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January 17, 2024

Mr. Tony Peterson
Waste and Materials Management Program
Wisconsin Department of Natural Resources
Eau Claire Service Center
1300 W. Clairemont Avenue
Eau Claire, WI 54701

Subject: Dairyland Power Cooperative – Alma Off-Site Disposal Facility Phase IV Landfill Plan of Operation Modification for Initial Permitting of Coal Combustion Residuals (CCR) Landfills – Addendum 1, Town of Belvidere, Buffalo County, Wisconsin (License #4126)

Dear Mr. Peterson:

On behalf of Dairyland Power Cooperative (DPC), this letter provides responses to the Wisconsin Department of Natural Resources (WDNR)'s April 26, 2023 Incompleteness Determination (Incompleteness Letter) for the Plan of Operation Approval Modification for Initial Permitting of CCR Landfills at the DPC Alma Off-Site Disposal Facility, Phase IV Landfill (Phase IV Landfill). This is Addendum 1 to the January 30, 2023 Plan of Operation Modification for the Phase IV Landfill (January 2023 Plan Mod).

This addendum is presented in the form of a letter such that each item requiring additional information is shown in bold text followed by DPC's response. If additional materials are needed to supplement the textual response, these supplemental materials are provided within attachments to this Addendum 1.

Attachment 1 contains the certification statement for this Addendum. **Attachment 2** provides the Incompleteness Letter prepared by the WDNR.

1. ***Section NR 504.04(4)(b), Wis. Adm Code: Provide a revised endangered species or critical habitat demonstration narrative that includes a statement about the existence of potential habitat for the threatened snail species within the approved liner areas Cell 4 Module A, and Module B.***

   Response: The following is a revision to paragraph 3 of Section 2.4 of the January 2023 Plan Mod.

   > The WDNR also requires habitat surveys for the snail species. Based on a review of aerial imagery, approved liner areas Cell 4 Module A and Module B were forested along steep slopes prior to tree clearing activities occurring before 2008 and between 2011 and 2015. Cell 4 Module A and Module B approved liner areas presently contain forested areas, grassed steep southeast-facing and southwest-facing slopes, and landfill access routes. Potentially suitable habitat may be present along grassed steep southeast and southwest-facing slopes as a result of anthropogenic activities modifying the natural landscape. Prior to disturbing areas where potential snail habitat occurs during liner construction activities, DPC will have a qualified individual perform a snail habitat survey. If snail habitat is found and would need to be impacted, DPC will contact the WDNR Endangered Resources Utility Liaison to discuss how to avoid impacts or to apply for an Incidental Take Permit, as per the requirement listed in the ER review letter.

2. Section NR 504.04(4)(c), Wis. Adm. Code: Provide a copy of the facility's Wisconsin Pollutant Discharge Elimination System (WPDES) permit and a copy of the facilities most recent stormwater pollution prevention plan (SWPPP).

Response: The Alma Offsite Stormwater Pollution Prevent Plan (SWPPP) is included in **Attachment 3**. The document was last updated in January 2023. The Alma Offsite facility does not have a Wisconsin Pollutant Discharge Elimination System (WPDES) permit as the facility does not discharge liquids other than stormwater from the facility, nor does the facility have a wastewater treatment plant on-site.

Associated with the management and inspections related to storm water, DPC requests to decrease the frequency of stormwater inspection following storm events. As noted in the January 2023 Plan Mod, the storm water infrastructure features were built to accommodate the 100-year, 24-hour storm event at the time of design, which exceeds the required 25-year, 24-hour event required by s. NR 504.12(2). Currently the Phase IV Landfill is approved to operate under the requirement of conducting post-storm inspections following rain events over 1 inch in 24 hours. The Phase IV Landfill has been in operation since 2001 and the numerous inspections conducted over this time have shown that these small regularly occurring rain events do not negatively impact the final cover or stormwater management system. DPC requests that the frequency for post-storm event inspections be decreased to require inspections following storm events over of 2 inches or greater in a 24-hour period; as observations made during stormwater inspections after 2-inch rain events indicate that the final cover and stormwater management features have not been negatively impacted by this magnitude of storm event.

3. Section NR 504.06, Wis. Adm. Code: Provide the information required for the design and construction of the liner and leachate collection and removal system.

a. Section NR 504.06(3)(c) and (k), Wis. Adm. Code: Clarify if the geomembrane installation will adhere to the requirements of these code cites.

Response: As noted in Section 3.2.2.3 of the January 2023 Plan Mod, "placement of the geomembrane will comply with the requirements of s. NR 504.06(3)(a-k)". This reference includes (c) and (k) noted above.

In addition, this section of the January 2023 Plan Mod includes a reference to Section 4.6.4 of the 2000 Plan of Operation which was included in Appendix F.1. The referenced text indicates that geomembrane will be installed with panels orientated perpendicular to the contours on slopes in excess of 10H:1V (or 10%), which meets the requirements of s. NR 504.06(3)(c). In addition, the referenced text details that anchor trenches will be constructed at the top of the slope for the liner to secure the geomembrane during installation, which is located along the perimeter of the landfill, and the geomembrane will be seamed completely to the end of the panels to minimize tears to start along the seams placed in the anchor trench, which meets the requirements of s. NR 504.06(3)(k).

b. ***Section NR 504.06(5)(j), Wis. Adm. Code: Provide a revised leachate removal system which includes a sump and side slope riser design.***

Response: The existing removal system was approved by the WDNR during the initial permitting of the Phase IV Landfill. An exemption to s. NR 504.06(5)(j) was approved for the Phase IV Landfill in the May 2001 Conditional Plan of Operation Approval Letter for the Phase IV Landfill (Grant of Exemptions #2) provided in Appendix B of the January 2023 Plan Mod. Each of the existing liner areas constructed at the facility has utilized a gravity drain system that penetrates the base of the landfill. As part of the construction of Cell 3A in March 2013, a dual encased pipe terminating at the future Cell 4 liner penetration location was installed in the southern perimeter berm of the Phase IV Landfill. This pipe was capped and marked and will connect the future Cell 4 leachate collection system to the Phase IV Landfill leachate transfer system utilizing gravity to convey leachate from Cell 4 to the transfer system.

Details relating to this design have been provided in the construction drawings for Cell 1, Cell 2A and Cell 3A and in the 2000 Plan of Operation. Details from the 2000 Plan of Operation were included in Appendix F.2 of the January 2023 Plan Mod.

c. ***Section NR 504.06(5)(l), Wis. Adm. Code: Regarding the leachate transfer lines, clarify whether the upslope end of the secondary pipe is sealed and the downslope end is open to allow any collected liquid to flow into the manhole.***

Response: Leachate transfer manholes and leachate transfer lines associated with the Phase IV landfill were constructed during the development of Cell 1, Cell 2A and Cell 3A. The manhole and transfer line servicing Cell 4 was constructed during development of Cell 3A to avoid the need for excavating deep trenches in the south berm of the Phase IV Landfill during the development of Cell 4. Given that these features are existing infrastructure, discussion relating to the design of the manholes was limited in the January 2023 Plan Mod.

In Section 3.2.3.3 of the January 2023 Plan Mod, it was noted that the concrete manholes were designed to allow for the monitoring of the interstice between the casing (outer) and the carrier (inner) pipe. Detail 2 on Plan Sheet 18 from the 2000 Plan of Operation, which was provided in Appendix F.2 of the January Mod, indicates that a watertight seal was to be installed between the inside and outside pipe on the downslope side of the manhole, a similar seal is not shown on the upslope side of the manhole. This allows DPC to monitor for leaks in the carrier pipe and for liquids in the casing pipe to flow into the manhole for collection.

Watertight seals were installed during construction on the downslope side of the manhole for Manholes 1-6 as detailed in the construction drawings for Cell 1 and 3A. The downslope in Manhole 7 does not contain a watertight seal based on documentation drawings for Cell 3A.

d. ***Section NR 504.06(5)(p), Wis. Adm. Code: Provide a discussion of the measures to be taken to prevent accidental discharge at the loadout station and provide the required specifications for the leachate loadout station design.***

Response: As noted in the January 2023 Plan Mod, the loadout station was installed and utilized prior to the permitting of the Phase IV landfill. The existing loadout station is located near the maintenance building and allows for manually top-loading tanker trucks with leachate from the leachate collection tank.

The existing loadout station receives leachate from the existing leachate tank and is comprised of a manhole with a sump, pump, controls and overhead loadout piping. The entire loadout area is covered with asphalt pavement. An asphalt curb located on the downslope side of the loadout area directs potential spills that could occur during loadout operations to an inlet and into the loadout manhole's sump. The manhole's sump would contain spilled liquid until it can be pumped into a tanker truck. If sufficient volume is spilled, liquid in the manhole sump would rise and flow to the leachate collection tank via the outer pipe of the double walled leachate transfer pipe that is routed from the tank through the manhole. Photos showing the curbing and inlet to the manhole pit along with the leachate loadout station are provided in **Attachment 4**.

During leachate loadout, DPC and/or its subcontractors will physically monitor the loadout of the leachate into the top loaded trucks. As per the current operation, leachate loadout cannot occur until a tanker truck is located at the station and the loadout pump is manually activated. The level within the tanker truck will be monitored while the truck is being filled to confirm that the tanker truck does not overtop. Phase IV Landfill's Leachate loading procedure is provided in **Attachment 4**.

4. ***Section NR 504.07, Wis. Adm. Code: Provide the information required for the design and construction of the final cover.***

a. ***Section NR 504.07(4)(a)12 through 15, Wis. Adm. Code: Provide the soil barrier layer specifications and clarify if its construction will adhere to the requirements of these code cites.***

Response: A final cover system that utilized a soil barrier layer was approved in the 2001 Plan of Operation Conditional approval letter. This cover system consisted of (from bottom to top): 2-foot soil barrier layer, geosynthetic clay liner (GCL), 40 mil geomembrane, 1-foot granular drainage layer, 1.5 feet general fill rooting zone, and 6 inches of topsoil; however, following a 2004 plan modification, this final cover configuration was replaced with an alternate final cover system that did not include a soil barrier layer.

