
○○○○○○○○○○○	LIMITS OF CCR DISPOSAL (ACTIVE LANDFILL)
– – – –	PHASE LINE
● W42	MONITORING WELL (NOT INCLUDED IN FEDERAL GWMP)
◉ W42B	PIEZOMETER (NOT INCLUDED IN FEDERAL GWMP)
● W101	MONITORING WELL LOCATION
◉ W101A	PIEZOMETER LOCATION

NOTES

1. THE BASE MAP WAS COMPILED FROM THE CELL 3B LINER CONSTRUCTION DOCUMENTATION REPORT (OCTOBER, 2016) AND THE NOVEMBER 12, 2020 ANNUAL AIR SPACE SURVEY BY EXETER DESIGN, INC.
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.

0 200 400

SCALE IN FEET

PROJECT:
DAIRYLAND POWER COOPERATIVE
RUN-ON AND RUN-OFF CONTROL SYSTEMS PLAN
ALMA OFF-SITE PHASE IV LANDFILL
BUFFALO COUNTY, WISCONSIN

TITLE:
EXISTING CONDITIONS

WORKING COPY

DRAWN BY:	S. HAMWAY	PROJ NO.:	421717
CHECKED BY:	B. KAHNK		
APPROVED BY:		FIGURE 1	
DATE:	OCTOBER 2021		

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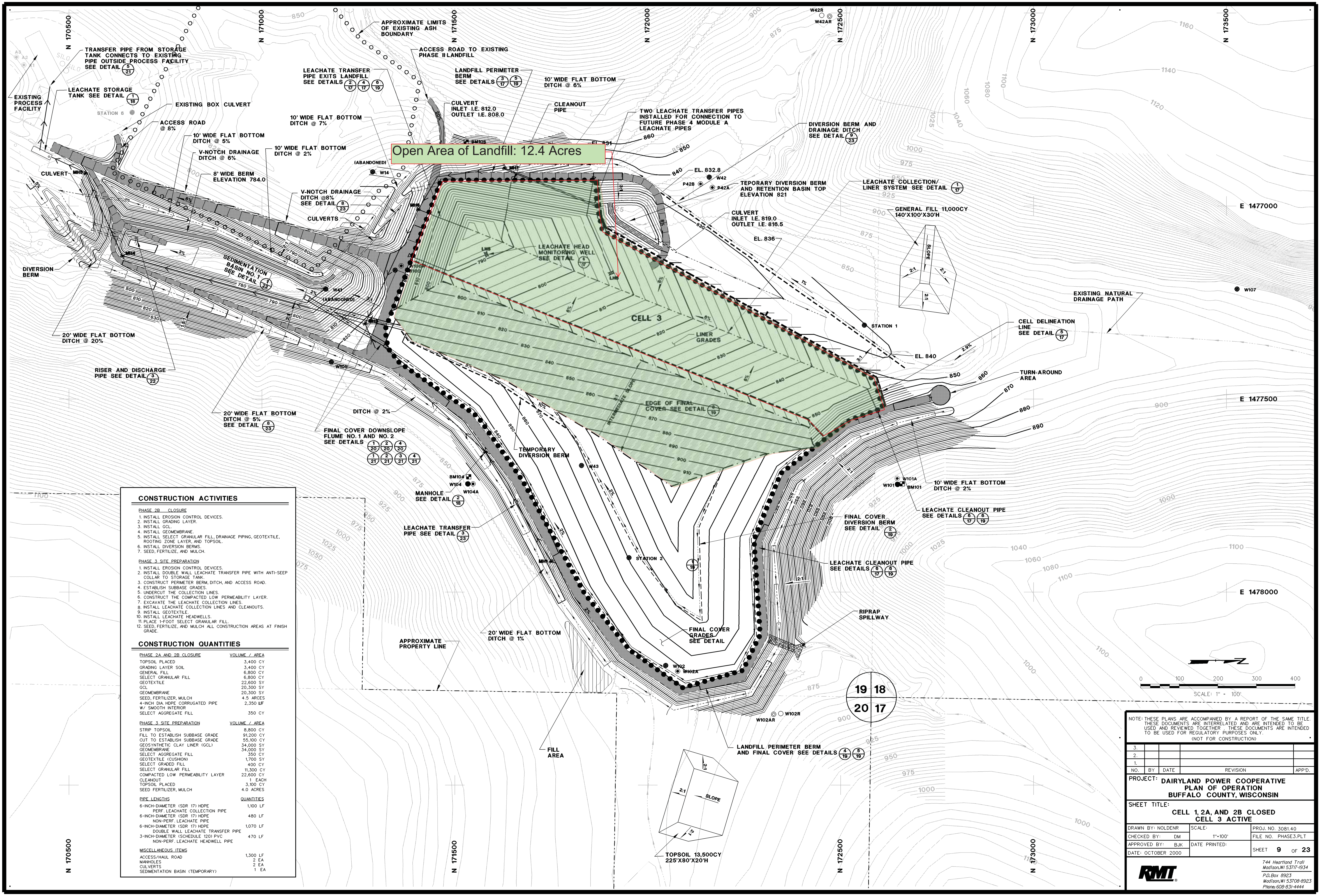
Phone: 608.826.3600

FILE NO.: 421717.01.dwg

11x17 --- ATTACHED XREFS: WELLS 200; GRID 200; PROPOSED: EG 2020-11-12 --- ATTACHED IMAGES:
DRAWING NAME: J:\dairyland power\Alma\421717 - 2020 annual groundwater\0000\421717.01.dwg --- PLOT DATE: April 28, 2021 - 3:59PM --- LAYOUT: FIGURE 2 GROUNDWATER ELEVATION MAP

Version: 2017-03-03



CONSTRUCTION ACTIVITIES

PHASE 2B CLOSURE

1. INSTALL EROSION CONTROL DEVICES.
2. INSTALL GRADING LAYER.
3. INSTALL GCL.
4. INSTALL GEOMEMBRANE.
5. INSTALL SELECT GRANULAR FILL, DRAINAGE PIPING, GEOTEXTILE, ROOTING ZONE LAYER, AND TOPSOIL.
6. INSTALL DIVERSION BERMS.
7. SEED, FERTILIZE, AND MULCH.

PHASE 3 SITE PREPARATION

1. INSTALL EROSION CONTROL DEVICES.
2. INSTALL DOUBLE WALL LEACHATE TRANSFER PIPE WITH ANTI-SEEP COLLAR TO STORAGE TANK.
3. CONSTRUCT PERIMETER BERM, DITCH, AND ACCESS ROAD.
4. ESTABLISH SUBBASE GRADES.
5. UNDERCUT THE COLLECTION LINES.
6. CONSTRUCT THE COMPACTED LOW PERMEABILITY LAYER.
7. EXCAVATE THE LEACHATE COLLECTION LINES.
8. INSTALL LEACHATE COLLECTION LINES AND CLEANOUTS.
9. INSTALL GEOTEXTILE.
10. INSTALL LEACHATE HEADWELLS.
11. PLACE 1-FOOT SELECT GRANULAR FILL.
12. SEED, FERTILIZE, AND MULCH ALL CONSTRUCTION AREAS AT FINISH GRADE.

CONSTRUCTION QUANTITIES

PHASE 2A AND 2B CLOSURE	VOLUME / AREA
TOPSOIL PLACED	3,400 CY
GRADING LAYER SOIL	3,400 CY
GENERAL FILL	6,800 CY
SELECT GRANULAR FILL	6,800 CY
GEOTEXTILE	22,600 SY
GCL	20,300 SY
GEOMEMBRANE	20,300 SY
SEED, FERTILIZER, MULCH	4.5 ARCES
4-INCH DIA. HDPE CORRUGATED PIPE W/ SMOOTH INTERIOR	2,350 LF
SELECT AGGREGATE FILL	350 CY

PHASE 3 SITE PREPARATION	VOLUME / AREA
STRIP TOPSOIL	8,800 CY
FILL TO ESTABLISH SUBBASE GRADE	91,200 CY
CUT TO ESTABLISH SUBBASE GRADE	55,100 CY
GEOSYNTHETIC CLAY LINER (GCL)	34,000 SY
GEOMEMBRANE	34,000 SY
SELECT AGGREGATE FILL	350 CY
GEOTEXTILE (CUSHION)	1,700 SY
SELECT GRADED FILL	400 CY
SELECT GRANULAR FILL	11,300 CY
COMPACTED LOW PERMEABILITY LAYER	22,600 CY
CLEANOUT	1 EACH
TOPSOIL PLACED	3,100 CY
SEED FERTILIZER, MULCH	4.0 ACRES

PIPE LENGTHS	QUANTITIES
6-INCH-DIAMETER (SDR 17) HDPE PERF. LEACHATE COLLECTION PIPE	1,100 LF
6-INCH-DIAMETER (SDR 17) HDPE NON-PERF. LEACHATE PIPE	480 LF
6-INCH-DIAMETER (SDR 17) HDPE DOUBLE WALL LEACHATE TRANSFER PIPE	1,070 LF
3-INCH-DIAMETER (SCHEDULE 120) PVC NON-PERF. LEACHATE HEADWELL PIPE	470 LF

MISCELLANEOUS ITEMS	
ACCESS/HAUL ROAD	1,300 LF
MANHOLES	2 EA
CULVERTS	2 EA
SEDIMENTATION BASIN (TEMPORARY)	1 EA

NOTE: THESE PLANS ARE ACCOMPANIED BY A REPORT OF THE SAME TITLE. THESE DOCUMENTS ARE INTERRELATED AND ARE INTENDED TO BE USED AND REVIEWED TOGETHER . THESE DOCUMENTS ARE INTENDED TO BE USED FOR REGULATORY PURPOSES ONLY.

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

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

SHEET TITLE: **CELL 1, 2A, AND 2B CLOSED**
CELL 3 ACTIVE

DRAWN BY: NOLDENR	SCALE: 1"=100'	PROJ. NO. 3081.40
CHECKED BY: DM		FILE NO. PHASE3.PLT
APPROVED BY: BJK	DATE PRINTED:	SHEET 9 OF 23
DATE: OCTOBER 2000		

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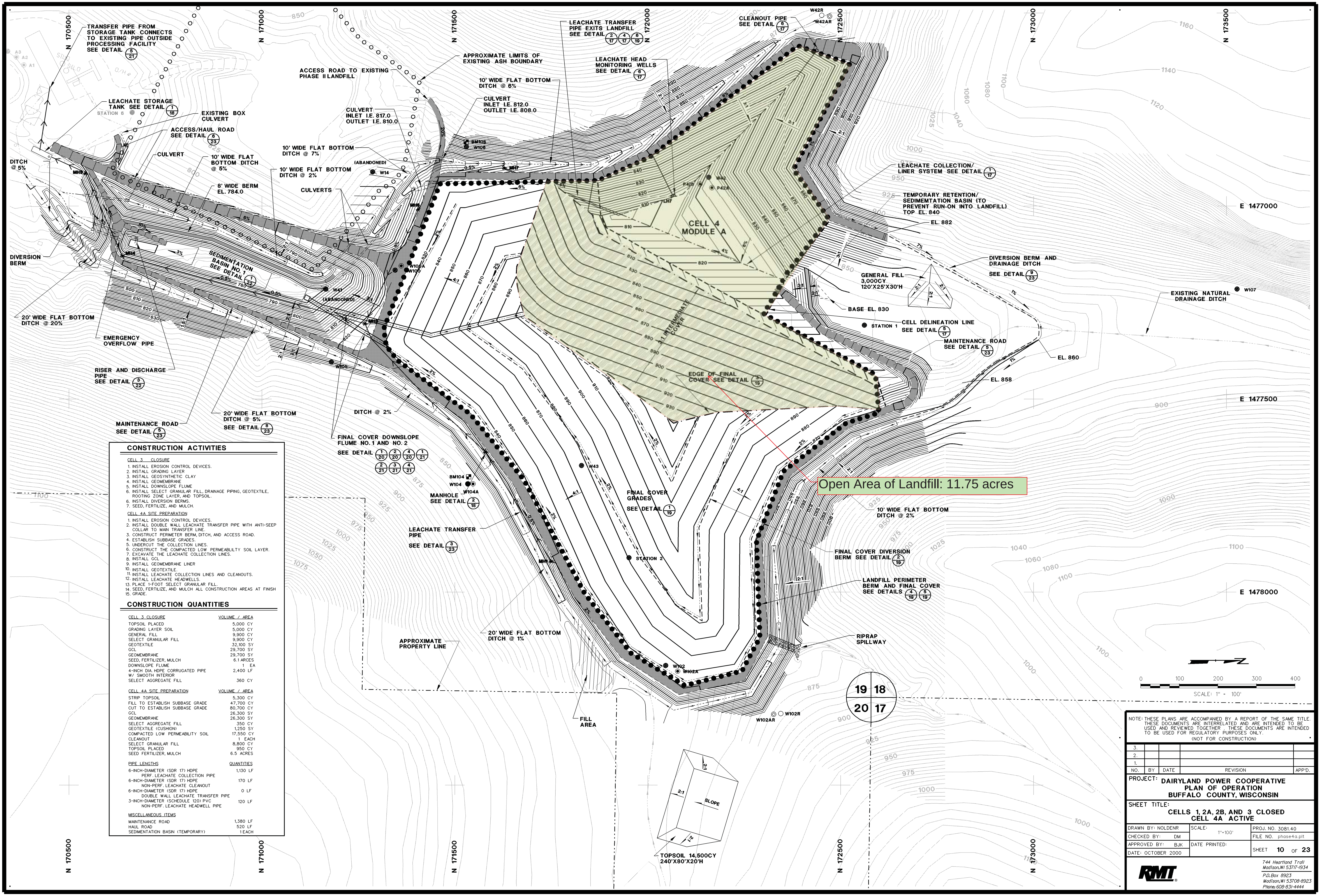

CONSTRUCTION ACTIVITIES

CELL 3 CLOSURE

1. INSTALL EROSION CONTROL DEVICES.
2. INSTALL GRADING LAYER
3. INSTALL GEOSYNTHETIC CLAY
4. INSTALL GEOMEMBRANE
5. INSTALL DOWNSLOPE FLUME
6. INSTALL SELECT GRANULAR FILL, DRAINAGE PIPING, GEOTEXTILE, ROOTING ZONE LAYER, AND TOPSOIL.
6. INSTALL DIVERSION BERMS.
7. SEED, FERTILIZE, AND MULCH.