As noted in Section 3.3.1 of the January 2023 Plan Mod, a 2004 plan modification was approved with an alternate final cover system that consisted of (from bottom to top) 2-feet of moisture conditioned and compacted "select" fly ash, 40-mil geomembrane, 1-foot drainage layer, 1.5-foot general soil cover layer (rooting zone), and 6 inches of topsoil. This cover system was used to construct the first three final cover events. It is DPC's understanding that the final cover system contained in the approved 2004 Plan

Modification will not be acceptable for future final cover construction events. Therefore, future final cover construction events will utilize the final cover system that was approved in the 2001 Plan of Operation Conditional Approval letter and discussed in the preceding paragraph. The final cover design that has been installed to date will not be revised and will remain as constructed.

Soil barrier layer requirements for the final cover system will be consistent with the liner system soil barrier layer requirements presented in the 2001 Plan of Operation Conditional Approval letter (referenced as the low permeability layer in the January 2023 Plan Mod and 2001 Plan of Operation). Details pertaining to the installation of the soil barrier layer (in reference to the base liner system) were previously provided in Section 3.2.2.1 of the January 2023 Plan Mod and will be followed for the final cover system as well.

Soil barrier layer will consist of the following requirements:

- Consist of soil types with Unified Soil Classification System classes of ML, CL, CH, SM, or SC or dual-classification of these soils. The upper 1 foot shall have a maximum particle diameter less than 1 inch and have at least 80% by weight pass the No. 60 screen and a P200 content of 40% of greater (s. NR 504.07[4][a][12]).
- Placement of the soil barrier layer would comply with s. NR 504.07(4)(a)(14-15) as detailed in Section 4.6.1 of Appendix F.1. This section detailed that the low permeability layer would have a minimum thickness of 2 feet. Compaction of the material would meet the following requirements:
  - As noted in Section 4.6.1 of Appendix F.1: Compaction will be achieved by use of a sheepsfoot compactor with a minimum static weight of 30,000 pounds, or an equivalent piece of equipment (s. NR 504.07[4][a][14]).
  - Compaction will meet a minimum of 90 percent of the modified proctor density as noted in the Construction Quality Assurance Plan (CQA Plan) provided in Appendix G of the January 2023 Plan Mod.
- Placement of the soil barrier layer will be placed in lifts no greater than 12 inches following compaction using footed compaction equipment with feet at least 6 inches long. Each lift shall be disked or otherwise mechanically processed prior to compaction to break up clods and allow for moisture content adjustment. Clod sizes will not exceed 2 inches in diameter (s. NR 504.07[4][a][13]).

The CQA Plan was updated to indicate that the soil barrier layer (i.e. “low permeability layer”) will be applicable to the final cover system as well as the liner system. This is included in **Attachment 5**.

b. Section NR 504.07(6)(b), (7), and (8), Wis. Adm. Code: Re-evaluate the final cover perimeter storm water drain system design and provide the specifications and application rates for fertilizer and mulch addition to topsoil.

Response: The responses pertaining to the final cover stormwater drain system and fertilizer/mulch are provided below.

Stormwater Drain System – The existing and approved perimeter final cover drainage design includes a minimum 4-inch diameter drainpipe that is located along the diversion berms and toe of final cover slope near the perimeter berm of the proposed landfill as shown in Details 2 and 4 on Plan Sheet 19 in Appendix F.2. Coarse aggregate fill meeting the same gradation as the leachate collection drainage layer (minimum hydraulic conductivity of $1x10^{-2}$ cm/s) will be placed around the piping, which meets s. NR 504.07(6)(b). The October 2000 Plan of Operation Section 3.11.4 (Appendix F.2 of the January 2023 Plan Mod) proposed that the pipes located in trenches in the perimeter berm will follow the same slope as the top of berm and discharge through pipes located at 500-foot intervals around the landfill. Whereas pipes located in areas where the top of berm is flat will be sloped at 2 percent and discharge through pipes spaced at -200-foot intervals.

However, during construction of the existing final cover areas, a maximum 200-foot spacing for the final cover drainage outlets was used. This spacing meets the requirements of s. NR 504.07(6)(b). This will continue for future final cover construction events. **Attachment 6** contains the layout and details from the first three final cover construction events.

Fertilizer and Mulch – Specifications on the mulch and fertilizer are not required per the code reference. Topsoil will be tested prior to placement to confirm fertilizer requirements. Seeding, fertilizer, mulching methods and rates will be consistent with methods and rates utilized during previous final cover construction events, unless topsoil testing indicates otherwise. Seed mix and fertilizer will be applied at a rate of approximately 2 pounds of seed and 7 pounds of fertilizer per 1,000 square feet. Seed mix and fertilizer may be applied simultaneously via a hydroseeder, particularly along slopes. Current recommended fertilizer consists of 16% nitrogen, 6% phosphoric acid, and 24% soluble potash; however, this will be confirmed prior to placement of topsoil. Mulch will be applied to the seeded area at a rate of at least 1.5 tons per acre and will consist of either oat or wheat straw.

c. Section NR 504.12(3)(a)5, Wis. Adm. Code: Specify the hydraulic conductivity standard of the soil barrier layer material to be used in construction of the liner and provide justification for the assumptions made for the liquid flow rate calculation for the soil barrier layer.

Response: Section NR 504.12(3)(a)(5) corresponds with the base liner of the landfill, as such the responses provided will be focused on the base liner system. Per s. NR 504.12(3)(a)(5), a GCL and soil barrier layer may be used in place of the clay layer of the composite liner per s. NR 504.06(7). Section NR 504.06(7) requires that the underlain soil barrier layer must be a minimum of 2 feet thick and meet the specifications of s. NR 504.07(4)(a)12 to 17. The requirements in s. NR 504.07(4)(a) 12 to 17 do not include a hydraulic conductivity requirement. The only requirements pertain to particle size and the classification of the material, which are detailed in Section 3.2.2.1 of the January 2023 Plan Mod.

Appendix H.1 of the January 2023 Plan Mod included the required liquid flow rate calculation. This calculation compared the flow through the alternative liner system (GCL and soil barrier layer) to the flow through 2 feet of compacted clay. Only the hydraulic conductivity of the GCL was evaluated in the previously provided flow rate calculation. As noted in the footnotes of the provided calculation, the hydraulic conductivity of the GCL used in the calculation was based on previous testing conducted during construction. To further justify the hydraulic conductivity used for the GCL, **Attachment 7** contains the conformance testing results from the previous construction events which show that the GCL hydraulic conductivities have been within the same order of magnitude of the hydraulic conductivity used in the flow rate calculation.

The calculation accounts for only the hydraulic conductivity of the GCL because (1) there is no requirement from WDNR on the hydraulic conductivity of the soil barrier layer, (2) discussion of alternative liner system in the preamble of the Federal Register, which promulgated the requirements for CCR landfills, details that a lower component liner alternative was noted as the GCL not GCL plus another soil material, and (3) including the hydraulic conductivity of the soil barrier layer would reduce the average hydraulic conductivity of the system, as detailed below.

If the hydraulic conductivity in the flow rate equation for the alternate liner system was weighted to account for the 2 feet of soil barrier layer material, due to the greater thickness of the soil barrier layer material than the GCL thickness, the soil barrier layer would need to have a hydraulic conductivity on a similar scale as the compacted clay liner requirements (10^{-7} cm/s) This would likely be unattainable for some of the soil types allowed by s. NR 504.07(4)(a)(12) for the soil barrier layer and would defeat the benefit of using a GCL alternative liner system.

5. ***Section NR 507.15(3), Wis. Adm. Code: Provide the following information for general environmental monitoring requirements.***

   a. ***Section NR 507.15(3)(a), Wis. Adm Code: Provide a more detailed discussion on the known or suspected contaminant pathways and how the proposed CCR groundwater monitoring system is designed to cover all the pathways.***

   Response: If contaminants were released from the Phase IV Landfill they would migrate downward through the unsaturated zone until encountering the water table. Once dissolved in groundwater, contaminants will migrate in the direction of groundwater flow. Therefore, monitoring wells installed at the downgradient waste boundary are positioned to detect a release to groundwater from the Phase IV Landfill. As detailed in Section 4.2 of the January 2023 Plan Mod, the groundwater monitoring system includes three water table wells (W-100R, W-105, and W-106) and one piezometer (W-100AR) located downgradient of the Phase IV Landfill. The monitoring wells and piezometer provide both horizontal and vertical coverage for detecting a potential release. There are no wetlands or waterways between the landfill and the downgradient monitoring wells; therefore, there is no risk of groundwater being intercepted by surface water pathways prior to reaching the downgradient monitoring wells.

b. Section NR 507.15(3)(b), Wis. Adm Code: Provide site-specific technical data on the below listed items and provide additional discussion on how that information was considered when deciding the number, spacing, and depths of monitoring wells that are part of the proposed CCR groundwater monitoring system.

i. Aquifer Thickness.

Response: As discussed in Section 4.1 of the January 2023 Plan Mod, the saturated thickness of the uppermost aquifer includes up to 20 feet of sandy soil and approximately 400 feet of Cambrian sandstone. Due to the predominance of horizontal flow in layered sedimentary systems caused by anisotropy (i.e., horizontal hydraulic conductivity is always greater than vertical hydraulic conductivity in layered geologic units), and the predominantly vertical flow of a potential release through the unsaturated zone, the monitoring system design includes monitoring wells screened at the water table, which is the most likely location to detect a release from the Phase IV Landfill.

In addition, downward vertical gradients indicate the potential for vertical flow in the shallow portion of the aquifer. This potential for downward vertical flow warrants a downgradient piezometer to monitor groundwater quality below the water table. As discussed in Section 4.2 of the January 2023 Plan Mod, the groundwater monitoring system includes a piezometer (W-100AR) located downgradient of the Phase IV Landfill.

ii. Groundwater flow rate.

Response: The groundwater flow rate in the sand and gravel unit of the uppermost aquifer has previously been calculated to be approximately 370 feet per year as noted in the Groundwater Monitoring Program (GWMP) for Compliance with the Federal Coal Combustion Residual Rule report (TRC, 2017). This calculation is based on measured horizontal hydraulic gradients of 0.05 foot per foot (ft/ft), assumed effective porosity of 20%, and geometric mean hydraulic conductivity of 1.4×10^{-3} cm/s. The groundwater flow rate in the sandstone is expected to be slower than in the sand and gravel due to lower mean hydraulic conductivity of 1.1×10^{-3} cm/s. Assuming the same horizontal hydraulic gradient and effective porosity, the groundwater flow rate in the sandstone is approximately 285 feet per year. Monitoring wells W-100R, W-100AR, W-105, and W-106 are located near the downgradient waste boundary, thus these wells are designed to detect a release from the landfill quickly after the release reaches the downgradient waste boundary.

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iii. Seasonal and temporal fluctuations in groundwater flow.

Response: Groundwater flow maps for the Phase IV Landfill have been prepared and included in the annual groundwater monitoring reports since the 2018 Annual Groundwater Monitoring Report (TRC, 2018). The water table maps in the annual reports use water level data for September of the year preceding the report date, beginning with the 2018 report. In addition, GWMP for Compliance with the Federal Coal Combustion Residual Rule report (TRC, 2017) included a water table map generated using data from March 2015.

Based on a review of these water table maps, there is very little temporal fluctuation in groundwater flow. All water table maps for the Phase IV Landfill show groundwater flowing south in the down-valley direction and generally converging toward W-100R and W-105. A comparison of the Marsh 2015 water table map to the September water table maps for subsequent years also shows consistency in the flow pattern between March and September; therefore, there is no significant seasonal variation. Because the shallow groundwater flow pattern consistently shows flow toward the downgradient wells, the well network design is appropriate for detecting a release from the Phase IV Landfill.

iv. Hydraulic conductivities, porosities and effective porosities for the saturated and unsaturated geologic units overlying the uppermost aquifer and materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the uppermost aquifer.

Response: As detailed above, the geometric mean hydraulic conductivity of the sand and gravel is 1.4×10^{-3} cm/s and the geometric mean hydraulic conductivity of the sandstone is 1.1×10^{-3} cm/s. Both units are assumed to have an effective porosity of 20% for the groundwater velocity calculation; however, the effective porosity of these units could range up to 30%. Total porosity in sand and sandstone is generally not significantly higher than the effective porosity and is likely also in the range of 20% to 30%.

As the uppermost aquifer includes the Cambrian sandstone formations, the confining unit defining the lower boundary of the uppermost aquifer consists of Precambrian igneous and metamorphic rocks that underlie the Cambrian sandstone formations. These Precambrian rocks are expected to have very low values for effective porosity and hydraulic conductivity.

The monitoring well network is designed to monitor the sand and gravel and sandstone units, which are the permeable formations at this site.

c. Section NR 507.15(3)(b), Wis. Adm. Code: Provide a groundwater flow map for the site that includes at a minimum the proposed CCR wells, other groundwater monitoring wells, the landfill footprint, and groundwater flow direction.

Response: The groundwater flow map for the September 2022 groundwater sampling event is included in **Attachment 8**.

d. Section NR 507.15(3)(i), Wis. Adm. Code: Provide baseline groundwater monitoring data for copper, manganese, silver, zinc, and field temperature in the CCR Wells.

Response: Baseline groundwater monitoring data for copper, manganese, silver, zinc, and field temperature for the CCR wells are included in **Attachment 9**.

e. Section NR 507.15(3)(k), Wis. Adm. Code: Provide a statement for the owner/operator to notify the department in writing within 60 days of completing sampling and analysis at any CCR well when a groundwater standard has been attained or exceeded in accordance with s. NR 507.15(3)(k), Wis. Adm. Code.

Response: In accordance with s. NR 507.15(3)(k), the owner/operator will notify the department in writing within 60 days of completing sampling analysis at any CCR well when a groundwater standard is attained or exceeded. The Phase IV Landfill has not had a confirmed statistically significant increase (SSI) under the federal CCR monitoring program.

6. Section NR 507.16(1), Wis. Adm. Code: Provide the following information for the sampling plan.

a. Section NR 507.16(1)(a), Wis. Adm. Code: Provide an updated Site Monitoring Locations map that includes the leachate tank and retention pond.

Response: An updated Site Monitoring Locations map is included in the Environmental Sampling and Analysis Plan (ESAP) provided in **Attachment 10**. A label for the leachate tank has been added to the map. The two sedimentation basins associated with this facility are also shown on the Site Monitoring Locations map. The retention pond language has been removed from the ESAP as no retention pond is associated with the license for landfill 4126.

b. Section NR 507.16(1)(c), Wis. Adm. Code: Provide revised procedures for field measurements for the items listed below.

i. A detailed order in which wells should be sampled if the groundwater has been impacted by regulated or other activities.

Response: Section 3.0 of the ESAP states that the wells will generally be sampled from upgradient to downgradient. If wells are determined to be impacted by regulated or other activities, impacted wells shall be sampled after unimpacted wells have been sampled. The ESAP has been modified to indicate that if more than one well is determined to be impacted by a given substance, the order of sampling of impacted wells will be from the well with the lowest concentration of contaminant to the well with the highest concentration of contaminant.

ii. The procedures and types of equipment to determine turbidity, odor, and color.

Response: The procedure for determining turbidity and color of groundwater samples in the field is to visually observe the sample bottles after filling and noting any turbidity (yes or no) or color on the field sheet. It is not recommended to directly smell groundwater samples; therefore, the procedure for noting sample odor is to note on the field sheet (yes or no) if an odor is detected in the ambient air while the groundwater samples are being collected.

Section NR 507.16(1)(c)(3) does not require specification of equipment for determining turbidity, odor, and color; however, "equipment" for these consists of the eyes and nose of the sampler.

c. Section NR 507.16(1)(d), Wis. Adm. Code: Provide an update to the equipment cleaning process that includes procedures to clean purging equipment between wells.

Response: As detailed in the ESAP, the wells are purged using dedicated pumps. The only equipment with the potential to cause cross-contamination of laboratory samples between wells is the water level measurement device. Section 3.1.7 of the ESAP specifies the procedure for cleaning the water level measurement device between wells. Section 3.1.7 of the ESAP has been modified to indicate that non-dedicated purging equipment will also be cleaned between wells if it is used during a sampling event.

d. Section NR 507.16(1)(e), Wis. Adm. Code: Provide revised procedures for obtaining samples from wells that include the following

i. The volume of sample required for analysis.

Response: The ESAP has been modified to indicate that the anticipated total sample volume is approximately one-half liter per well.

ii. The rate of flow when sampling, when applicable.

Response: The ESAP has been modified to specify that the flow rate during sampling will be the same or less than the flow rate used while purging the well, and in all cases less than a half-liter per minute.

e. Section NR 507.16(1)(f), Wis. Adm Code: Provide revised procedures for establishing field quality assurance and quality control that include procedures for and the frequency at which field blanks will be collected and processed.

Response: The ESAP specifies that the rate of collection of field blanks (i.e., equipment blanks) will be one per sampling event if non-dedicated and/or non-disposable field sampling equipment is used. The ESAP also specifies that in such a case, the field blank will be collected by passing reagent grade water through decontaminated field equipment. The ESAP has been modified to specify that the equipment blank water will be collected into laboratory-supplied sample bottles and analyzed for the same parameters as the groundwater samples.

As stated in the ESAP, the anticipated purging and sampling procedures use only dedicated and disposable equipment; therefore, field blanks will not be collected under typical sampling conditions. The WDNR's Groundwater Sampling Desk Reference (WDNR, 1996) states that "field blanks are not required if dedicated sampling equipment or disposable sampling equipment is used."

7. Section NR 514.045(1)(c)1 through 3, Wis. Adm. Code: Provide a demonstration addressing the stability items of this section.

Response: The Location Restrictions Demonstration was previously provided in Appendix D of the January 2023 Plan Mod and summarized in Section 2.2 of the main text of the January 2023 Plan Mod. Section NR 514.045(1)(c) includes three demonstration requirements to determine that the Phase IV Landfill is not located within an unstable area. These demonstration requirements are: (1) on-site or local soil conditions that may result in significant differential settling, (2) on-site or local geologic or geomorphic features, and (3) on-site or local human-made feature or events both surface and subsurface. The Phase IV Landfill demonstrated compliance with each of these per the following:

- ***On-site or local soil conditions that may result in significant differential settling*** – Settlement and differential settlement is typically caused by extensive deposits of soft, fine-grained soils located below the subbase of the landfill. Based on the geotechnical exploration that was conducted as part of the Feasibility Report in May 1997, the CCR landfill is not located in soil condition that may cause significant differential settling. The on-site soils consisted of silt and lean clay overlying silty sand and sand, weathered bedrock (sandstone or dolomite), and sandstone. In areas the silty sand/sand extended from the existing ground surface to bedrock. These observations do not generally suggest an unstable foundation.

  Based on standard penetration testing (SPT) conducted during the time of the soil borings, the fine-grained loess material (silt and clay) generally consisted of medium stiff to stiff relative densities. Beneath the Phase IV Landfill, the fine-grained material was generally silt. Soft/loose clay and silt were observed in isolated pockets along the perimeters or at elevations above or near subbase grades, but it is not anticipated that these will impact settlement of the facility as they are underlain by medium dense to dense soils. In addition, based on the SPT blow counts the silty sand and sand are categorized as primarily medium dense to dense. Soils at these relative densities along with appropriate preparation of the subgrade, generally would not be susceptible to significant differential settlement for the Landfill. Cross sections and select wells logs completed during the Feasibility Report were included in Appendix D of the January 2023 Plan Mod. Additional boring logs completed at the time of the Feasibility Report are included in **Attachment 11**.