CELL 4A SITE PREPARATION

1. INSTALL EROSION CONTROL DEVICES.
2. INSTALL DOUBLE WALL LEACHATE TRANSFER PIPE WITH ANTI-SEEP COLLAR TO MAIN TRANSFER LINE.
3. CONSTRUCT PERIMETER BERM, DITCH, AND ACCESS ROAD.
4. ESTABLISH SUBBASE GRADES.
5. UNDERCUT THE COLLECTION LINES.
6. CONSTRUCT THE COMPACTED LOW PERMEABLILTY SOIL LAYER.
7. EXCAVATE THE LEACHATE COLLECTION LINES.
8. INSTALL GCL
9. INSTALL GEOMEMBRANE LINER
10. INSTALL GEOTEXTILE.
11. INSTALL LEACHATE COLLECTION LINES AND CLEANOUTS.
12. INSTALL LEACHATE HEADWELLS.
13. PLACE 1-FOOT SELECT GRANULAR FILL.
14. SEED, FERTILIZE, AND MULCH ALL CONSTRUCTION AREAS AT FINISH
15. GRADE.

CONSTRUCTION QUANTITIES

CELL 3 CLOSURE	VOLUME / AREA
TOPSOIL PLACED	5,000 CY
GRADING LAYER SOIL	5,000 CY
GENERAL FILL	9,900 CY
SELECT GRANULAR FILL	9,900 CY
GEOTEXTILE	32,100 SY
GCL	29,700 SY
GEOMEMBRANE	29,700 SY
SEED, FERTILIZER, MULCH	6.1 ARCES
DOWNSLOPE FLUME	1 EA
4-INCH DIA. HDPE CORRUGATED PIPE W/ SMOOTH INTERIOR	2,400 LF
SELECT AGGREGATE FILL	360 CY

CELL 4A SITE PREPARATION	VOLUME / AREA
STRIP TOPSOIL	5,300 CY
FILL TO ESTABLISH SUBBASE GRADE	47,700 CY
CUT TO ESTABLISH SUBBASE GRADE	80,700 CY
GCL	26,300 SY
GEOMEMBRANE	26,300 SY
SELECT AGGREGATE FILL	350 CY
GEOTEXTILE (CUSHION)	1,250 SY
COMPACTED LOW PERMEABILITY SOIL	17,550 CY
CLEANOUT	1 EACH
SELECT GRANULAR FILL	8,800 CY
TOPSOIL PLACED	950 CY
SEED FERTILIZER, MULCH	6.5 ACRES

PIPE LENGTHS	QUANTITIES
6-INCH-DIAMETER (SDR 17) HDPE PERF. LEACHATE COLLECTION PIPE	1,130 LF
6-INCH-DIAMETER (SDR 17) HDPE NON-PERF. LEACHATE CLEANOUT	170 LF
6-INCH-DIAMETER (SDR 17) HDPE DOUBLE WALL LEACHATE TRANSFER PIPE	0 LF
3-INCH-DIAMETER (SCHEDULE 120) PVC NON-PERF. LEACHATE HEADWELL PIPE	120 LF

MISCELLANEOUS ITEMS	
MAINTENANCE ROAD	1,380 LF
HAUL ROAD	520 LF
SEDIMENTATION BASIN (TEMPORARY)	1 EACH

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(NOT FOR CONSTRUCTION)

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

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

SHEET TITLE:
CELLS 1, 2A, 2B, AND 3 CLOSED
CELL 4A ACTIVE

DRAWN BY: NOLDENR	SCALE: 1"=100'	PROJ. NO. 3081.40
CHECKED BY: DM		FILE NO. phase4a.plt
APPROVED BY: BJK	DATE PRINTED:	SHEET 10 OF 23
DATE: OCTOBER 2000		

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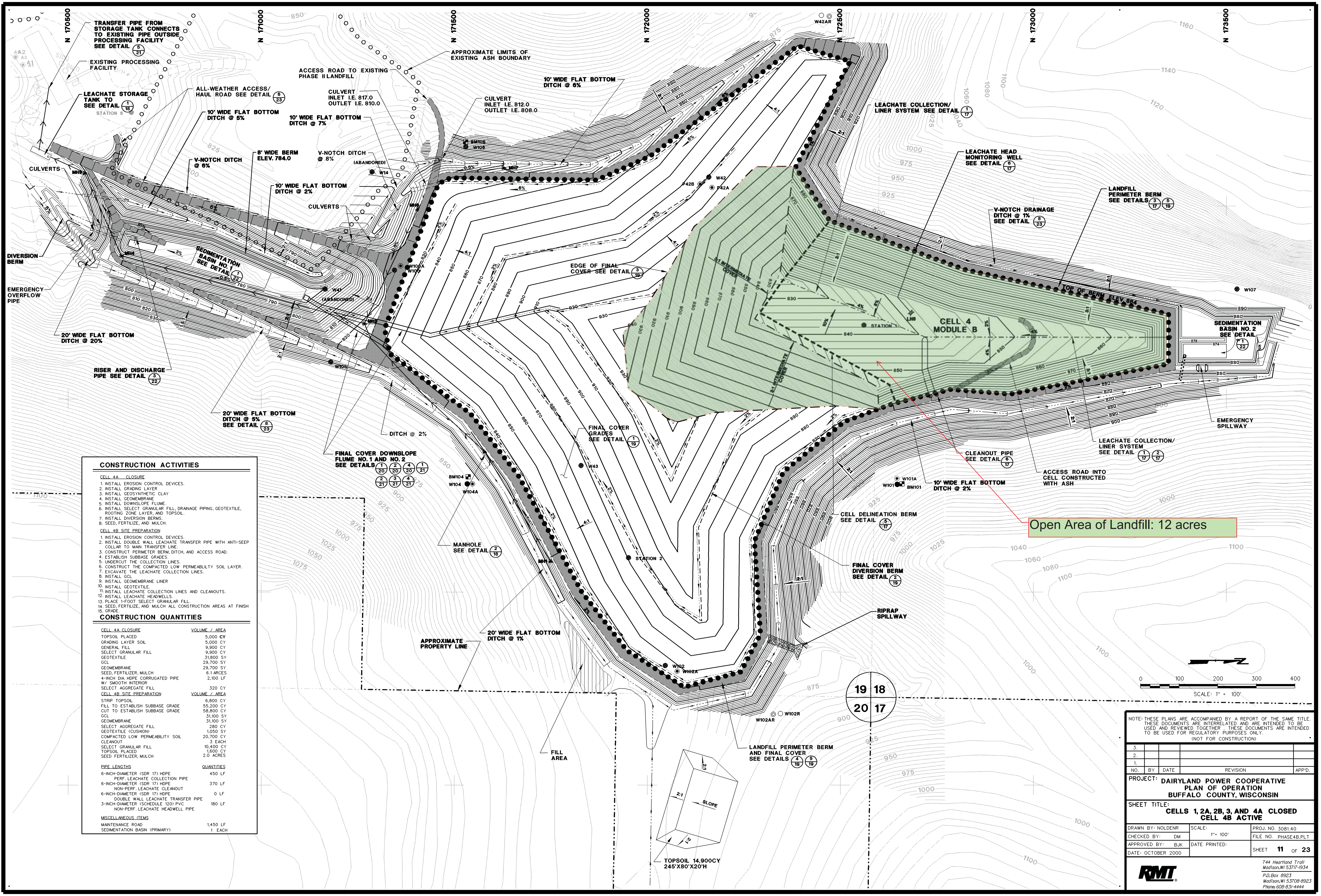

CONSTRUCTION ACTIVITIES

CELL 4A CLOSURE

1. INSTALL EROSION CONTROL DEVICES.
2. INSTALL GRADING LAYER
3. INSTALL GEOSYNTHETIC CLAY
4. INSTALL GEOMEMBRANE
5. INSTALL DOWNSLOPE FLUME.
6. INSTALL SELECT GRANULAR FILL, DRAINAGE PIPING, GEOTEXTILE, ROOTING ZONE LAYER, AND TOPSOIL.
7. INSTALL DIVERSION BERMS.
8. SEED, FERTILIZE, AND MULCH.

CELL 4B SITE PREPARATION

1. INSTALL EROSION CONTROL DEVICES.
2. INSTALL DOUBLE WALL LEACHATE TRANSFER PIPE WITH ANTI-SEEP COLLAR TO MAIN TRANSFER LINE.
3. CONSTRUCT PERIMETER BERM, DITCH, AND ACCESS ROAD.
4. ESTABLISH SUBBASE GRADES.
5. UNDERCUT THE COLLECTION LINES.
6. CONSTRUCT THE COMPACTED LOW PERMEABLILTY SOIL LAYER.
7. EXCAVATE THE LEACHATE COLLECTION LINES.
8. INSTALL GCL
9. INSTALL GEOMEMBRANE LINER
10. INSTALL GEOTEXTILE.
11. INSTALL LEACHATE COLLECTION LINES AND CLEANOUTS.
12. INSTALL LEACHATE HEADWELLS.
13. PLACE 1-FOOT SELECT GRANULAR FILL.
14. SEED, FERTILIZE, AND MULCH ALL CONSTRUCTION AREAS AT FINISH
15. GRADE.

CONSTRUCTION QUANTITIES

CELL 4A CLOSURE	VOLUME / AREA
TOPSOIL PLACED	5,000 CY
GRADING LAYER SOIL	5,000 CY
GENERAL FILL	9,900 CY
SELECT GRANULAR FILL	9,900 CY
GEOTEXTILE	31,800 SY
GCL	29,700 SY
GEOMEMBRANE	29,700 SY
SEED, FERTILIZER, MULCH	6.1 ARCES
4-INCH DIA. HDPE CORRUGATED PIPE W/ SMOOTH INTERIOR	2,100 LF
SELECT AGGREGATE FILL	320 CY
CELL 4B SITE PREPARATION	VOLUME / AREA
STRIP TOPSOIL	6,800 CY
FILL TO ESTABLISH SUBBASE GRADE	55,200 CY
CUT TO ESTABLISH SUBBASE GRADE	58,800 CY
GCL	31,100 SY
GEOMEMBRANE	31,100 SY
SELECT AGGREGATE FILL	280 CY
GEOTEXTILE (CUSHION)	1,050 SY
COMPACTED LOW PERMEABILITY SOIL	20,700 CY
CLEANOUT	3 EACH
SELECT GRANULAR FILL	10,400 CY
TOPSOIL PLACED	1,600 CY
SEED FERTILIZER, MULCH	2.0 ACRES
PIPE LENGTHS	QUANTITIES
6-INCH-DIAMETER (SDR 17) HDPE PERF. LEACHATE COLLECTION PIPE	450 LF
6-INCH-DIAMETER (SDR 17) HDPE NON-PERF. LEACHATE CLEANOUT	370 LF
6-INCH-DIAMETER (SDR 17) HDPE DOUBLE WALL LEACHATE TRANSFER PIPE	0 LF
3-INCH-DIAMETER (SCHEDULE 120) PVC NON-PERF. LEACHATE HEADWELL PIPE	180 LF
MISCELLANEOUS ITEMS	
MAINTENANCE ROAD	1,450 LF
SEDIMENTATION BASIN (PRIMARY)	1 EACH

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

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

SHEET TITLE: **CELLS 1, 2A, 2B, 3, AND 4A CLOSED**
CELL 4B ACTIVE

DRAWN BY: NOLDENR	SCALE: 1"= 100'	PROJ. NO. 3081.40
CHECKED BY: DM		FILE NO. PHASE4B.PLT
APPROVED BY: BJK	DATE PRINTED:	SHEET 11 OF 23
DATE: OCTOBER 2000		

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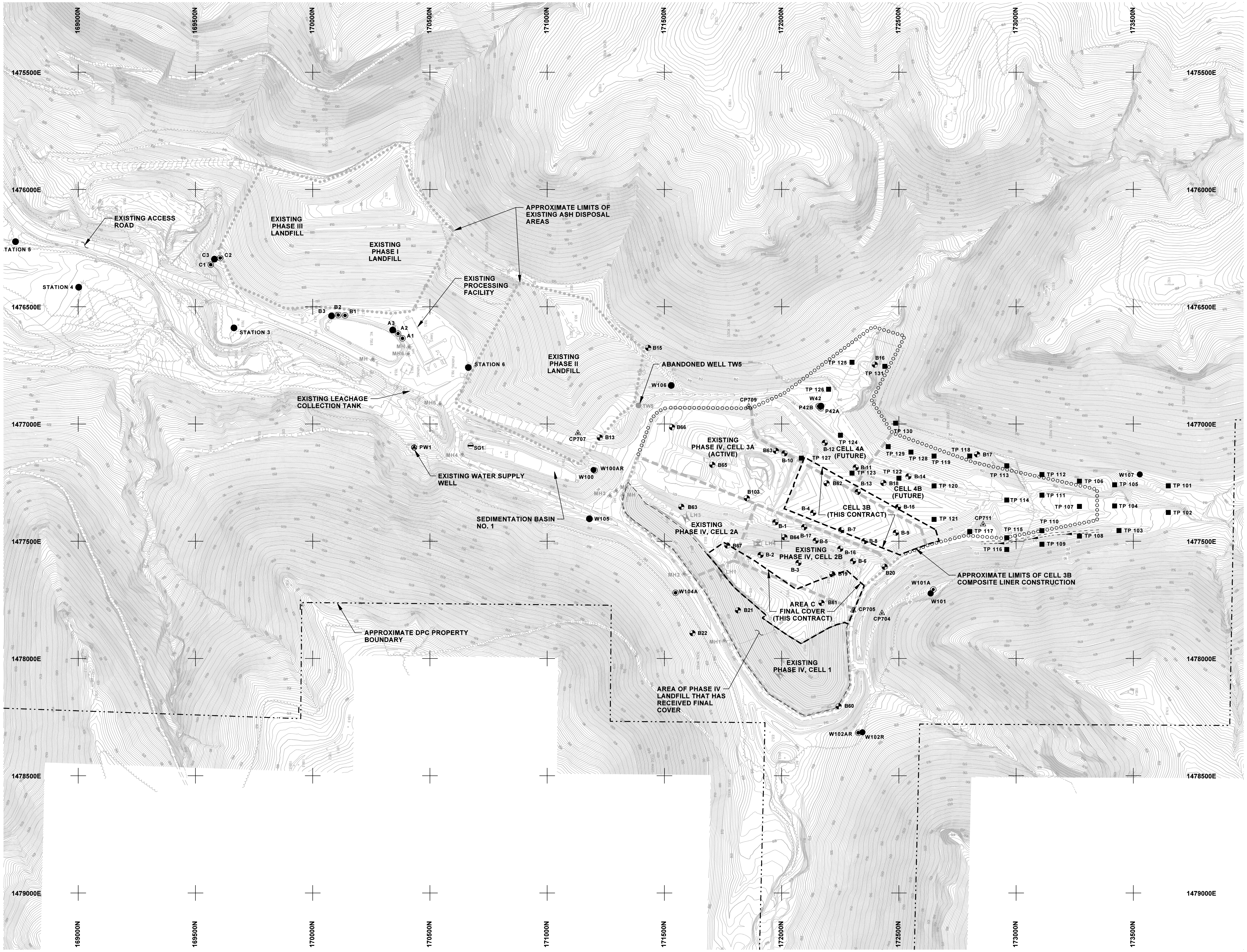
Appendix C: Relevant October 2000 POO Plan Sheets

- Sheet 3 Existing Conditions Map – Phase IV, Cell 3B Liner & Area C (Over Cells 1 & 2) Final Cover Construction
- Sheet 5 Proposed Base Grades
- Sheet 9 Phasing Plan – Cell 1, 2A, and 2B Closed; Cell 3 Active
- Sheet 11 Phasing Plan – Cell 1, 2A, 2B, 3, and 4A Closed; Cell 4B Active
- Sheet 12 Proposed Final Grades
- Sheet 17 Details – Liner and Collection Pipes
- Sheet 19 Details – Final Cover
- Sheet 22 Details – Sedimentation Basins
- Sheet 23 Details – Miscellaneous

NOTES

1. REFER TO PLAN SHEET 2 FOR STANDARD LEGEND, NOTES, AND BENCHMARK LOCATIONS.



0 200 400 600 800

SCALE IN FEET

NOTE: THE CONTRACTOR SHALL NOTIFY ALL AREA UTILITY COMPANIES PRIOR TO COMMENCING WORK ON THIS CONTRACT, IN ACCORDANCE WITH STATE AND LOCAL REQUIREMENTS.