- ***On-Site or local geologic or geomorphic features*** – As detailed in Appendix D of the January 2023 Plan Mod and above, geologic or geomorphic features that are unstable were not encountered during the exploration for the Phase IV Landfill. The subsurface consisted of primary silts and silty sand and sand underlain by weathered bedrock and bedrock. The bedrock consisted of sandstone. Karst systems were not encountered during the exploration. Faults were not observed within the rock cores and no faults have been identified to have occurred in the area in the past 1.6 million years as noted in the updated Earthquake Fault Map summarized in Section 2.2 of the January 2023 Plan Mod. In addition, the Phase IV Landfill is not located within a seismic impact zone. These geologic features provide a stable foundation for the Phase IV Landfill.

  As noted in Section 2.5 of Appendix D of the January 2023 Plan Mod, global stability analyses were performed during the 2000 Plan of Operation. The analysis indicated acceptable factors of safety for the critical slopes. These global stability analyses were previously included in Appendix D and Appendix F.7 of the January 2023 Plan Mod.

- ***On-site or local human-made feature or events both surface and subsurface*** – As described in Section 2.2 and shown in the cross sections presented of Appendix D of the January 2023 Plan Mod, the Phase IV Landfill is not located on human-made features or events that would be considered unstable. The facility was designed and constructed to efficiently manage storm water and leachate. The base liner was constructed at grades greater than 5 feet above the highest noted groundwater level. Based on the analyses, the existing Landfill and future lateral expansions are not considered unstable.

8. Section NR 514.07(1)(i) and (j), Wis. Adm. Code: Provide updated construction quality control and assurance plans that include the placement of the 2-foot soil barrier layer of the final cover.

Response: An updated Construction Quality Control and Assurance Plan (CQA Plan) is provided in **Attachment 5**.

9. Section NR 514.07(10), Wis. Adm. Code: Provide additional information for the operational plans required for the CCR landfill.

a. Section NR 514.07(10)(b)3, Wis. Adm. Code: Provide an updated run-on and run-off control system plan that includes construction procedures and a schedule for construction of the storm water control structures.

Response: Information pertaining to construction procedures and a schedule for construction of the storm water control structures was provided in Section 5.2 of the January 2023 Plan Mod and included in Sections 2.2.2 and 2.3.2 of Appendix K of the January 2023 Plan Mod.

The information from Section 5.2 was incorporated into the Run-on and Run-off Control System Plan provided in **Attachment 12**. No other changes to the Run-on and Run-off Control System Plan have been made. General updates to the Run-on and Run-off Control System Plan will be completed in 2026 as part of the 5-year update.

b. Section NR 514.07(10)(c)6, Wis. Adm. Code: Provide the anticipated schedule of final cover construction activities including the year and number of acres of each construction event.

Response: Section NR 514.07(10)(c)(6) requires that a *"schedule for the completion of all closure activities, including an estimate of the year in which all closure activities for the CCR landfill will be completed. The schedule shall provide sufficient information to describe the sequential steps that will be taken to close the CCR landfill, including identification of major milestones such as coordinating with other agencies and obtaining other necessary approvals or permits, installation of the final cover system, and the estimated timeframes to complete each step or phase of CCR landfill closure. If the estimated timeframes to complete closure exceed the timeframes specified under s. NR 506.083 (3) (a), the plan shall include the site-specific information, factors and considerations that support any time extension."* Section NR 506.083 references the completion of closure activities, i.e. when the entire landfill is closed, and does not refer to intermediate closure events while operations are still active.

Phasing of the Phase IV Landfill was provided in the 2000 Plan of Operation with phasing drawings provided in Appendix F.2 of the January 2023 Plan Mod. However, determining when each intermediate closure event will occur is not practicable as it is based on the filling rates which are variable and dependent on the amount of CCR waste that is generated and the amount of the CCR waste that can be beneficially reused/sold.

Table 1 of Appendix P of the January 2023 Plan Mod provided an estimated schedule for the completion of all closure activities (Phase IV Landfill becomes inactive and completely closed) as required by s. NR 514.07(10)(c)(6) and that met the timeframes detailed in s. NR 506.083. Table 1 indicated that final closure is currently estimated to be initiated in 2057, and 124 days is estimated to be required to cover the potential largest final cover area of the Phase IV Landfill (approximately 12.4 acres) along with completing the notification of completion of closure and deed notation and notification. This table provides estimated timelines for each step of the final cover process and their anticipated durations as required by s. NR 514.07(10)(c)(6).

c. Section NR 514.07(10)(d)1.d., Wis. Adm. Code: Provide a statement that the groundwater monitoring system will be maintained and monitored in accordance with ch. NR 507, Wis. Adm. Code.

Response: Section 2.3.5 of the Post Closure Care Plan from the January 2023 Plan Mod (Appendix Q) indicates that the groundwater system will be maintained throughout the post-closure period. In addition, the system will be sampled as outlined in the ESAP, which was developed in compliance with ch. NR 507. A code reference to ch. 507 was added into the Post Closure Care Plan and the updated plan is included in **Attachment 13**.

d. Section NR 514.07(10)(d)2, Wis. Adm. Code: Provide the name of the person or office to contact about the facility during long-term care.

Response: The contact person or office for the long-term care of the Phase IV Landfill was previously specified in Section 2.2 of the Post Closure Plan provided in Appendix Q of the January 2023 Plan Mod. The information provided included the title of the person that should be contacted along with an address, phone number, and email address.

10. ***Sections NR 520.07(2) and (3), Wis. Adm. Code: Provide updated cost estimates for closure and long- term care as needed to reflect above items.***

Response: Updated closure and post-closure costs are provided in **Appendix 14**.

11. ***Provide a chronological listing of all previous department issued plan of operation and modification approvals, including expedited plan modifications, along with a listing of their approval conditions, indicating the status (active, completed or superseded) of each condition.***

Response: Per s. NR 514.07(6m), a plan of operation for any proposed landfill that includes a vertical or horizontal overlay onto an existing facility shall include a summary of the applicable conditions, approvals, or orders issued by the WDNR in chronological order, indicating which are active and subject to compliance and the status of each condition. This was not included in the January 2023 Plan Mod for the following reasons:

- The Phase IV Landfill is an existing facility with no horizontal or vertical expansion proposed.
- This request was not identified as a requirement in the s. NR 514.045 for the Plan of Operation Plan Modification for Initial Permitting.
- As noted in s. NR 514.045(1) the January 2023 submittal was a Plan of Operation Modification, not a new Plan of Operation. Section NR 514.07(6m), which governs the request in WDNR's Comment 11, applies to new Plans of Operation not modifications to existing Plans of Operation.

As this is not required per ch. NR 514 for Plan Modifications or for the Plan Modification for Initial Permitting of CCR landfills, DPC will not be assembling this information. Approval letters associated with the Phase IV Landfill were provided as Appendix B in the January 2023 Plan Mod for WDNR's convenience.

12. ***Please note that the proposed final cover alternative which includes 2-ft of moisture conditioned and compacted fly ash overlain by a geomembrane does not meet code requirements and therefore will not be approved.***

Response: The proposed final cover alternative was previously approved by the WDNR via the Plan Modification submitted in January 2004 and provided in full in Appendix J.1 of the January 2023 Plan Mod. The associated approval letter was included in Appendix B of the January 2023 Plan Mod. If the January 2004 alternative final cover will not approved for future final cover events, the final cover system provided in the 2001 Plan of Operation Approval Letter consisting of 2-foot soil barrier layer, GCL, geomembrane, 1-foot drainage layer, 1.5-foot rooting zone layer, and 6-inch topsoil layer will be utilized as detailed in the response to Comment 4a.

Proposed Preventive Action Limits (PALs) and Alternative Concentration Limits (ACLs)

In addition to the above responses to WDNR comments, this Addendum includes proposed PALs and ACLs. Consistent with NR 507 and the WDNR 2007 guidance document "How to Calculate Preventive Action Limits (PALs) and Alternative Concentration Limits (ACLs) for Solid Waste Facilities", PALs were calculated for the following indicator parameters for CCR monitoring wells: alkalinity, calcium, hardness, total dissolved solids (TDS), specific conductance, and lithium. PAL calculations were based on eight rounds of background groundwater quality data collected in 2022-2023 or 2015-2017. PALs for these indicator parameters were calculated as the greater of: 1) the mean of at least eight values plus three standard deviations, or 2) the mean of at least eight values plus the increment specified in s. NR 140.20, Table 3. Selected values for PALs were rounded up to two significant digits as specified in the WDNR guidance. Proposed PALs are summarized in **Table 1**. The PAL calculations are summarized in **Attachment 15**. Previously approved PALs for hardness and alkalinity at the CCR wells were based on filtered samples, and therefore, are not applicable to the CCR monitoring program.

Baseline groundwater data were reviewed to determine if monitoring parameters exceed existing NR 140 groundwater standards at CCR wells. Nitrate plus nitrite as nitrogen was detected at concentrations exceeding the NR 140 PAL in six of the CCR wells. Due to these exceedances, ACLs were calculated for nitrate plus nitrite as nitrogen at the six CCR wells where exceedances were identified. ACLs were calculated as the mean concentration of the eight baseline sampling events, plus two standard deviations, as outlined in the 2007 WDNR guidance document referenced above. Values for ACLs were rounded up to two significant digits as specified in the WDNR guidance. Proposed ACLs are summarized in **Table 2**. The ACL calculations are summarized in **Attachment 15**.

Per s. NR 140.28(1)(a), the WDNR may not approve a facility where a PAL has been exceeded unless an exemption is granted. Therefore, in accordance with s. NR 140.28 and s. NR 507.29, DPC is requesting an exemption for PAL exceedances for nitrate plus nitrite as nitrogen at W-100R, W-100AR, W-101, W-105, W-106, and W-107. Because the highest concentrations of nitrate plus nitrite as nitrogen are found in the upgradient wells, the nitrogen in groundwater appears to be coming from an upgradient source, most likely upgradient agricultural land use. Per NR s. 140.28(3)(a), the department may grant an exemption for background nitrate exceeding the PAL if the facility is designed to achieve the lowest possible concentration for that substance which is technically and economically feasible and the existing or anticipated increase in the concentration of the substance does not present a threat to public health or welfare. The facility is designed to prevent the release of contaminants to the environment. Therefore, the facility is designed to achieve the lowest possible concentration that is technically and economically feasible, and there is no anticipated increase in nitrate plus nitrite as nitrogen in groundwater resulting from the facility.

DPC and TRC trust that we have provided the information requested by the Department. Additional copies of this Addendum 1 have been distributed according to the attached distribution list.

Request for Additional Waste Stream in Phase IV Landfill

In addition to the information requested by the Department, DPC requests approval to accept a new waste stream for a limited time into the Phase IV Landfill as part of this Plan Modification. The new waste stream is anticipated to be a limited time occurrence correlating with and consisting of waste from the removal of the EJ Stoneman Landfill in Cassville, Wisconsin. To support this request, detailed information on the waste type and quantity, anticipated schedule, and management procedures is provided in **Attachment 16**.

DPC is requesting that the WDNR review and provide an approval for the Phase IV Landfill. Please feel free to contact Leif Tolokken at (608) 386-2675 or me at (608) 622-9382 with questions regarding this document.

Sincerely,

TRC

Todd W. Martin

Todd Martin
Principal Project Manager

cc: See attached Distribution List

List of Enclosures

Attachment 1:	Addendum Certification Statement
Attachment 2:	WDNR Incompleteness Determination for the Plan of Operation Approval Modification for Initial Permitting of Coal Combustion Residuals (CCR) Landfill for the Dairyland Power Cooperative Alma Off-Site Disposal Facility, Phase IV Landfill (License #4126), dated April 26, 2023
Attachment 3:	Site Specific Storm Water Pollution Prevention Plan
Attachment 4:	Loadout Station
Attachment 5:	Construction Quality Assurance Plan
Attachment 6:	Final Cover Construction – Stormwater Drainage Piping
Attachment 7:	Previous GCL Conformance Testing
Attachment 8:	Water Table Map
Attachment 9:	Baseline Groundwater Monitoring Data
Attachment 10:	Revised Environmental Sampling and Analysis Plan
Attachment 11:	Additional Information for s. NR 514.045(c) Demonstration
Attachment 12:	Revised Run-On and Run-Off Systems Plan
Attachment 13:	Revised Post Closure Care Plan
Attachment 14:	Revised Closure and Post-Closure Costs
Attachment 15:	PAL and ACL Calculations
Attachment 16:	Additional Waste Stream Request

TRC

Distribution List

Recipient	Hard Copy	Electronic Copy[1]
Anthony Peterson Wisconsin Department of Natural Resources 141 NW Barstow Street #180 Waukesha, WI 53188	1	Yes
Matthew Bachman Wisconsin Department of Natural Resources 1300 W Clairemont Ave Eau Claire, WI 54701	1	Yes
Leif Tolokken Dairyland Power Cooperative 3200 East Avenue South La Crosse, WI 54601		Yes
Don Loock Dairyland Power Cooperative S2180 State Hwy 35 Alma, WI 54610		Yes
BreAnne Kahnk TRC 999 Fourier Drive, Suite 101 Madison, WI 53717		Yes

Footnotes:

(1) Electronic copies to be sent via an e-mail link.

Attachment 1

Addendum Certification Statement

Certification Statement

"I, Douglas R. Genthe, P.E., hereby certify that I am a licensed professional engineer in the State of Wisconsin in accordance with the requirements of ch. A-E 4, Wis. Adm. Code; that this document has been prepared in accordance with the Rules of Professional Conduct in ch. A-E 8, Wis. Adm. Code; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 500 to 538, Wis. Adm. Code."

WISCONSIN
Douglas R.
Genthe
E-27604
Madison,
WI
PROFESSIONAL ENGINEER

1/16/2024

WISCONSIN
STEPHEN M
SELLWOOD
PG-1228
MADISON
WI
PROFESSIONAL GEOLOGIST

I, Stephen Sellwood, P.G., hereby certify that I am a licensed professional geologist in the State of Wisconsin in accordance with the requirements of Chapter GHSS 2, Wisconsin Administrative Code; that the preparation of this document has not involved any unprofessional conduct as detailed in Chapter GHSS 5, Wisconsin Administrative Code; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in Chapters NR 500 to NR 538, Wisconsin Administrative Code.

Attachment 2

WDNR Incompleteness Determination for the Plan of Operation Approval Modification for Initial Permitting of Coal Combustion Residuals (CCR) Landfill for the Dairyland Power Cooperative Alma Off-Site Disposal Facility, Phase IV Landfill (License #4126), dated April 26, 2023

State of Wisconsin
DEPARTMENT OF NATURAL RESOURCES
1300 W Clairemont Ave.
Eau Claire, WI 54701

Tony Evers, Governor
Adam N. Payne, Secretary
Telephone 608-266-2621
Toll Free 1-888-936-7463
TTY Access via relay - 711

April 26, 2023

FID: 606043900
Buffalo County
SW/ Correspondence

Mr. Leif Tolokken
Dairyland Power Cooperative
JPM Station
500 Old State Highway 35
Alma, WI 54610

Subject: Incompleteness Determination for the Plan of Operation Approval Modification for Initial Permitting of Coal Combustion Residuals (CCR) Landfill for the Dairyland Power Cooperative Alma Off-Site Disposal Facility, Phase IV Landfill (License #4126)

Dear Mr. Tolokken:

The Department of Natural Resources (department) has reviewed for completeness the plan of operation modification for initial permitting of a CCR Landfill ("the plan"), submitted on behalf of Dairyland Power Cooperative (DPC), by TRC Companies for the Dairyland Power Cooperative Alma Off-Site Disposal Facility, Phase IV Landfill. The plan includes a report and set of plan sheets titled: "Plan Modification for Initial Permitting of CCR Landfills, Alma Off-site Disposal Facility, Phase IV Landfill", dated and received by the department on January 30, 2023.

The department has determined the plan is not complete since the minimum requirements of chs. NR 500 to 520, Wis. Adm. Code, have not been met in accordance with s. NR 514.045, Wis. Adm. Code. The department understands the complexity of the new CCR rules and its implementation and will be available to discuss the following items while you work to prepare the addenda to your initial submittal.

The following information must be provided in order for the department to issue a determination that the plan is complete:

1. **Section NR 504.04(4)(b), Wis. Adm Code:** Provide a revised endangered species or critical habitat demonstration narrative that includes a statement about the existence of potential habitat for the threatened snail species within the approved liner areas Cell 4 Module A, and Module B.

2. **Section NR 504.04(4)(c), Wis. Adm. Code:** Provide a copy of the facility's Wisconsin Pollutant Discharge Elimination System (WPDES) permit and a copy of the facilities most recent stormwater pollution prevention plan (SWPPP).

3. **Section NR 504.06, Wis. Adm. Code:** Provide the information required for the design and construction of the liner and leachate collection and removal system.

a. Section NR 504.06(3)(c) and (k), Wis. Adm. Code: Clarify if the geomembrane installation will adhere to the requirements of these code cites.

b. Section NR 504.06(5)(j), Wis. Adm. Code: Provide a revised leachate removal system which includes a sump and side slope riser design.

c. Section NR 504.06(5)(l), Wis. Adm. Code: Regarding the leachate transfer lines, clarify whether the upslope end of the secondary pipe is sealed and the downslope end is open to allow any collected liquid to flow into the manhole.

d. Section NR 504.06(5)(p), Wis. Adm. Code: Provide a discussion of the measures to be taken to prevent accidental discharge at the loadout station and provide the required specifications for the leachate loadout station design.

4. **Section NR 504.07, Wis. Adm. Code:** Provide the information required for the design and construction of the final cover.

a. Section NR 504.07(4)(a)12 through 15, Wis. Adm. Code: Provide the soil barrier layer specifications and clarify if its construction will adhere to the requirements of these code cites.

b. Section NR 504.07(6)(b), (7), and (8), Wis. Adm. Code: Re-evaluate the final cover perimeter storm water drain system design and provide the specifications and application rates for fertilizer and mulch addition to topsoil.

c. Section NR 504.12(3)(a)5, Wis. Adm. Code: Specify the hydraulic conductivity standard of the soil barrier layer material to be used in construction of the liner and provide justification for the assumptions made for the liquid flow rate calculation for the soil barrier layer.

5. **Section NR 507.15(3), Wis. Adm. Code:** Provide the following information for general environmental monitoring requirements.

a. Section NR 507.15(3)(a), Wis. Adm Code: Provide a more detailed discussion on the known or suspected contaminant pathways and how the proposed CCR groundwater monitoring system is designed to cover all the pathways.

b. Section NR 507.15(3)(b), Wis. Adm Code: Provide site-specific technical data on the below listed items and provide additional discussion on how that information was considered when deciding the number, spacing, and depths of monitoring wells that are part of the proposed CCR groundwater monitoring system.

i. Aquifer Thickness.

ii. Groundwater flow rate.

iii. Seasonal and temporal fluctuations in groundwater flow.

iv. Hydraulic conductivities, porosities and effective porosities for the saturated and unsaturated geologic units overlying the uppermost aquifer and materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the uppermost aquifer.

c. Section NR 507.15(3)(b), Wis. Adm. Code: Provide a groundwater flow map for the site that includes at a minimum the proposed CCR wells, other groundwater monitoring wells, the landfill footprint, and groundwater flow direction.

d. Section NR 507.15(3)(i), Wis. Adm. Code: Provide baseline groundwater monitoring data for copper, manganese, silver, zinc, and field temperature in the CCR Wells.

e. Section NR 507.15(3)(k), Wis. Adm. Code: Provide a statement for the owner/operator to notify the department in writing within 60 days of completing sampling and analysis at any CCR well when a groundwater standard has been attained or exceeded in accordance with s. NR 507.15(3)(k), Wis. Adm. Code.