NOTE: THESE PLANS ARE ACCOMPANIED BY A PROJECT MANUAL OF THE SAME TITLE. THESE DOCUMENTS ARE INTERRELATED AND ARE INTENDED TO BE USED TOGETHER.

NO.	BY	DATE	REVISION	APP'D.

PROJECT:
DAIRYLAND POWER COOPERATIVE
PHASE IV, CELL 3B LINER & AREA C (OVER CELLS 1 & 2)
FINAL COVER CONSTRUCTION
BUFFALO COUNTY, WISCONSIN

SHEET TITLE:

EXISTING CONDITIONS MAP

DRAWN BY: lstormer	SCALE: AS SHOWN	PROJ. NO. 216851.0004
CHECKED BY: DM		FILE NO. 215851.0004.SHT03-EC.PLT
APPROVED BY: TWM	DATE PRINTED:	SHEET 3 OF 13
DATE: MARCH 2015		

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Phone: 608.826.3600

Plot Data
Design File J:\Dairyland Power\Alma\216851\0004\216851.0004.SHT03-EC.PLT
lstormer
Plot File = J:\Dairyland Power\Alma\216851\0004\216851.0004.SHT03-EC.prf
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Ref. File 10 = *no ref name* (10) *no ref logical* (10) *no ref levels*

NOTE:

GRADES SHOWN INSIDE THE TOP OF THE PERIMTER BERM REPRESENT THE TOP OF THE 2-FOOT-THICK LOW PERMEABILITY SUBBASE SOIL LAYER.

GRADES SHOWN ON TOP AND OUTSIDE THE PERIMETER BERM REPRESENT THE TOP OF TOPSOIL

NOTE: THESE PLANS ARE ACCOMPANIED BY A REPORT OF THE SAME TITL THESE DOCUMENTS ARE INTERRELATED AND ARE INTENDED TO BE USED AND REVIEWED TOGETHER . THESE DOCUMENTS ARE INTENDE TO BE USED FOR REGULATORY PURPOSES ONLY.

(NOT FOR CONSTRUCTION)

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

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

SHEET TITLE:

PROPOSED BASE GRADES

DRAWN BY: reyzekd
CHECKED BY: DM
APPROVED BY: BJK
DATE: OCTOBER 2000
SCALE: 1"=100'
DATE PRINTED:
PROJ. NO. 3081.40
FILE NO. BASEGRDS.PLT
SHEET 5 OF 23

RMT

744 Heartland Trail
Madison, WI 53717-1934

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

CONSTRUCTION ACTIVITIES

PHASE 2B CLOSURE

1. INSTALL EROSION CONTROL DEVICES.
2. INSTALL GRADING LAYER.
3. INSTALL GCL.
4. INSTALL GEOMEMBRANE.
5. INSTALL SELECT GRANULAR FILL, DRAINAGE PIPING, GEOTEXTILE, ROOTING ZONE LAYER, AND TOPSOIL.
6. INSTALL DIVERSION BERMS.
7. SEED, FERTILIZE, AND MULCH.

PHASE 3 SITE PREPARATION

1. INSTALL EROSION CONTROL DEVICES.
2. INSTALL DOUBLE WALL LEACHATE TRANSFER PIPE WITH ANTI-SEEP COLLAR TO STORAGE TANK.
3. CONSTRUCT PERIMETER BERM, DITCH, AND ACCESS ROAD.
4. ESTABLISH SUBBASE GRADES.
5. UNDERCUT THE COLLECTION LINES.
6. CONSTRUCT THE COMPACTED LOW PERMEABILITY LAYER.
7. EXCAVATE THE LEACHATE COLLECTION LINES.
8. INSTALL LEACHATE COLLECTION LINES AND CLEANOUTS.
9. INSTALL GEOTEXTILE.
10. INSTALL LEACHATE HEADWELLS.
11. PLACE 1-FOOT SELECT GRANULAR FILL.
12. SEED, FERTILIZE, AND MULCH ALL CONSTRUCTION AREAS AT FINISH GRADE.

CONSTRUCTION QUANTITIES

PHASE 2A AND 2B CLOSURE	VOLUME / AREA
TOPSOIL PLACED	3,400 CY
GRADING LAYER SOIL	3,400 CY
GENERAL FILL	6,800 CY
SELECT GRANULAR FILL	6,800 CY
GEOTEXTILE	22,600 SY
GCL	20,300 SY
GEOMEMBRANE	20,300 SY
SEED, FERTILIZER, MULCH	4.5 ARCES
4-INCH DIA. HDPE CORRUGATED PIPE W/ SMOOTH INTERIOR	2,350 LLF
SELECT AGGREGATE FILL	350 CY

PHASE 3 SITE PREPARATION	VOLUME / AREA
STRIP TOPSOIL	8,800 CY
FILL TO ESTABLISH SUBBASE GRADE	91,200 CY
CUT TO ESTABLISH SUBBASE GRADE	55,100 CY
GEOSYNTHETIC CLAY LINER (GCL)	34,000 SY
GEOMEMBRANE	34,000 SY
SELECT AGGREGATE FILL	350 CY
GEOTEXTILE (CUSHION)	1,700 SY
SELECT GRADED FILL	400 CY
SELECT GRANULAR FILL	11,300 CY
COMPACTED LOW PERMEABILITY LAYER	22,600 CY
CLEANOUT	1 EACH
TOPSOIL PLACED	3,100 CY
SEED FERTILIZER, MULCH	4.0 ACRES

PIPE LENGTHS	QUANTITIES
6-INCH-DIAMETER (SDR 17) HDPE PERF. LEACHATE COLLECTION PIPE	1,100 LF
6-INCH-DIAMETER (SDR 17) HDPE NON-PERF. LEACHATE PIPE	480 LF
6-INCH-DIAMETER (SDR 17) HDPE DOUBLE WALL LEACHATE TRANSFER PIPE	1,070 LF
3-INCH-DIAMETER (SCHEDULE 120) PVC NON-PERF. LEACHATE HEADWELL PIPE	470 LF

MISCELLANEOUS ITEMS	
ACCESS/HAUL ROAD	1,300 LF
MANHOLES	2 EA
CULVERTS	2 EA
SEDIMENTATION BASIN (TEMPORARY)	1 EA

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

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

SHEET TITLE:
CELL 1, 2A, AND 2B CLOSED
CELL 3 ACTIVE

DRAWN BY: NOLDENR	SCALE: 1"=100'	PROJ. NO. 3081.40
CHECKED BY: DM		FILE NO. PHASE3.PLT
APPROVED BY: BJK	DATE PRINTED:	SHEET 9 OF 23
DATE: OCTOBER 2000		

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CONSTRUCTION ACTIVITIES

CELL 4A CLOSURE

1. INSTALL EROSION CONTROL DEVICES.
2. INSTALL GRADING LAYER
3. INSTALL GEOSYNTHETIC CLAY
4. INSTALL GEOMEMBRANE
5. INSTALL DOWNSLOPE FLUME.
6. INSTALL SELECT GRANULAR FILL, DRAINAGE PIPING, GEOTEXTILE, ROOTING ZONE LAYER, AND TOPSOIL.
7. INSTALL DIVERSION BERMS.
8. SEED, FERTILIZE, AND MULCH.

CELL 4B SITE PREPARATION

1. INSTALL EROSION CONTROL DEVICES.
2. INSTALL DOUBLE WALL LEACHATE TRANSFER PIPE WITH ANTI-SEEP COLLAR TO MAIN TRANSFER LINE.
3. CONSTRUCT PERIMETER BERM, DITCH, AND ACCESS ROAD.
4. ESTABLISH SUBBASE GRADES.
5. UNDERCUT THE COLLECTION LINES.
6. CONSTRUCT THE COMPACTED LOW PERMEABLILTY SOIL LAYER.
7. EXCAVATE THE LEACHATE COLLECTION LINES.
8. INSTALL GCL
9. INSTALL GEOMEMBRANE LINER
10. INSTALL GEOTEXTILE.
11. INSTALL LEACHATE COLLECTION LINES AND CLEANOUTS.
12. INSTALL LEACHATE HEADWELLS.
13. PLACE 1-FOOT SELECT GRANULAR FILL.
14. SEED, FERTILIZE, AND MULCH ALL CONSTRUCTION AREAS AT FINISH
15. GRADE.

CONSTRUCTION QUANTITIES

CELL 4A CLOSURE	VOLUME / AREA
TOPSOIL PLACED	5,000 CY
GRADING LAYER SOIL	5,000 CY
GENERAL FILL	9,900 CY
SELECT GRANULAR FILL	9,900 CY
GEOTEXTILE	31,800 SY
GCL	29,700 SY
GEOMEMBRANE	29,700 SY
SEED, FERTILIZER, MULCH	6.1 ARCES
4-INCH DIA. HDPE CORRUGATED PIPE W/ SMOOTH INTERIOR	2,100 LF
SELECT AGGREGATE FILL	320 CY
CELL 4B SITE PREPARATION	**VOLUME / AREA**
STRIP TOPSOIL	6,800 CY
FILL TO ESTABLISH SUBBASE GRADE	55,200 CY
CUT TO ESTABLISH SUBBASE GRADE	58,800 CY
GCL	31,100 SY
GEOMEMBRANE	31,100 SY
SELECT AGGREGATE FILL	280 CY
GEOTEXTILE (CUSHION)	1,050 SY
COMPACTED LOW PERMEABILITY SOIL	20,700 CY
CLEANOUT	3 EACH
SELECT GRANULAR FILL	10,400 CY
TOPSOIL PLACED	1,600 CY
SEED FERTILIZER, MULCH	2.0 ACRES

PIPE LENGTHS	QUANTITIES
6-INCH-DIAMETER (SDR 17) HDPE PERF. LEACHATE COLLECTION PIPE	450 LF
6-INCH-DIAMETER (SDR 17) HDPE NON-PERF. LEACHATE CLEANOUT	370 LF
6-INCH-DIAMETER (SDR 17) HDPE DOUBLE WALL LEACHATE TRANSFER PIPE	0 LF
3-INCH-DIAMETER (SCHEDULE 120) PVC NON-PERF. LEACHATE HEADWELL PIPE	180 LF

MISCELLANEOUS ITEMS	
MAINTENANCE ROAD	1,450 LF
SEDIMENTATION BASIN (PRIMARY)	1 EACH

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

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

SHEET TITLE:
CELLS 1, 2A, 2B, 3, AND 4A CLOSED
CELL 4B ACTIVE

DRAWN BY: NOLDENR	SCALE: 1"= 100'	PROJ. NO. 3081.40
CHECKED BY: DM		FILE NO. PHASE4B.PLT
APPROVED BY: BJK	DATE PRINTED:	SHEET **11** OF **23**
DATE: OCTOBER 2000		

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0 100 200 300 400

SCALE: 1" = 100'

CONSTRUCTION ACTIVITIES

PHASE 4B CLOSURE

1. INSTALL EROSION CONTROL DEVICES.
2. INSTALL GRADING LAYER.
3. INSTALL GCL.
4. INSTALL GEOMEMBRANE.
5. INSTALL DOWNSLOPE FLUME.
6. INSTALL SELECT GRANULAR FILL, DRAINAGE PIPING, GEOTEXTILE, ROOTING ZONE LAYER, AND TOPSOIL.
7. INSTALL DIVERSION BERMS.
8. SEED, FERTILIZE, AND MULCH.

CONSTRUCTION QUANTITIES

PHASE 4B CLOSURE	VOLUME / AREA
TOPSOIL PLACED	
GRADING LAYER SOIL	9,800 CY
GENERAL FILL	9,800 CY
SELECT GRANULAR FILL	19,600 CY
GEOTEXTILE	19,600 CY
GCL	61,700 SY
GEOMEMBRANE	58,600 SY
SEED, FERTILZER, MULCH	58.600 SY
DOWNSLOPE FLUME	12.1 ACRES
4-INCH DIA. HDPE CORRUGATED PIPT	1 EACH
W/ SMOOTH INTERIOR	3,150 LF
SELECT AGGREGATE FILL	470 CY

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

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

SHEET TITLE:

PROPOSED FINAL GRADES

DRAWN BY: NOLDENR	SCALE: 1"=100'	PROJ. NO. 3081.40
CHECKED BY: DM		FILE NO. FGRADES.PLT
APPROVED BY: BJK	DATE PRINTED:	SHEET 12 OF 23
DATE: OCTOBER 2000		

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Plot Data
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USER1NOLDENR
Plot File - J:\03081\40\FGRADES_pdf.prf
Pen Table - \\msn-plot\eQuorum$\TBL\MSV8 - KIP PDF.tbl
Plotter - MS PDF B&W 300dpi
Scale - 1:100.000000
Rotation - 90.000000
Plot Date - Thu Sep 17 07:57:45 2009
Levels On - 1,3,6-8,29,45,56,58