6. **Section NR 507.16(1), Wis. Adm. Code:** Provide the following information for the sampling plan.

a. Section NR 507.16(1)(a), Wis. Adm. Code: Provide an updated Site Monitoring Locations map that includes the leachate tank, and retention pond.

b. Section NR 507.16(1)(c), Wis. Adm. Code: Provide revised procedures for field measurements for the items listed below.

i. A detailed order in which wells should be sampled if the groundwater has been impacted by regulated or other activities.

ii. The procedures and types of equipment to determine turbidity, odor, and color.

c. Section NR 507.16(1)(d), Wis. Adm. Code: Provide an update to the equipment cleaning process that includes procedures to clean purging equipment between wells.

d. Section NR 507.16(1)(e), Wis. Adm. Code: Provide revised procedures for obtaining samples from wells that include the following

i. The volume of sample required for analysis.

ii. The rate of flow when sampling, when applicable.

e. Section NR 507.16(1)(f), Wis. Adm Code: Provide revised procedures for establishing field quality assurance and quality control that include procedures for and the frequency at which field blanks will be collected and processed.

7. **Section NR 514.045(1)(c)1 through 3, Wis. Adm. Code:** Provide a demonstration addressing the stability items of this section.

8. **Section NR 514.07(1)(i) and (j), Wis. Adm. Code:** Provide updated construction quality control and assurance plans that include the placement of the 2-foot soil barrier layer of the final cover.

9. **Section NR 514.07(10), Wis. Adm. Code:** Provide additional information for the operational plans required for the CCR landfill.

a. Section NR 514. 07(10)(b)3, Wis. Adm. Code: Provide an updated run-on and run-off control system plan that includes construction procedures and a schedule for construction of the storm water control structures.

b. Section NR 514. 07(10)(c)6, Wis. Adm. Code: Provide the anticipated schedule of final cover construction activities including the year and number of acres of each construction event.

c. Section NR 514.07(10)(d)1.d., Wis. Adm. Code: Provide a statement that the groundwater monitoring system will be maintained and monitored in accordance with ch. NR 507, Wis. Adm. Code.

d. Section NR 514.07(10)(d)2, Wis. Adm. Code: Provide the name of the person or office to contact about the facility during long-term care.

10. **Sections NR 520.07(2) and (3), Wis. Adm. Code:** Provide updated cost estimates for closure and long-term care as needed to reflect above items.

11. Provide a chronological listing of all previous department issued plan of operation and modification approvals, including expedited plan modifications, along with a listing of their approval conditions, indicating the status (active, completed or superseded) of each condition.

12. Please note that the proposed final cover alternative which includes 2-ft of moisture conditioned and compacted fly ash overlain by a geomembrane does not meet code requirements and therefore will not be approved.

This incompleteness determination is not a denial of the plan, but merely indicates that additional information is needed for the department to determine the plan is complete. Submittal of this information does not ensure approval, nor does it preclude the department from requiring additional information if continued review indicates it is needed.

If you have any questions regarding this letter, please contact Tony Peterson at (715) 491-8546 or anthony.peterson@wisconsin.gov, or Matthew Bachman at (608) 512-3233 or matthew.bachman@wisconsin.gov.

Sincerely,

John Morris, Professional Soil Scientist, Regional Supervisor
Northern and West Central Regions
Waste and Materials Management Program

cc: Brian Kalvelage – Dairyland Power Cooperative (brian.kalvelage@dairylandpower.com)
BreAnne Kahnk – TRC Companies (bkahnk@trccompanies.com)
Todd Martin – TRC Companies (twmartin@trccompanies.com)
Tony Peterson – DNR/WA (anthony.peterson@wisconsin.gov)
Matthew Bachman – DNR/WA (matthew.bachman@wisconsin.gov)
Joseph Lourigan – DNR/WA (joseph.lourigan@wisconsin.gov)
Malena Grimm – DNR/WA (malena.grimm@wisconsin.gov)

Attachment 3

Site Specific Storm Water Pollution Prevention Plan

Cover Sheet

Storm Water Pollution Prevention Plan (SWPPP) Alma Offsite
Environmental Department Controlled Document ***---Water Quality---***
Last Review/Revision Date: 1/12/2023

Review/Revision History

Reviewed or Revised By	Date	Reviewed or Revised By	Date
Mike Peters	9/18/09		
Mike Peters	12/10/18		
Mike Peters	10/11/19		
Andy Thomes	1/29/21		
Andy Thomes	12/17/21		
Andy Thomes	1/12/23		

Storm Water Pollution Prevention Plan (SWPPP)

Dairyland Power Cooperative

Alma Offsite Site

September 18, 2009

Alma Offsite Storm Water Pollution Prevention Plan
Distribution List

Name/Title/Work Location	Document Location
Don Loock / Mgr, Alma Fuels/ Alma Site	Working copy
Ty Johnson / Mechanical Foreperson/ Alma Offsite	Working copy
Janet Cleveland / Craig Leverance/ Performance Tech / JPM	Working copy
Andy Thomes / Water Compliance Specialist / La Crosse Admin.	Working original copy
Andy Thomes / Water Compliance Specialist / La Crosse Admin.	Alma Offsite Env. Comp. Manual and in p8

List current as of 1/12/2023.

Addendum

Item/Text Added or Changed	Reviewer	Date
Included text in site description to reflect Phase IV construction and additional storm water basins.	B. Kowalski	9/7/00
Added another potential storm water contamination source (ash spillage from trucks on way to landfill cell).	B. Kowalski	9/7/00
Added BMP practice (ash spillage from trucks when hauling ash to landfill cell).	B. Kowalski	9/7/00
Updated SWPP Plan distribution list.	B. Kowalski	9/7/00
Reformatted distribution list.	B. Kowalski	1/9/02
Updated team membership list.	B. Kowalski	1/9/02
Updated site manager, updated distribution list, added observation point for temporary sed basin for Cell 2A, updated inspection forms.	B. Kowalski	6/5/06
Updated distribution list, updated landfill cells narrative, added soil borrow sites to Facility Site Description, added observation points for soil borrow sites, updated inspection forms	M. Peters	9/18/09
Updated distribution and team member lists, removed mention of Alma 1-5 throughout document, updated plan to current ash processing conditions, added signature page for Brian Treadway, and updated Appendices B and C to current conditions.	M. Peters	12/10/18
Updated distribution and team member lists.	A Thomes	1/20/21
Updated personnel info	A Thomes	12/17/21

Table Of Contents

Introduction

Storm water regulations were published by the Environmental Protection Agency in 1990. The State of Wisconsin has authority to administer these regulations under NR 216. NR 216 defines the conditions under which storm water associated with industrial activity can be discharged to the waters of the State of Wisconsin. A WPDES Storm Water Permit is required to discharge storm water. One of the requirements of the permit is a Storm Water Pollution Prevention Plan.

Storm Water Pollution Prevention Plan(SWPPP)

Pollution Prevention Individual

Ty Johnson, Mechanical Foreperson, is the SWPPP coordinator for the Alma Offsite. This individual has the responsibility to coordinate the development, evaluation, maintenance, and amendment of the SWPPP with the assistance of corporate Environmental Water and Waste Management Department and the Alma Offsite Site Storm Water Pollution Prevention Team. See Appendix A for Team members.

Facility Site Description and Drainage Base Map

The Alma Offsite is a licensed coal ash landfill site. It is located in Buffalo County south of Alma, Wisconsin along and northeast of state highway 35. The site is located within a coulee(valley) and has an elevation of 770 - 875 feet above mean sea level(MSL). The main features of the site are as follows:

1. Ash processing building.

    Coal ash is brought to the site from Dairyland power plant sites in Alma(JPM) and Genoa(G-3), Wisconsin. Bottom ash is transported from the power plant site directly to the landfill. G-3 fly ash is brought to the site in semitrailer trucks, pneumatically unloaded, processed(conditioned), and loaded onto dump trucks for placement in the landfill. JPM fly ash is processed(conditioned) at JPM silos, and loaded onto dump trucks for placement in the landfill.

2. Landfill cells.

    The existing landfill area is divided into four phases. The first three phases have been filled and closed. Storm water from outside the landfill proper boundary is directed around the landfill boundary so that none of this water comes in contact with coal ash and site activities.

    Construction of the Phase IV landfill began in 2001 and will consist of 6 cells, each of which will be built one at a time. As of December 2018, the first three cells (Cell 1, 2A, and 2B) have been filled and capped. Cell 3A and 3B are constructed and are currently in use. Storm water that will contact ash will be directed to a leachate collection system and to a holding tank for either use in the ash conditioning process or used as make-up water in the JPM bottom ash dewatering system. Storm water that falls within the cell, that has not contacted ash, will be directed to one of two storm water runoff basins to settle out the suspended solids before discharge to the intermittent stream that runs through the site.

3. Soil borrow sites.

   The Alma Offsite contains two soil borrow sites that are used periodically. Soil excavated from the borrow sites will be used as capping material for the landfill cells associated with Phase IV. Storm water associated with the soil borrow sites will be managed per the requirements of WPDES Nonmetallic Mining Operations General Permit WI-0046515-5 which was received for the borrow sites.

4. Storm water runoff pond.

   A storm water runoff pond is located on the site to capture runoff from the immediate area surrounding the ash processing building. This water is used in the ash conditioning process. Water from this pond has never and is not anticipated to be discharged to surface water.

   The Phase IV landfill has two storm water runoff basins. The basins collect storm water from within each cell that has not contacted ash. The basins will provide settling of suspended solids before discharge to the intermittent stream that runs through the site.

The drainage base map is located in Appendix B. The map indicates drainage patterns and potential contaminant sources. This map will be updated as the landfill cells are filled and closed.

Summary of Existing Sampling Data or Observations

There is some water quality data for the storm water runoff pond. Because this water is collected and not discharged, there will be no further discussion of the data. This data is mentioned to inform agency personnel or other interested parties that it exists. The data for the runoff pond is maintained by the Environmental Water and Waste Management Department. No other observations which characterize storm water quality or identify storm water contamination sources exist.

Potential Sources of Storm Water Contamination

Potential sources of contaminated storm water are as follows:

aboveground fuel oil tank
used oil barrels
ash unloading area
ash loading area
transformers
soil erosion
ash spillage from trucks on way to landfill cell

Potential pollutants resulting from contact with these sources include:

suspended solids(ash fines, soil), trace metals(e.g. iron, zinc), petroleum VOCs(e.g. DRO), and oil and grease.

Status of Non-storm Water Discharges to the Storm Sewer

This site has no non-storm water discharges to the storm sewer system.

Source Area Control Best Management Practices

Petroleum AST has berm to capture leaks and is completely enclosed.
The site perimeter is graded to retain storm water runoff to the site, with the exception of those areas which are not a part of active operations per the landfill Plan of Operation.
Erosion in the landfill area is monitored and repaired as needed per the landfill Plan of Operation and/or Closure Plan.
The transformers are checked daily as site supervisors make their rounds of the site.
The ash unloading and loading areas are paved and sloped to a storm water collection drain and/or the runoff pond. Note: storm water from these sources is directed to the runoff pond.
Ash that may fall off of trucks in the ash loading area is picked up to minimize storm water contact and fugitive dust conditions.
Processed ash is loaded on the dump trucks to minimize spillage from the trucks during transport to the landfill cell.
Used oil barrels are placed on top of spill pallets.
Training for site personnel will be conducted annually via GPI Learn to maintain an awareness of storm water pollution prevention.

Residual Pollutants

No residual pollutants should leave the site except rain events which will exceed the 25-year, 24-hour storm events. The two storm water collection drains are designed to overflow to a nearby intermittent stream under extreme rain events as approved by the Bureau of Solid Waste when the landfill site was constructed. Under these events residual pollutants would consist of suspended solids and trace metals. No activities at this facility would contribute to BOD.

Storm Water Treatment Best Management Practices

Source BMPs should be sufficient to control potential storm water pollutants at this site.

Facility Monitoring Plan

The facility monitoring plan shall include the following:

1. Evaluations of non-storm water discharges

   a. end of pipe screening twice per year(January, July)

2. Evaluation of storm water discharges

   a. annual facility site compliance inspection(January)
   b. quarterly visual observations of storm water leaving the site.
      (Jan-Mar, Apr-Jun, Jul-Sep, Oct-Dec)

Inspection forms can be found in Appendix C.

SWPPP Implementation Schedule

Evaluation of non-storm water and storm water discharges will begin in 1997. BMPs identified in the SWPPP are already in place. No further action is warranted at this time.

Signature

Name: George Miller
Title: Site Manager

Signature:_________________________________

I certify under penalty of law that this document and attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information contained in the plan. Based on my inquiry of the person, or persons, who manage the system, or those persons directly responsible for gathering the information; the information contained in this document is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for providing false information, including the possibility of fine and imprisonment. In addition, I certify under penalty of law that, based upon inquiry of persons directly under my supervision, to the best of my knowledge and belief, the provisions of this document adhere to the provisions of the storm water permit for the development and implementation of a Storm Water Pollution Prevention Plan and that the plan will be complied with.

(Revision Recertification)

Signature

Name: Brian Treadway
Title: Site Manager

Signature:___________________________________

I certify under penalty of law that this document and attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information contained in the plan. Based on my inquiry of the person, or persons, who manage the system, or those persons directly responsible for gathering the information; the information contained in this document is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for providing false information, including the possibility of fine and imprisonment. In addition, I certify under penalty of law that, based upon inquiry of persons directly under my supervision, to the best of my knowledge and belief, the provisions of this document adhere to the provisions of the storm water permit for the development and implementation of a Storm Water Pollution Prevention Plan and that the plan will be complied with.

Appendix A

Alma Offsite SWPPP Team Members

Alma Offsite SWPPP Team Members

Team Leader:

Ty Johnson

Members

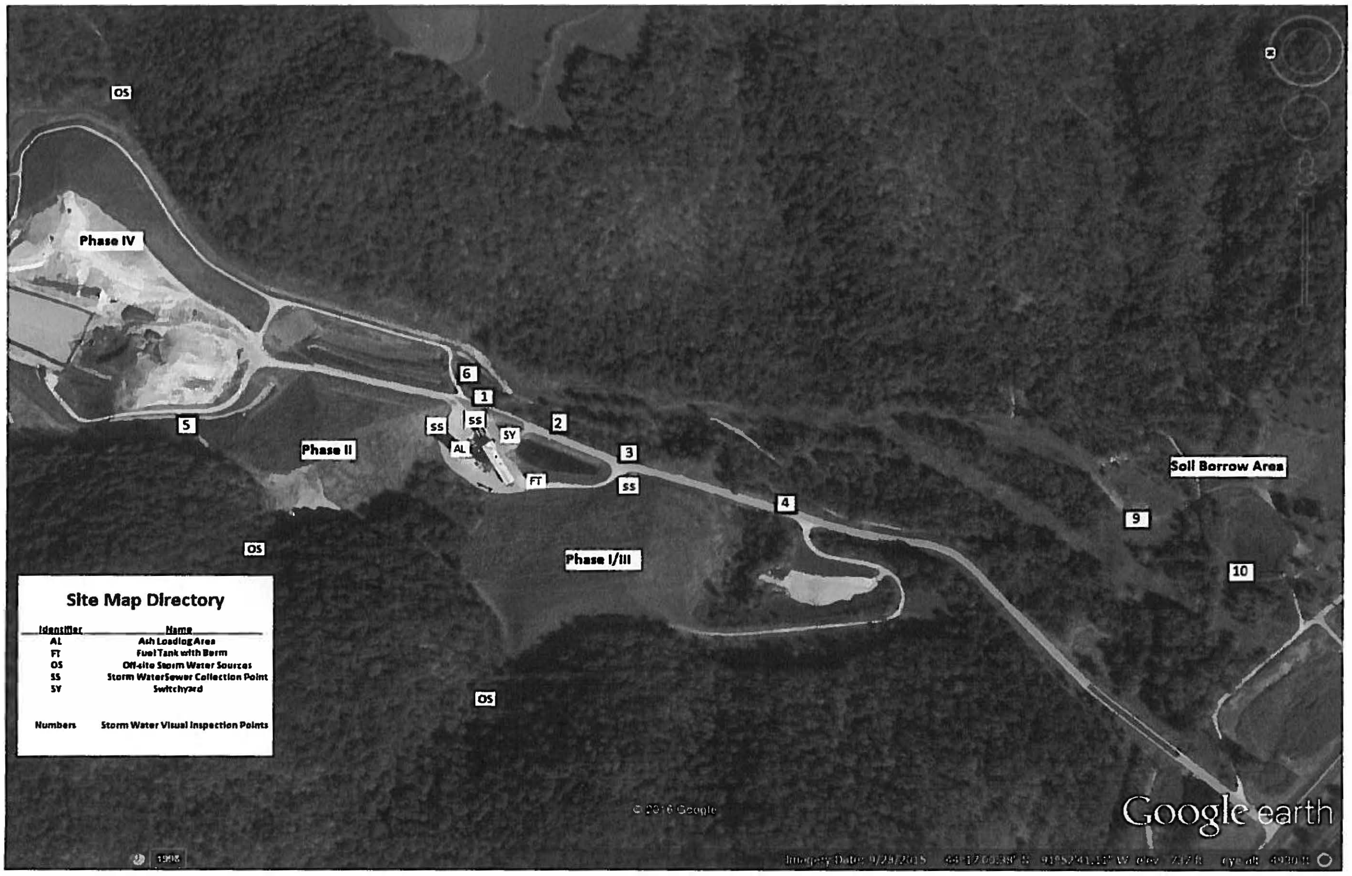
Don Loock
Janet Cleveland
Craig Leverance