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Ref. File 6 - J:\03081\40\border.dgn	(6) bdr	(6) 1-6,9,11,13,63
Ref. File 7 - J:\03081\40\pipe.dgn	(7) pip	(7) 3,4,16,18,22
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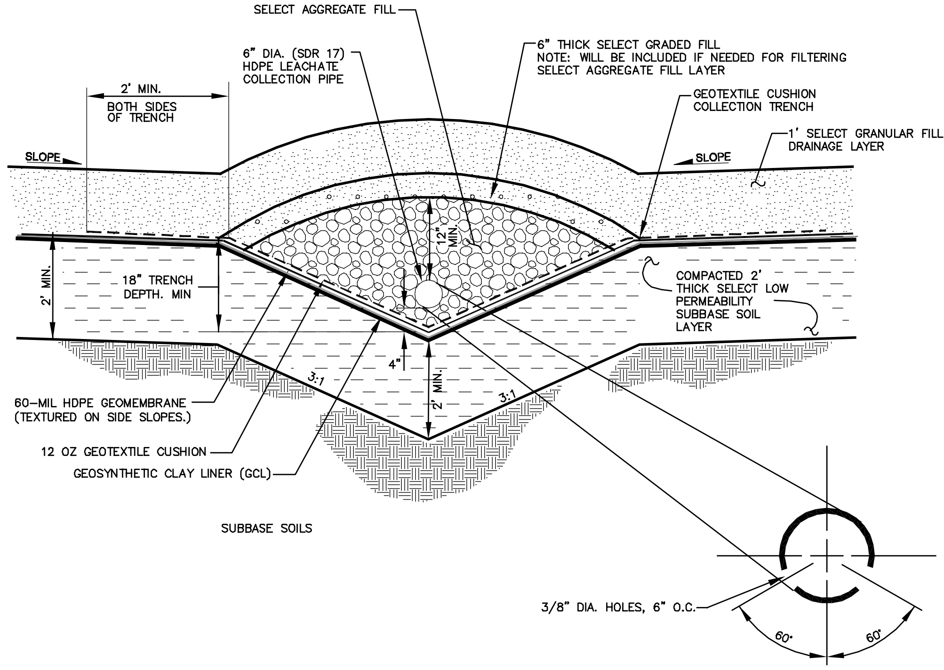
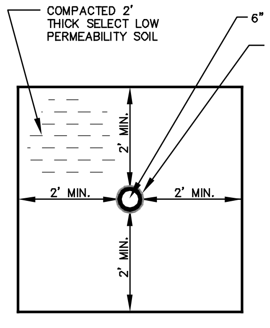


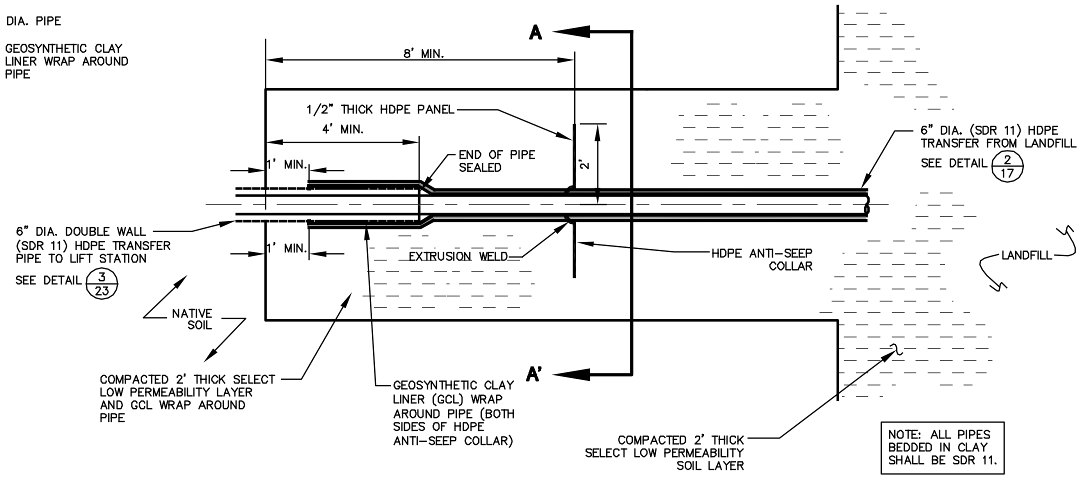
1
17

LEACHATE COLLECTION/LINER SYSTEM

(NOT TO SCALE)



SECTION A-A'

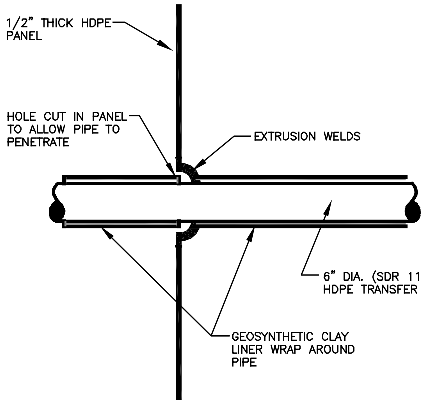


NOTE: ALL PIPES BEDDED IN CLAY SHALL BE SDR 11.

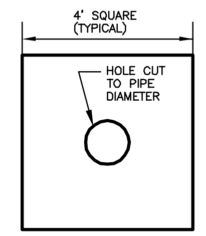
4
17

LEACHATE TRANSFER PIPE CLAY TRENCH CUT-OFF THROUGH PERIMETER BERM (TYPICAL)

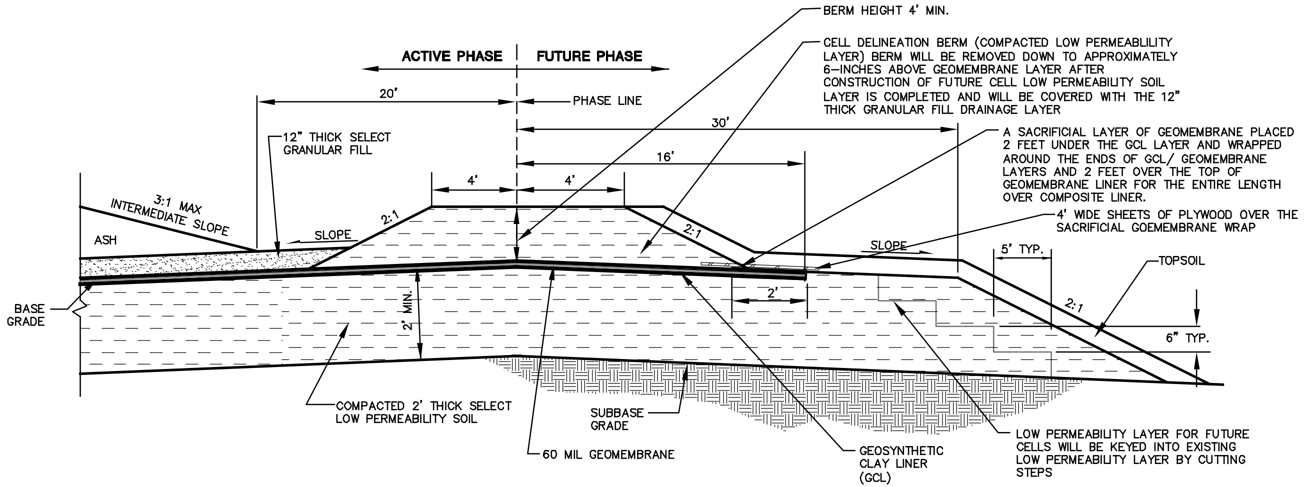
(NOT TO SCALE)



HDPE ANTI-SEEP COLLAR DETAIL (TYPICAL)



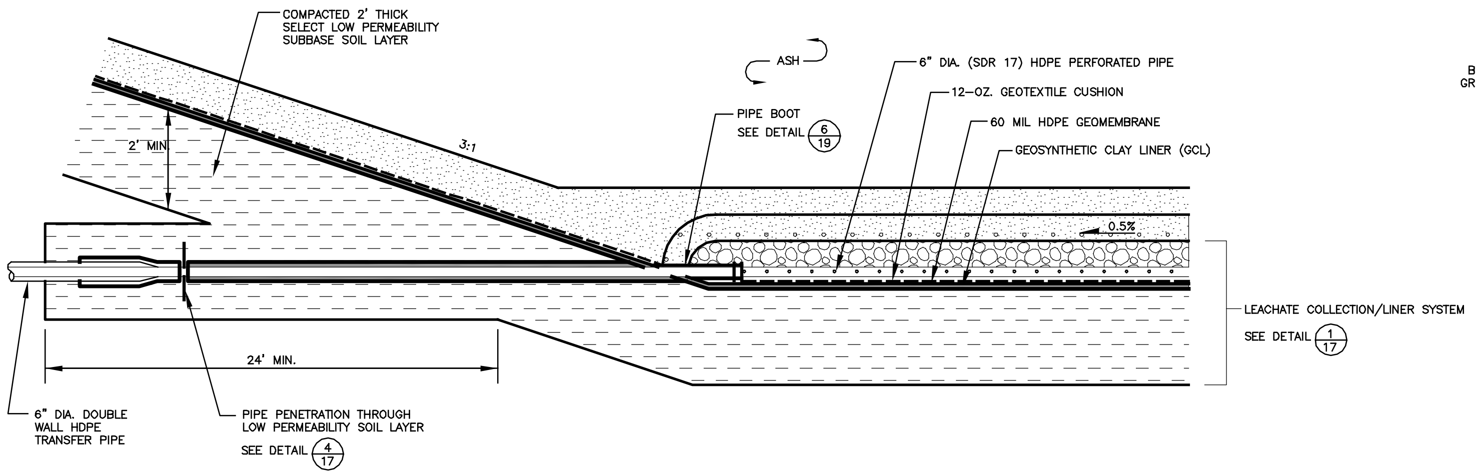
1/2" THICK HDPE PANEL



5
17

CELL DELINEATION BERM

(NOT TO SCALE)

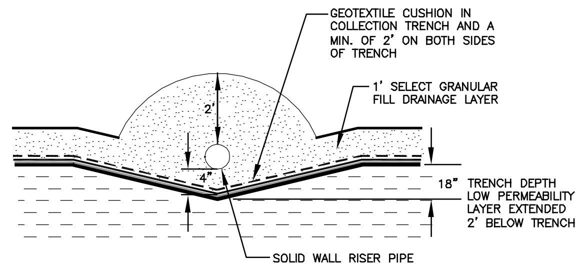


2
17

PIPE PENETRATION THROUGH LANDFILL PERIMETER BERM (TYPICAL)

(NOT TO SCALE)

LOOKING EAST



CROSS SECTION A-A'

RISER PIPE

LINE AND SHADING LEGEND			
- - - - -	GEOTEXTILE	▬▬▬	GEOMEMBRANE
▭	GEOCOMPOSITE	▬▬▬	GEOSYNTHETIC CLAY LINER (GCL)
▨	TOPSOIL	▦	NATIVE SOIL
░	SELECT GRANULAR FILL DRAINAGE LAYER	░	CONCRETE
░	PIPE BEDDING MATERIAL	▢	RIPRAP
▢	SELECT AGGREGATE FILL	▩	GRAVEL
— — —	COMPACTED SELECT LOW PERMEABILITY SOIL	⁄ −	GENERAL FILL

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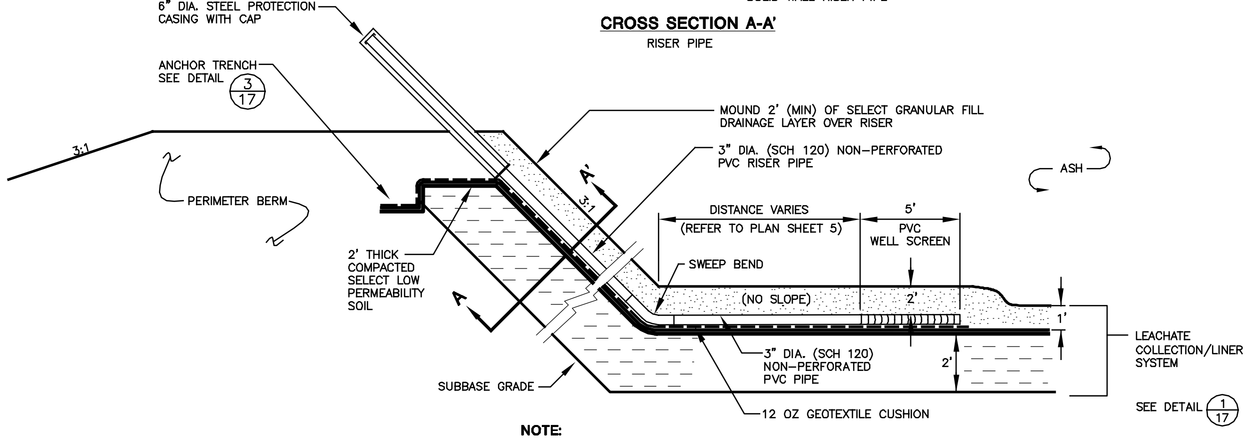


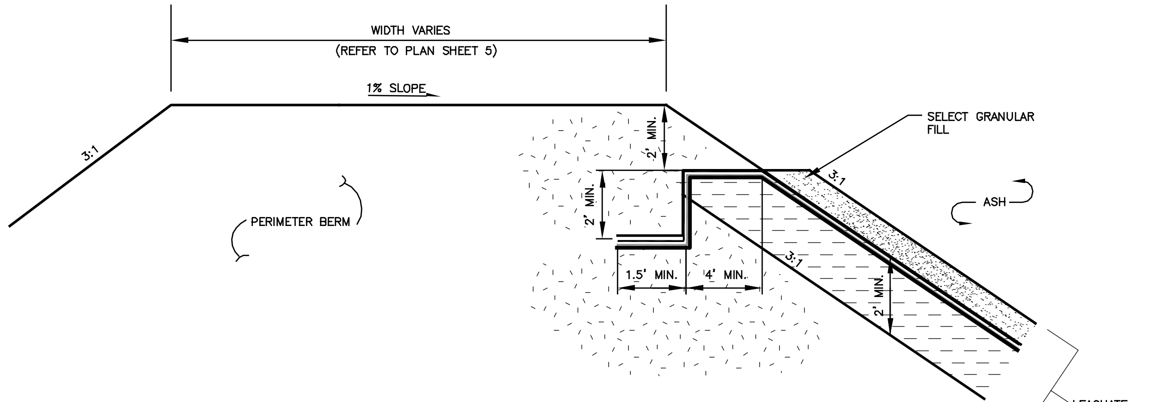
NOTE:
LEACHATE HEADWELL WILL LIE HORIZONTALLY ON TOP OF LINER AND WITHIN 12" SELECT GRANULAR FILL DRAINAGE LAYER.

PIPE CONSTRUCTION ON BERM SIDE SLOPE IS ALSO TYPICAL FOR LEACHATE CLEANOUT PIPES.

6
17

LEACHATE HEADWELL

(NOT TO SCALE)



3
17

BERM/ ANCHOR TRENCH

(NOT TO SCALE)

NO.	BY	DATE	REVISION	APP'D.
3.				
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PROJECT: **DAIRYLAND POWER COOPERATIVE**
PLAN OF OPERATION
BUFFALO COUNTY, WISCONSIN

SHEET TITLE:
DETAILS- LINER AND COLLECTION PIPES

DRAWN BY: **DEFOEJ**	SCALE: **NOT TO SCALE**	PROJ. NO. **3081.40**
CHECKED BY: **DM**		FILE NO. **30814005.DWG**
APPROVED BY: **BJK**	DATE PRINTED:	SHEET **17** OF **23**
DATE: OCTOBER 2000		

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PLOT DATA
$$DWG$$
$$USER$$ $$SCALE$$
$$PRF$$ $$ROT$$
$$PTABLE$$ $$SYTIME$$
$$PLOTTER$$ Attached Xref's: No xref's Attached.

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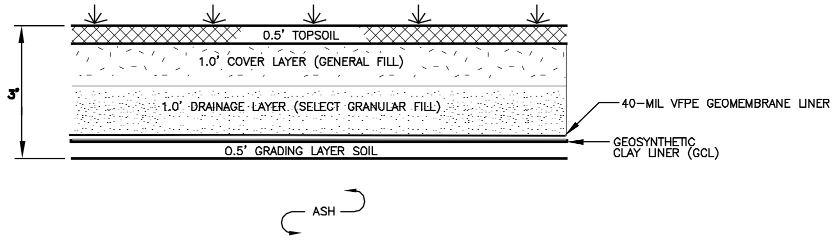
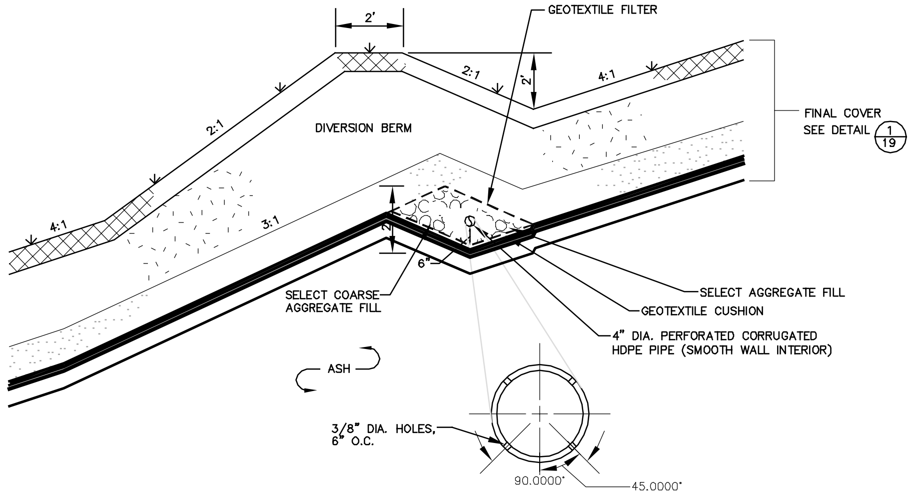


1/19 **FINAL COVER**

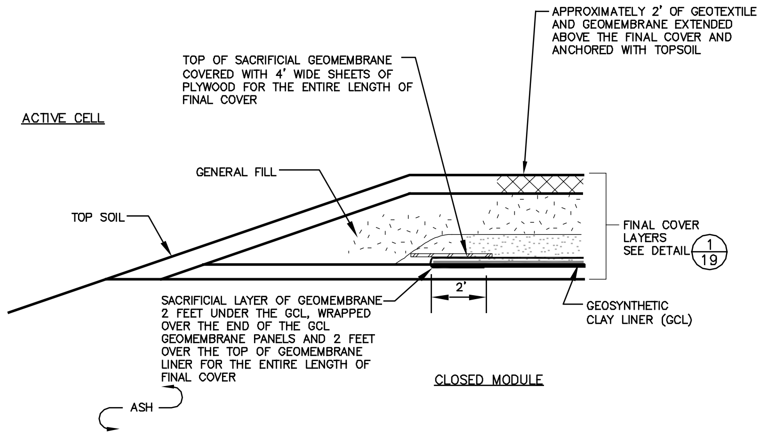
(NOT TO SCALE)



NOTE:
A 4" DIA. PERFORATED CORRUGATED HDPE PIPE WILL BE LOCATED BELOW EVERY DIVERSION BERM ABOVE THE FINAL COVER EXCEPT THE LOWEST BERM LOCATED NEXT TO THE LANDFILL PERIMETER BERM. TO COLLECT WATER IN THE DRAINAGE LAYER ALONG THE PERIMETER BERM PIPES WILL BE CONSTRUCTED IN THE BERM AS SHOWN ON DETAIL 4 OF 19.

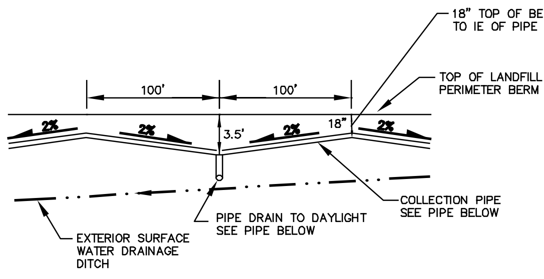
2/19 **SURFACE WATER DIVERSION BERM ON FINAL COVER (TYPICAL)**

(NOT TO SCALE)



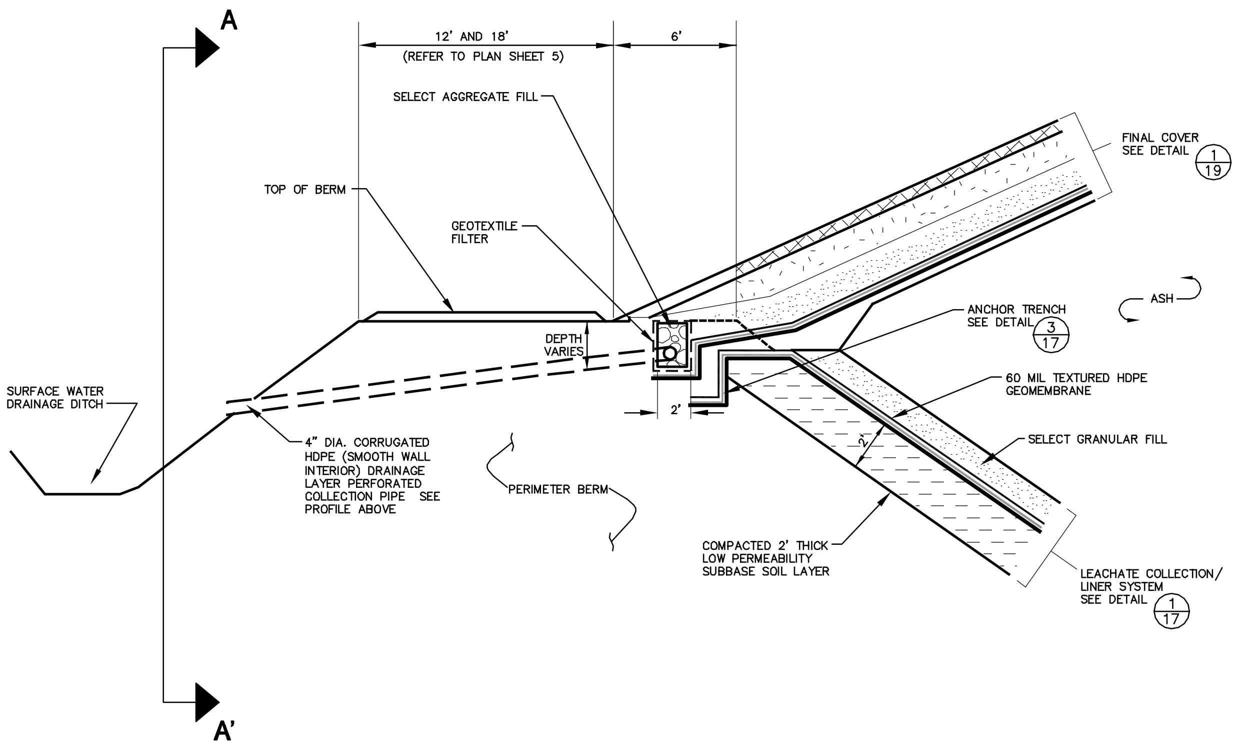
3/19 **CONSTRUCTION OF FINAL COVER FOR SPLICING FUTURE FINAL COVER**

(NOT TO SCALE)



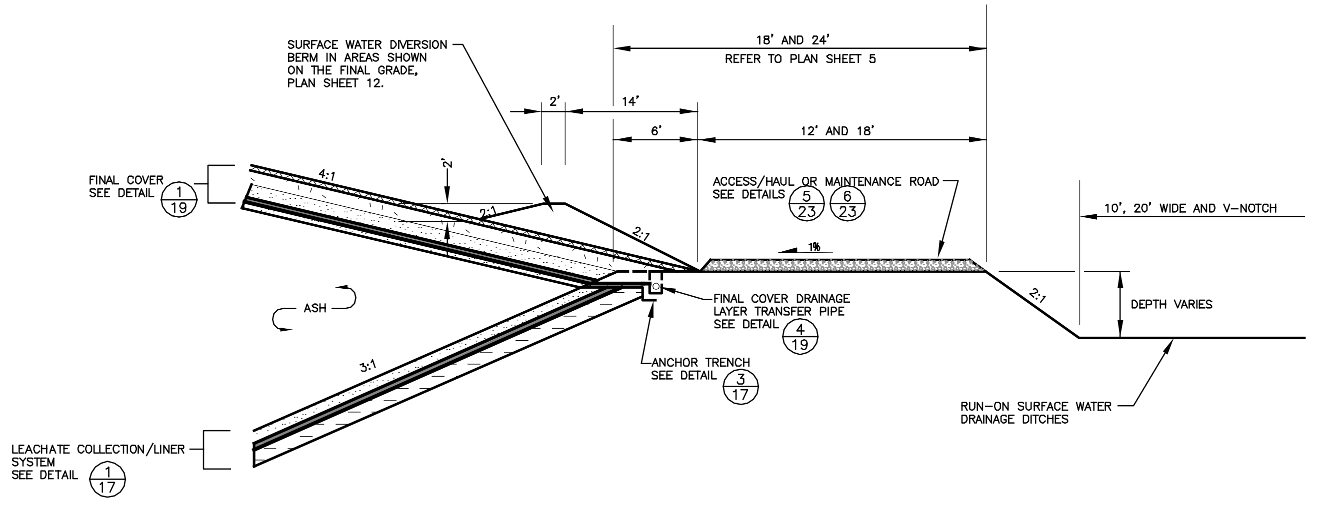
NOTE: IN AREAS WHERE THE TOP OF BERM SLOPES, THE COLLECTION PIPE WILL FOLLOW THE SAME SLOPE AS THE TOP OF BERM AND WILL OUTLET THROUGH DISCHARGE PIPES LOCATED AT SPECIFIED INTERVALS. REFER TO PLAN SHEET 12.

SECTION A-A' OF FINAL COVER DRAINAGE LAYER



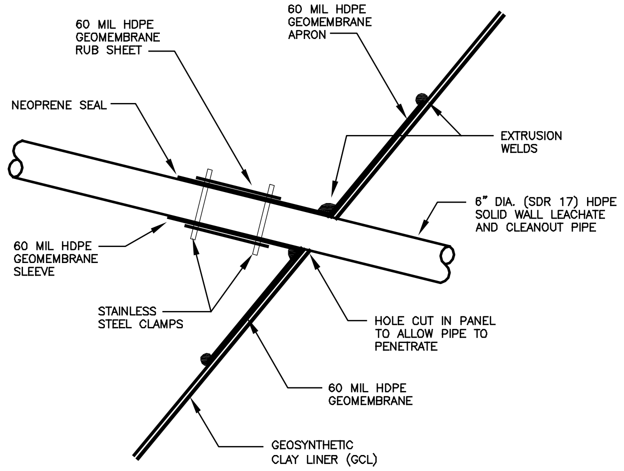
4/19 **PERIMETER BERM FINAL COVER DRAINAGE LAYER DISCHARGE PIPE (TYPICAL)**

(NOT TO SCALE)



5/19 **LANDFILL PERIMETER BERM AND SURFACE WATER DRAINAGE DITCHES (TYPICAL)**

(NOT TO SCALE)



6/19 **PIPE BOOT- PIPES PENETRATING THROUGH FINAL COVER AND LOW PERMEABILITY LAYER (TYPICAL)**

(NOT TO SCALE)

LINE AND SHADING LEGEND

– – – –	GEOTEXTILE	———	GEOMEMBRANE
≈≈≈≈	GEOCOMPOSITE	▬▬▬	GEOSYNTHETIC CLAY LINER (GCL)
▨	TOPSOIL	▦	NATIVE SOIL
░	SELECT GRANULAR FILL DRAINAGE LAYER	░	CONCRETE
░	PIPE BEDDING MATERIAL	▨	RIPRAP
▨	SELECT AGGREGATE FILL	▓	GRAVEL
☐	COMPACTED SELECT LOW PERMEABILITY SOIL	☐	GENERAL FILL

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

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

SHEET TITLE:
DETAILS- FINAL COVER

DRAWN BY: **DEFOEJ**
CHECKED BY: **DM**
APPROVED BY: **BJK**
DATE: OCTOBER 2000
SCALE: **NOT TO SCALE**
DATE PRINTED:
PROJ. NO. **3081.40**
FILE NO.**30814004.dwg**
SHEET **19** OF **23**

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$$SCALE$$
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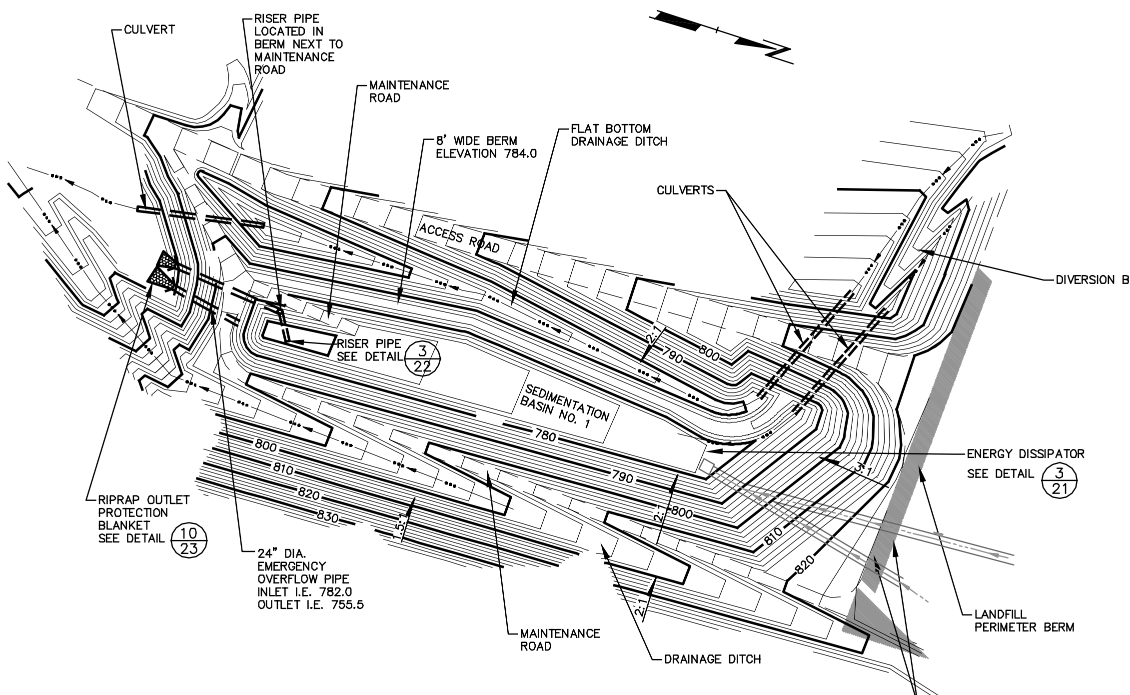
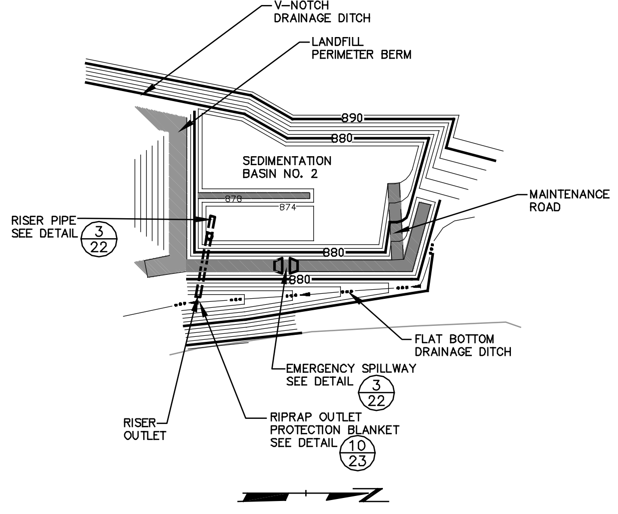


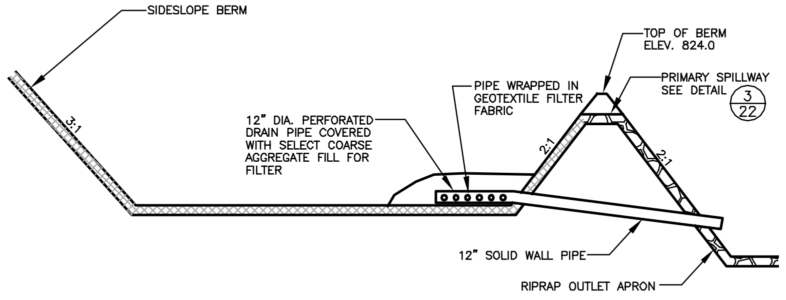
SEDIMENTATION BASIN #1
PLAN VIEW
NTS



SEDIMENTATION BASIN #2
PLAN VIEW
NTS

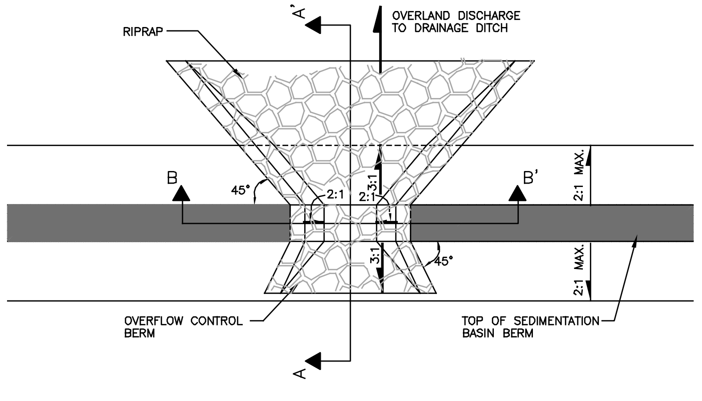
1/22 SEDIMENTATION BASINS NO. 1 AND NO. 2

(NOT TO SCALE)



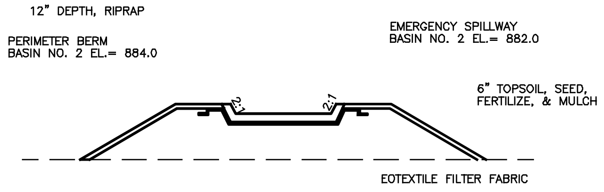
2/22 TEMPORARY SEDIMENTATION BASIN (TYPICAL)

(NOT TO SCALE)

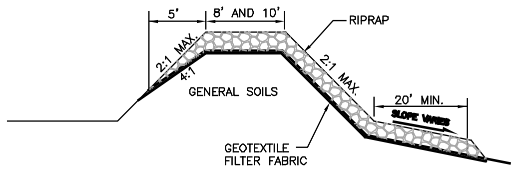


SURFACE WATER PRIMARY OR EMERGENCY SPILLWAY
PLAN VIEW

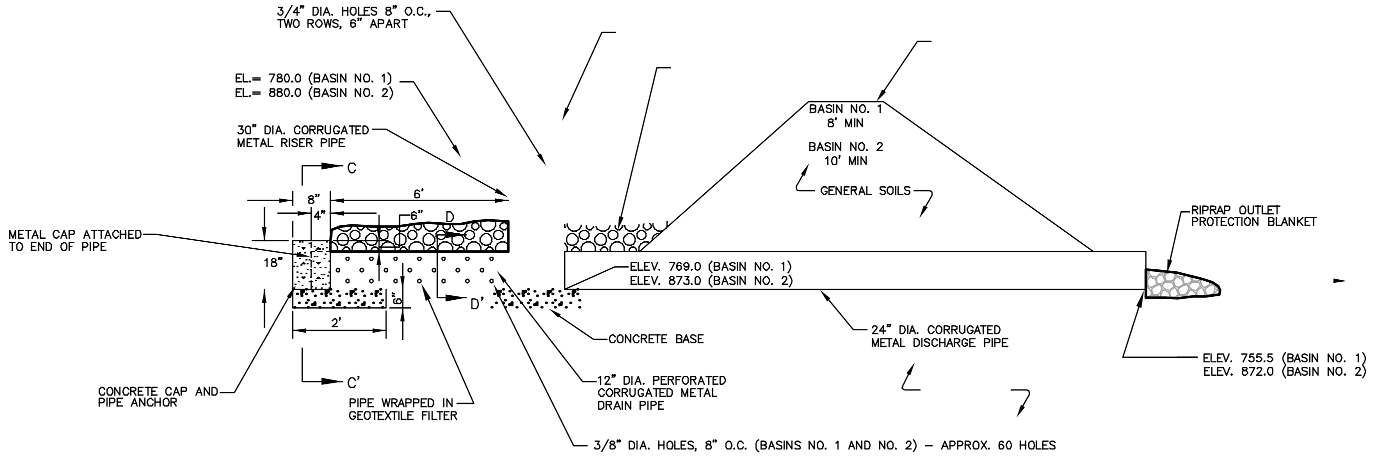
NOTE:
SEDIMENTATION BASIN NO. 1 WILL HAVE A CULVERT PIPE INSTALLED FOR THE EMERGENCY OVERFLOW. SEE DETAIL 1 OF 22.



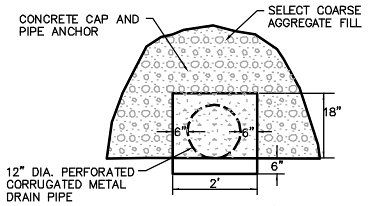
CROSSECTION B-B'



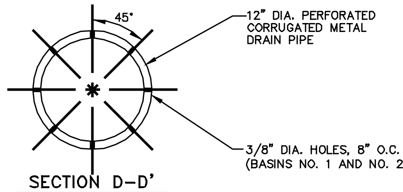
SECTION A-A'



RISER/DISCHARGE PIPE CROSS SECTION (TYPICAL)



SECTION C-C'



SECTION D-D'

3/22 RISER/DISCHARGE PIPE/EMERGENCY SPILLWAY

(NOT TO SCALE)

LINE AND SHADING LEGEND

– – –	GEOTEXTILE	—	GEOMEMBRANE
〰	GEOCOMPOSITE	━	GEOSYNTHETIC CLAY LINER (GCL)
▨	TOPSOIL	▦	NATIVE SOIL
░	SELECT GRANULAR FILL DRAINAGE LAYER	░	CONCRETE
░	PIPE BEDDING MATERIAL	▧	RIPRAP
▧	SELECT AGGREGATE FILL	▓	GRAVEL
– – –	COMPACTED SELECT LOW PERMEABILITY SOIL	⁄ – ⁄	GENERAL FILL

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

SHEET TITLE:
DETAILS- SEDIMENTATION BASINS

DRAWN BY: **DEFOEJ**	SCALE: **NOT TO SCALE**	PROJ. NO. **3081.40**
CHECKED BY: **DM**		FILE NO. **30814007.dwg**
APPROVED BY: **BJK**	DATE PRINTED:	SHEET **22** OF **23**
DATE: OCTOBER 2000		

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PLOT DATA
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$$PTABLE$$
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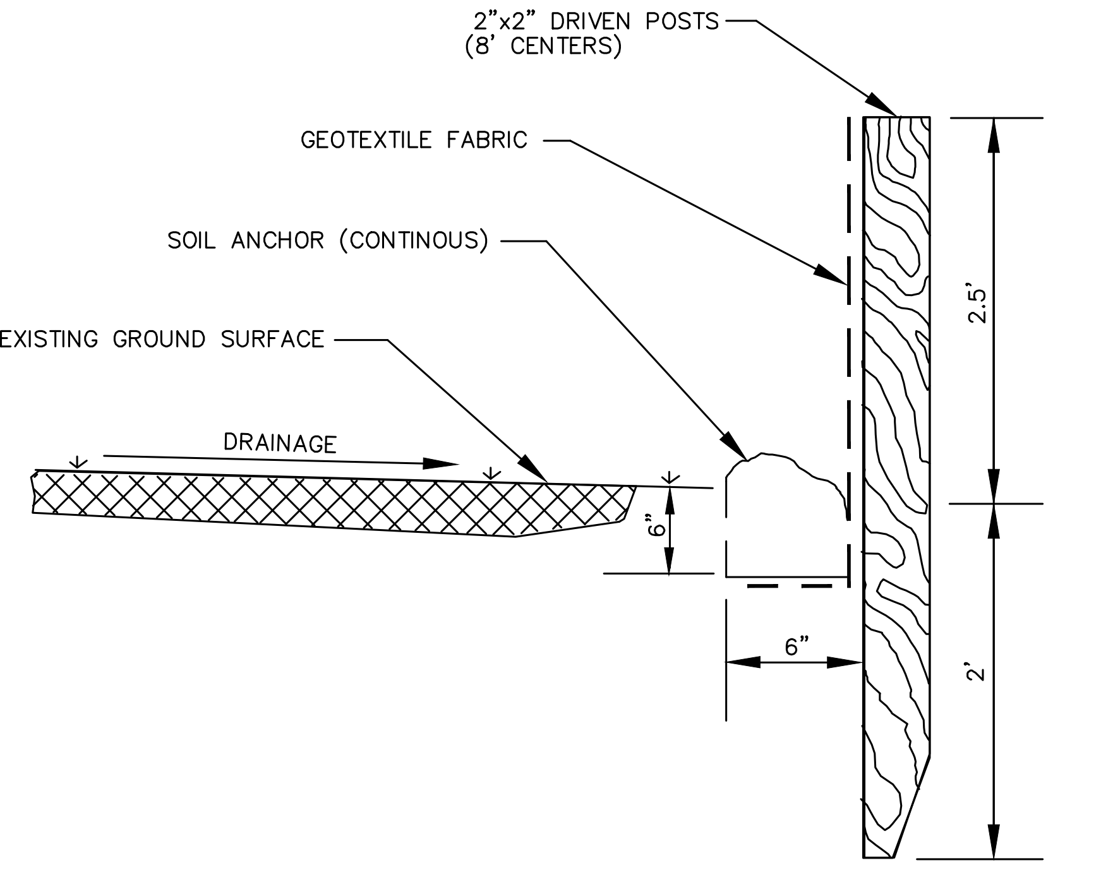
Attached Xref's: No xref's Attached.

RMT COMPUTER AIDED DESIGN & DRAFTING

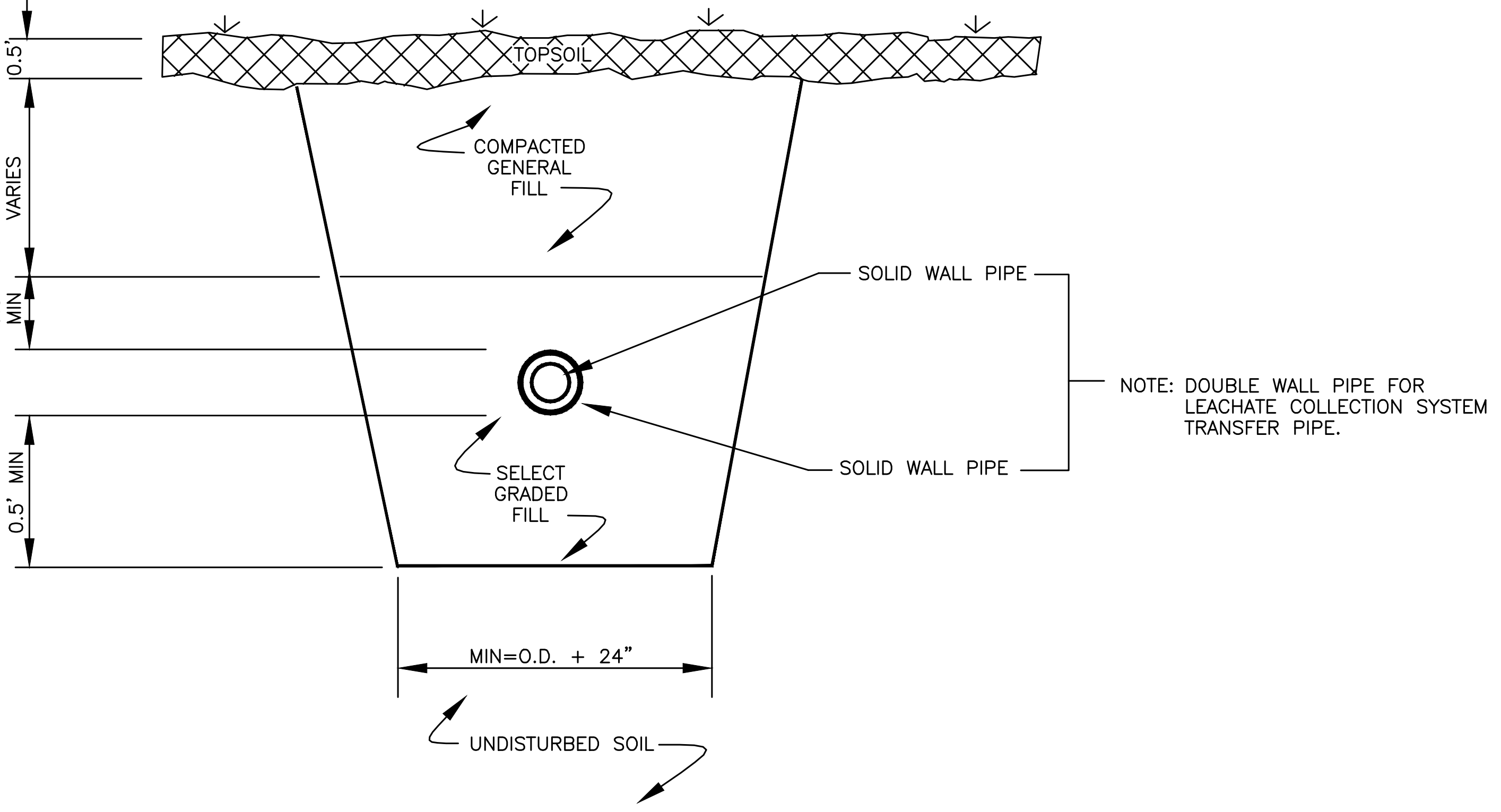


NOTE:
DETAIL SHOWN FOR PURPOSES OF IDENTIFYING INSTALLATION METHOD. LOCATION OF FENCE WILL BE DETERMINED AT DEVELOPMENT OF ENGINEERING PLANS FOR EACH PHASE OF CONSTRUCTION AND IN THE FIELD DURING ACTUAL CONSTRUCTION OF EACH PHASE.

1/23

SEDIMENT CONTROL FENCE

(NOT TO SCALE)

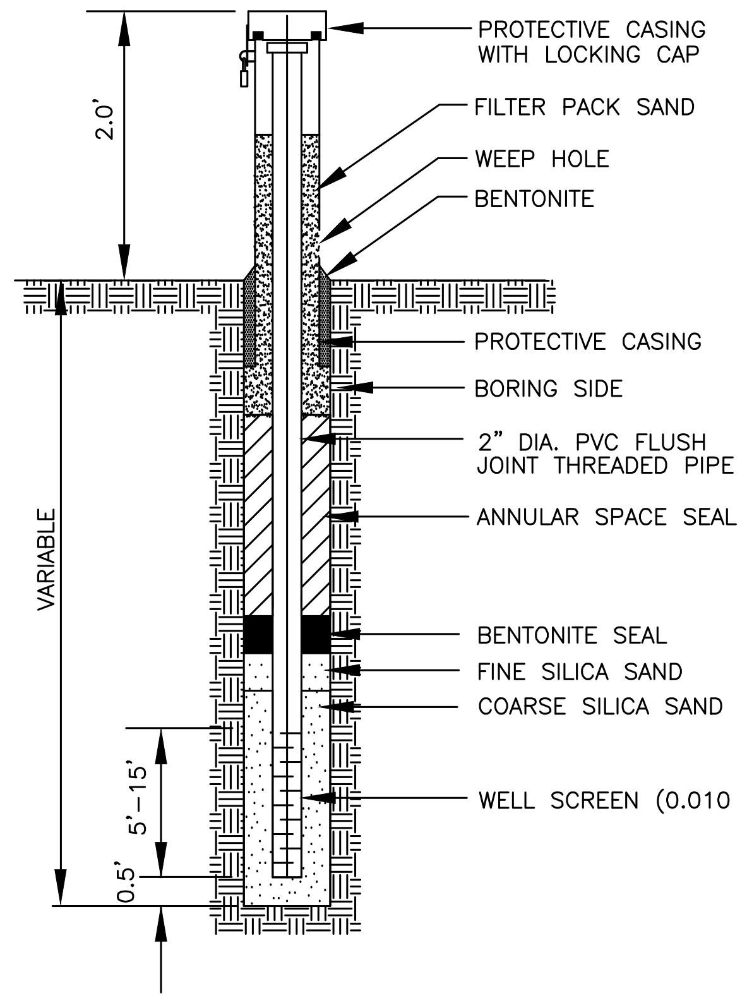


NOTE: DOUBLE WALL PIPE FOR LEACHATE COLLECTION SYSTEM TRANSFER PIPE.

3/23

DOUBLE WALL TRANSFER PIPE

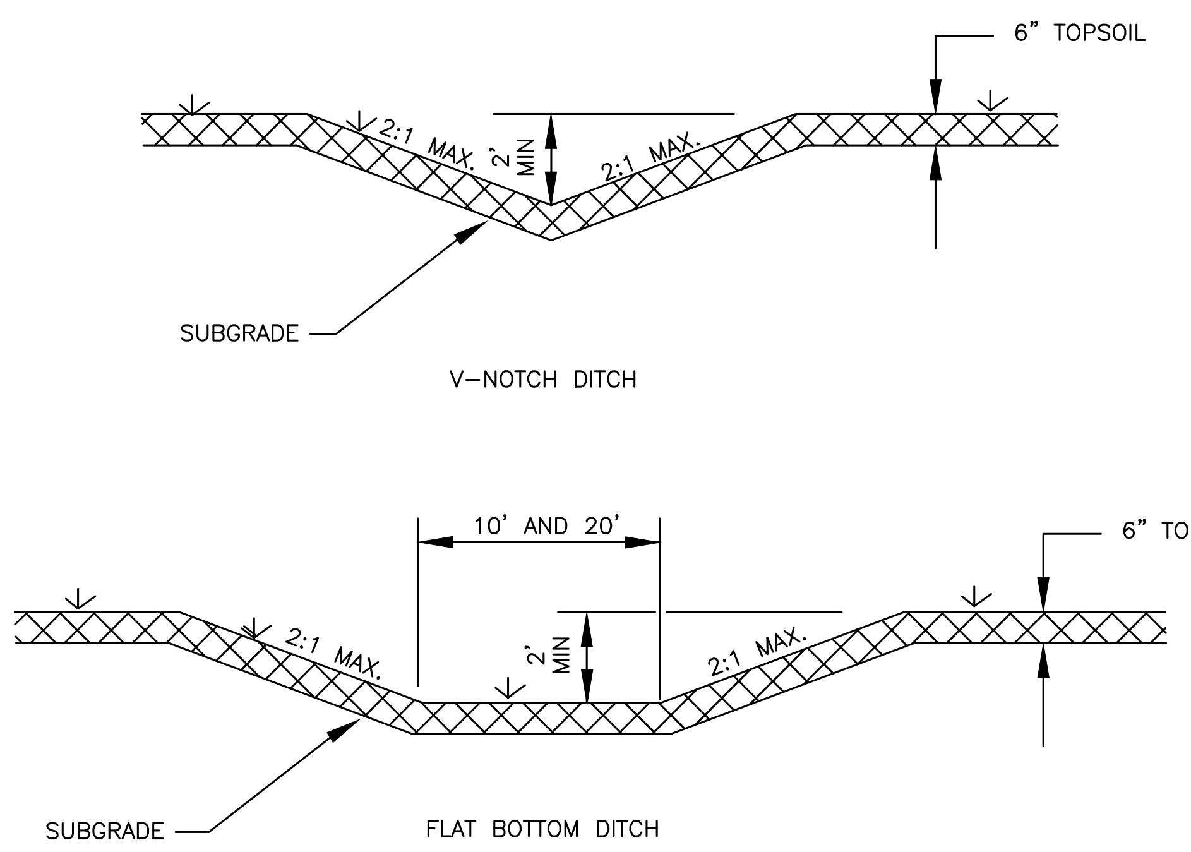
(NOT TO SCALE)



4/23

WATER TABLE MONITORING WELL

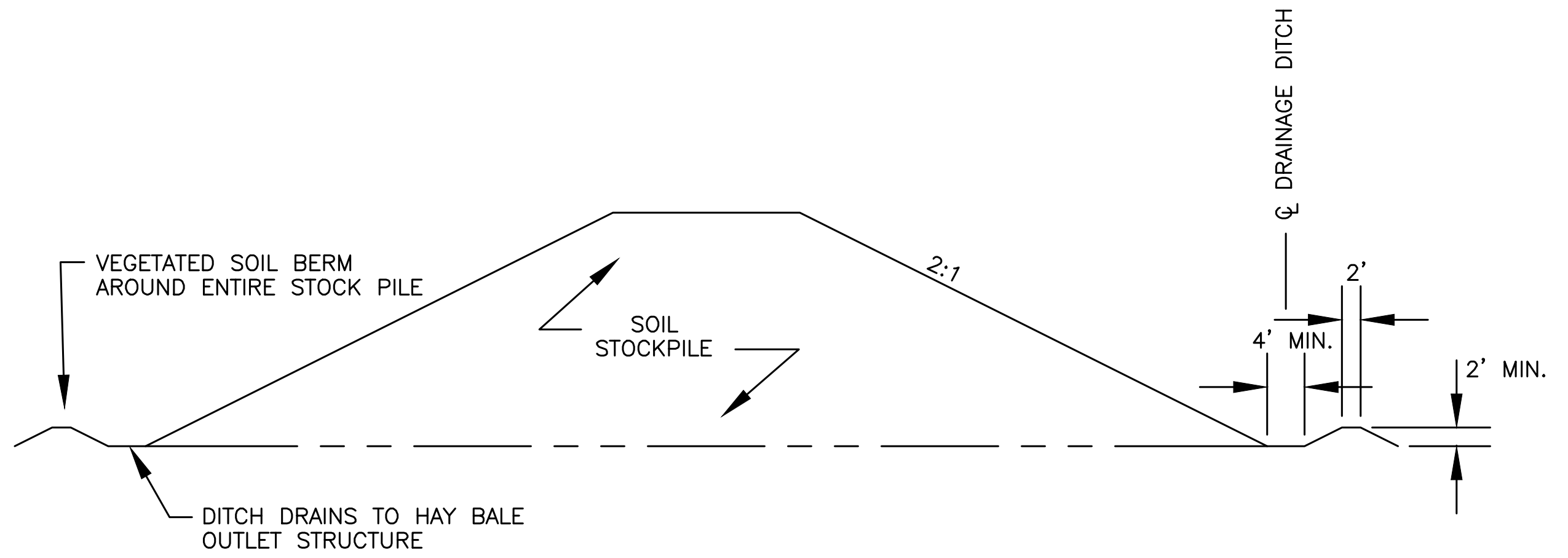
NOT TO SCALE



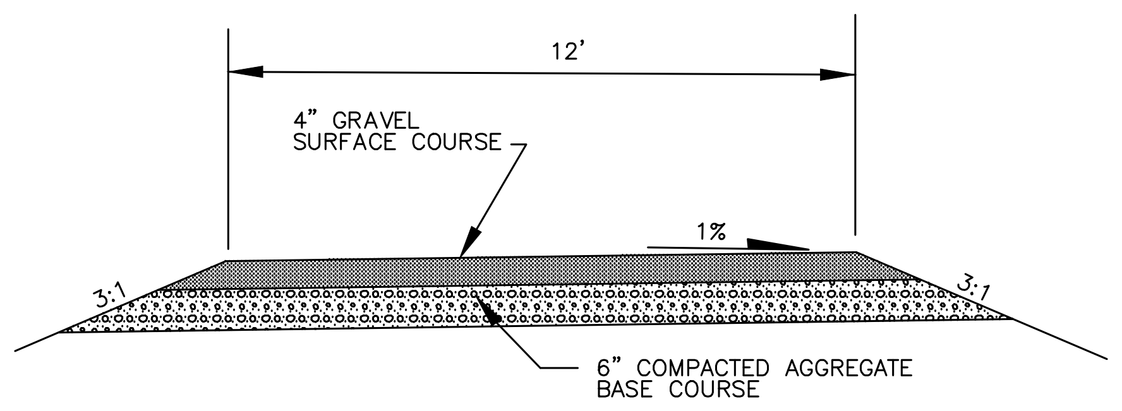
8/23

DRAINAGE DITCH DETAILS OUTSIDE LANDFILL COVER

(NOT TO SCALE)



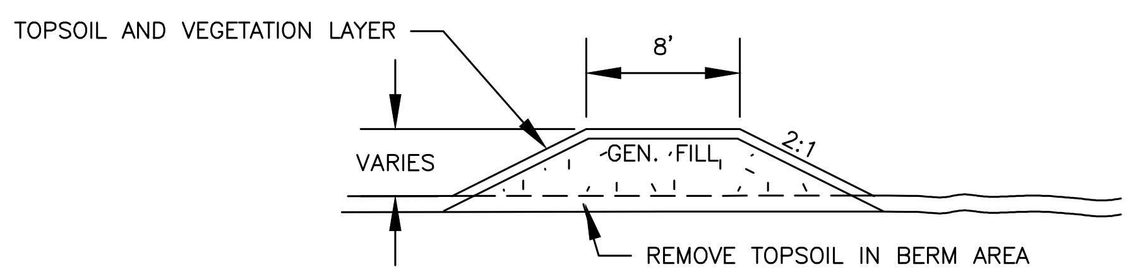
SECTION B-B'



5/23

MAINTENACE ROAD

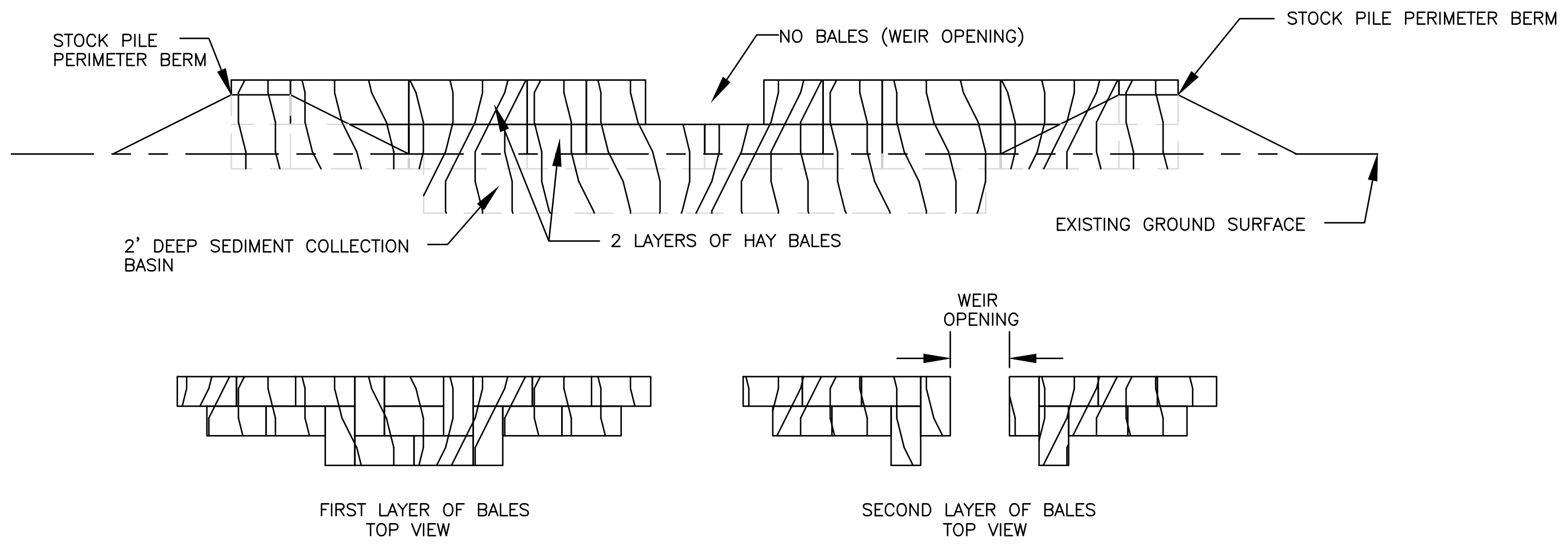
(NOT TO SCALE)



9/23

TEMPORARY BERM FOR CONTROLLING WATER

(NOT TO SCALE)



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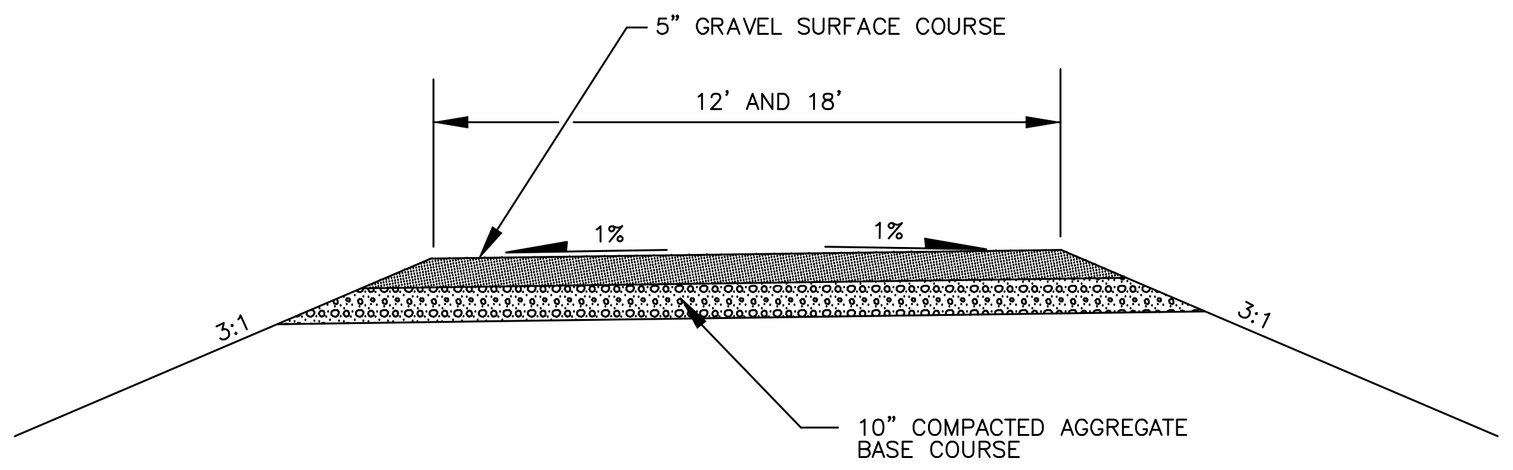

6/23

ALL WEATHER ACCESS/ HAUL ROAD

(NOT TO SCALE)

LINE AND SHADING LEGEND

– – – –	GEOTEXTILE	——	GEOMEMBRANE
⩘⩘⩘	GEOCOMPOSITE	═══	GEOSYNTHETIC CLAY LINER (GCL)
▩	TOPSOIL	▦	NATIVE SOIL
⠿	SELECT GRANULAR FILL DRAINAGE LAYER	▿	CONCRETE
⠶	PIPE BEDDING MATERIAL	⬡	RIPRAP
○	SELECT AGGREGATE FILL	▓	GRAVEL
— —	COMPACTED SELECT LOW PERMEABILITY SOIL	⁄ –	GENERAL FILL

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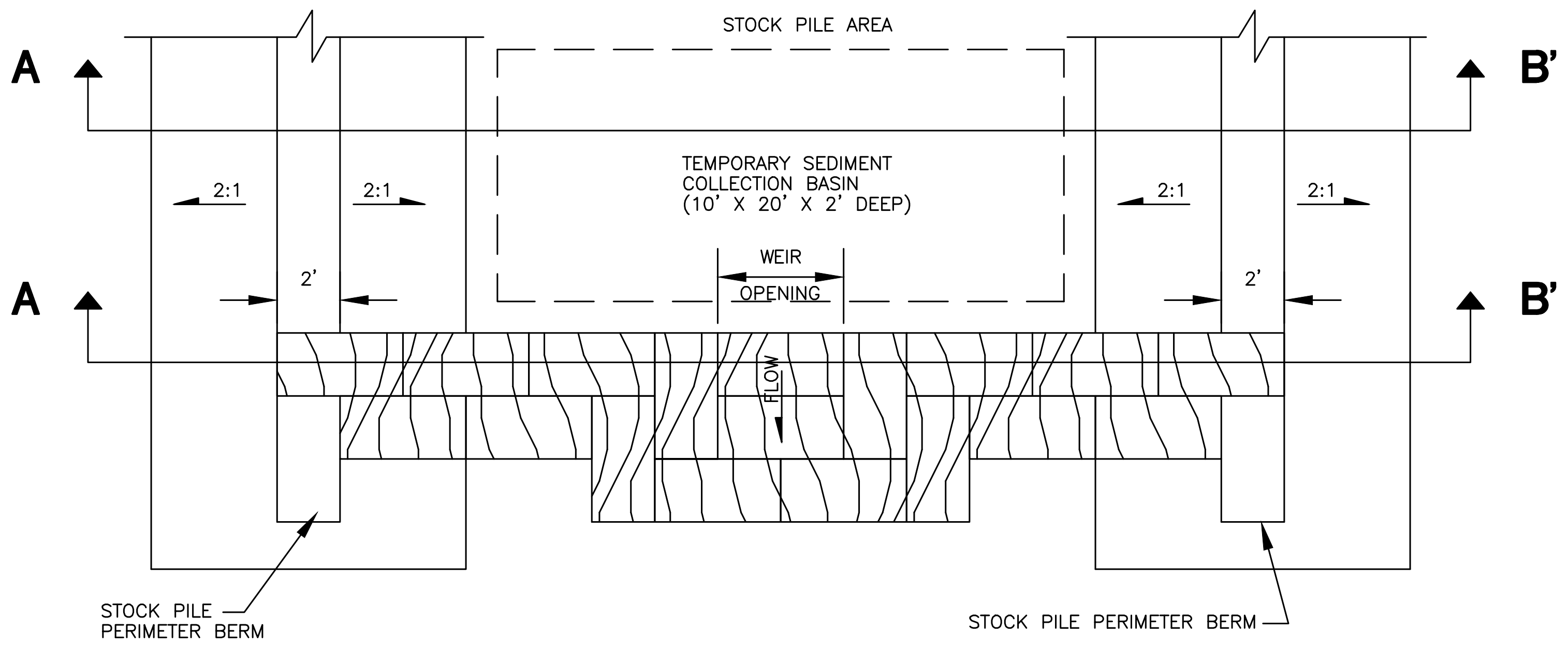
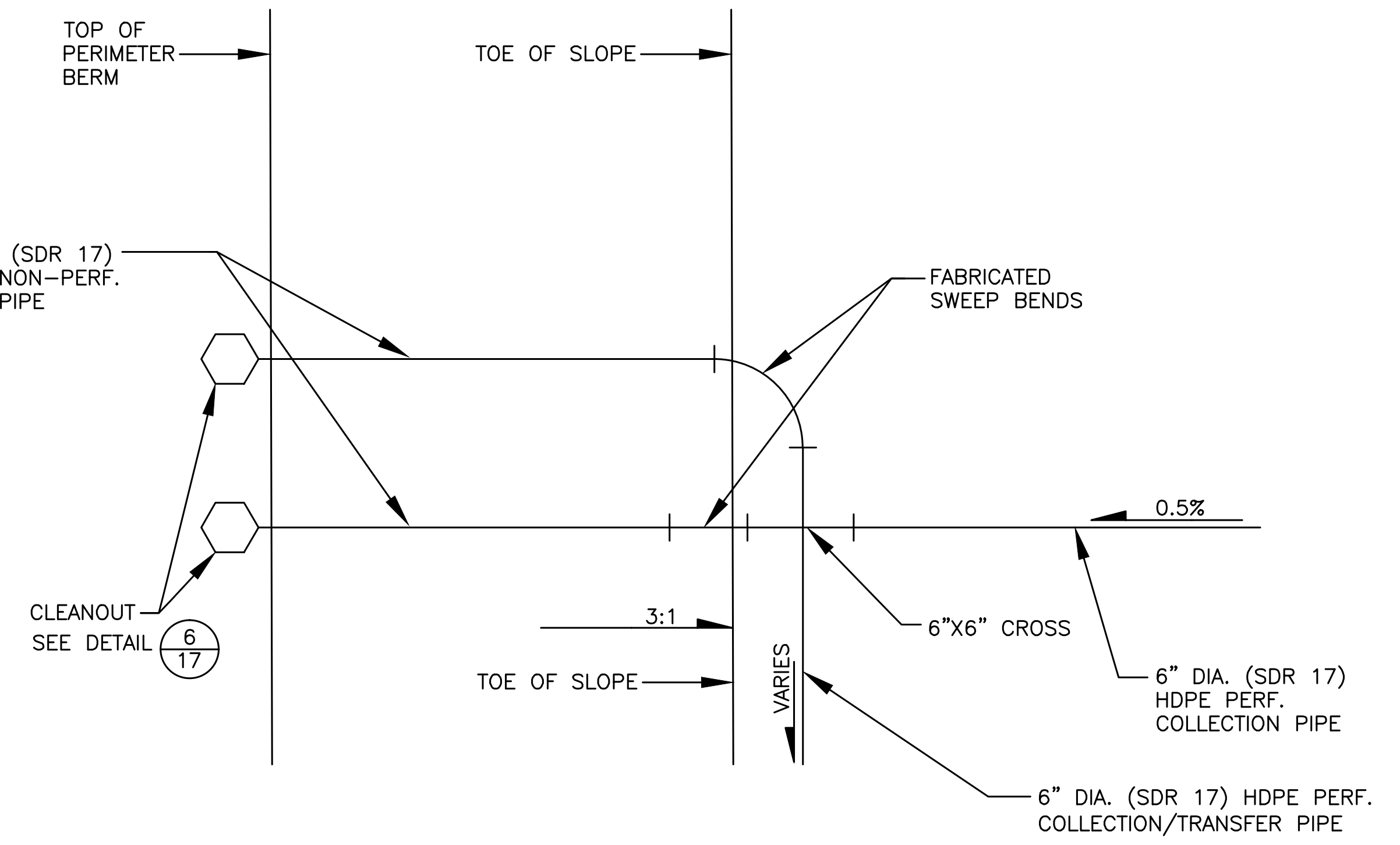


2/23

SURFACE WATER OUTLET FOR STOCKPILES

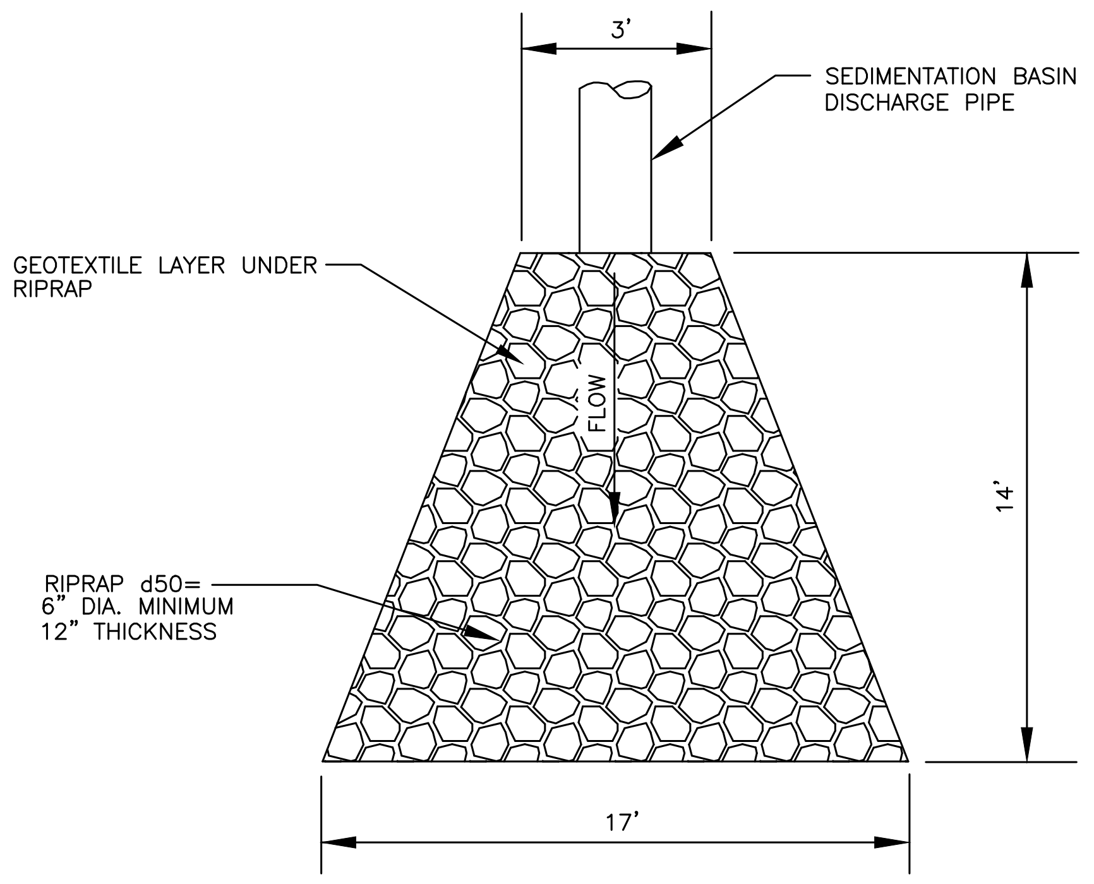
(NOT TO SCALE)



7/23

PIPE CONNECTIONS (TYPICAL)

(NOT TO SCALE)



10/23

DISCHARGE PIPE RIPRAP OUTLET PROTECTION BLANKET

(NOT TO SCALE)

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

SHEET TITLE:
DETAILS- MISCELLANEOUS

DRAWN BY: **DEFOEJ**	SCALE:	PROJ. NO. **3081.40**
CHECKED BY: **DM**	**NOT TO SCALE**	FILE NO.**30814003.dwg**
APPROVED BY: **BJK**	DATE PRINTED:	SHEET **23** OF **23**
DATE: OCTOBER 2000		

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