Advisor

Andy Thomes

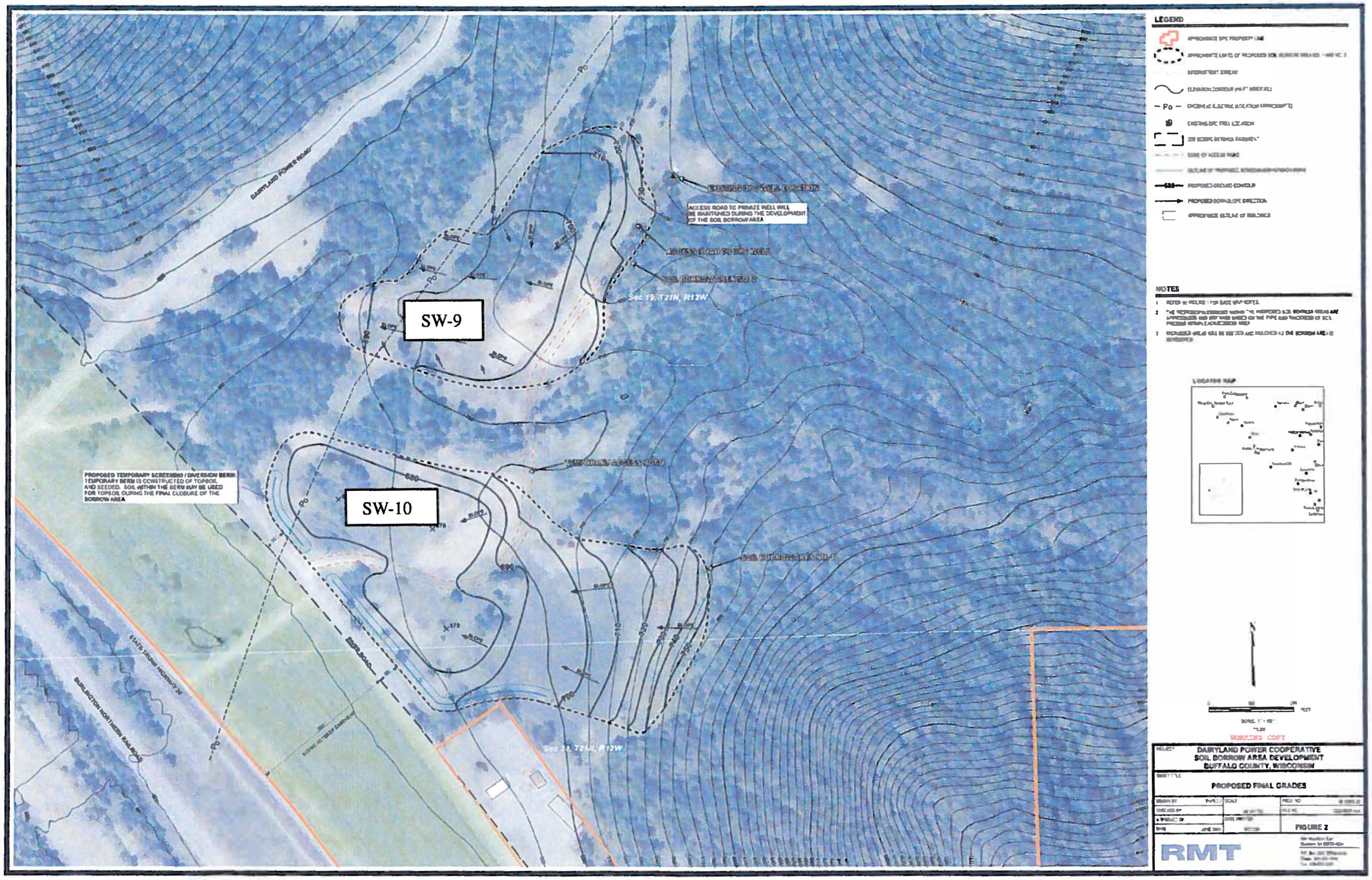
Appendix B

Site Base Maps



Alma Offsite Map including Quarterly Inspection Locations

Quarterly Inspection Locations SW-1 thru SW-6



Quarterly Inspection Locations SW-9 and SW-10

Appendix C

Inspection Form

4th Quarter

State of Wisconsin Department of Natural Resources	**Quarterly Visual Inspection – Field Sheet** Form 3400 – 176A (R 3/01)

This form is for your own use and should be kept as part of your Storm Water Pollution Prevention Plan. It does not have to be submitted to the Department unless requested. If false information from quarterly visual inspections is reported to the Department, you could be subject to penalties up to $10,000 pursuant to s. 283.91(4), Wis. Stats.

Use one form per outfall.

Quarterly visual inspections at each storm water discharge outfall on your site can be a valuable assessment tool and are required by the Tier 1 and Tier 2 Industrial Storm Water General Permits. This inspection should be performed when sufficient runoff occurs during daylight hours. Try to make observations within the first 30 minutes after runoff begins discharging from the outfall, or as soon as practical, but no later than 60 minutes. If you find visible pollution, note the probable source and list any possible Best Management Practices that could be used to reduce or eliminate the problem.

Make any necessary changes to your **Storm Water Pollution Prevention Plan** as needed.

Facility Name **Dairyland Power Cooperative Alma Offsite**			
Street Address **State Highway 35 and River Road**	City **Alma**	State **WI**	ZIP Code **54610**
Name of Person Conducting Inspection		Inspection Date	
Employer **Dairyland Power Cooperative**		Telephone Number	
Outfall Number (make reference to site map) **SW-1**	Description of Outfall (e.g., ditch, concrete pipe, grassed swale, etc.) **End of pipe located northeast of Ash Processing Building. (see map)**		
Time of Rainfall Event	Time of Visual Inspection	**Optional**: Amount of rainfall at time of observation (nearest tenth of an inch)	

Describe your observations. An easy way to conduct this inspection is to use a glass jar to collect a sample of the storm water being discharged from the facility and visually inspect the water. Include any observations of color, odor, turbidity, floating solids, foam, oil sheen or any other visual indicators of storm water pollution and the probable sources of any observed storm water contamination.

Color:	☐ Clear	☐ Red	☐ Yellow	☐ Brown	☐ Other:
Odor:	☐ None	☐ Musty	☐ Sewage	☐ Rotten Egg	☐ Other:
Clarity:	☐ Clear	☐ Cloudy	☐ Opaque	☐ Suspended Solids	☐ Other:
Floatables:	☐ None	☐ Foam	☐ Garbage	☐ Oily Film	☐ Other:
Deposits/Stains:	☐ Clear	☐ Red	☐ Yellow	☐ Brown	☐ Other:

Comments:

This outfall could not be evaluated during this quarter due to the following reason:

4^{th} Quarter

State of Wisconsin Department of Natural Resources	**Quarterly Visual Inspection – Field Sheet** Form 3400 – 176A (R 3/01)

This form is for your own use and should be kept as part of your Storm Water Pollution Prevention Plan. It does not have to be submitted to the Department unless requested. If false information from quarterly visual inspections is reported to the Department, you could be subject to penalties up to $10,000 pursuant to s. 283.91(4), Wis. Stats.

Use one form per outfall.

Quarterly visual inspections at each storm water discharge outfall on your site can be a valuable assessment tool and are required by the Tier 1 and Tier 2 Industrial Storm Water General Permits. This inspection should be performed when sufficient runoff occurs during daylight hours. Try to make observations within the first 30 minutes after runoff begins discharging from the outfall, or as soon as practical, but no later than 60 minutes. If you find visible pollution, note the probable source and list any possible Best Management Practices that could be used to reduce or eliminate the problem.

Make any necessary changes to your **Storm Water Pollution Prevention Plan** as needed.

Facility Name **Dairyland Power Cooperative Alma Offsite**			
Street Address **State Highway 35 and River Road**	City **Alma**	State **WI**	ZIP Code **54610**
Name of Person Conducting Inspection		Inspection Date	
Employer **Dairyland Power Cooperative**		Telephone Number	
Outfall Number (make reference to site map) **SW-2**	Description of Outfall (e.g., ditch, concrete pipe, grassed swale, etc.) **End of pipe that exits the Runoff Pond. (see map)**		
Time of Rainfall Event	Time of Visual Inspection	**Optional**: Amount of rainfall at time of observation (nearest tenth of an inch)	

Describe your observations. An easy way to conduct this inspection is to use a glass jar to collect a sample of the storm water being discharged from the facility and visually inspect the water. Include any observations of color, odor, turbidity, floating solids, foam, oil sheen or any other visual indicators of storm water pollution and the probable sources of any observed storm water contamination.

Color:	☐ Clear	☐ Red	☐ Yellow	☐ Brown	☐ Other:
Odor:	☐ None	☐ Musty	☐ Sewage	☐ Rotten Egg	☐ Other:
Clarity:	☐ Clear	☐ Cloudy	☐ Opaque	☐ Suspended Solids	☐ Other:
Floatables:	☐ None	☐ Foam	☐ Garbage	☐ Oily Film	☐ Other:
Deposits/Stains:	☐ Clear	☐ Red	☐ Yellow	☐ Brown	☐ Other:

Comments:

This outfall could not be evaluated during this quarter due to the following reason:

4th Quarter

State of Wisconsin Department of Natural Resources	**Quarterly Visual Inspection – Field Sheet** Form 3400 – 176A (R 3/01)

This form is for your own use and should be kept as part of your Storm Water Pollution Prevention Plan. It does not have to be submitted to the Department unless requested. If false information from quarterly visual inspections is reported to the Department, you could be subject to penalties up to $10,000 pursuant to s. 283.91(4), Wis. Stats.

Use one form per outfall.

Quarterly visual inspections at each storm water discharge outfall on your site can be a valuable assessment tool and are required by the Tier 1 and Tier 2 Industrial Storm Water General Permits. This inspection should be performed when sufficient runoff occurs during daylight hours. Try to make observations within the first 30 minutes after runoff begins discharging from the outfall, or as soon as practical, but no later than 60 minutes. If you find visible pollution, note the probable source and list any possible Best Management Practices that could be used to reduce or eliminate the problem.

Make any necessary changes to your **Storm Water Pollution Prevention Plan** as needed.

Facility Name
Dairyland Power Cooperative Alma Offsite

Street Address	City	State	ZIP Code
State Highway 35 and River Road	**Alma**	**WI**	**54610**

Name of Person Conducting Inspection	Inspection Date
Employer **Dairyland Power Cooperative**	Telephone Number

Outfall Number (make reference to site map)	Description of Outfall (e.g., ditch, concrete pipe, grassed swale, etc.)
SW-3	**End of pipe located southwest of the Runoff Pond. (see map)**

Time of Rainfall Event	Time of Visual Inspection	**Optional**: Amount of rainfall at time of observation (nearest tenth of an inch)

Describe your observations. An easy way to conduct this inspection is to use a glass jar to collect a sample of the storm water being discharged from the facility and visually inspect the water. Include any observations of color, odor, turbidity, floating solids, foam, oil sheen or any other visual indicators of storm water pollution and the probable sources of any observed storm water contamination.

Color:	☐ Clear	☐ Red	☐ Yellow	☐ Brown	☐ Other:
Odor:	☐ None	☐ Musty	☐ Sewage	☐ Rotten Egg	☐ Other:
Clarity:	☐ Clear	☐ Cloudy	☐ Opaque	☐ Suspended Solids	☐ Other:
Floatables:	☐ None	☐ Foam	☐ Garbage	☐ Oily Film	☐ Other:
Deposits/Stains:	☐ Clear	☐ Red	☐ Yellow	☐ Brown	☐ Other:

Comments:

This outfall could not be evaluated during this quarter due to the following reason:

4th Quarter

State of Wisconsin Department of Natural Resources	**Quarterly Visual Inspection – Field Sheet** Form 3400 – 176A (R 3/01)

This form is for your own use and should be kept as part of your Storm Water Pollution Prevention Plan. It does not have to be submitted to the Department unless requested. If false information from quarterly visual inspections is reported to the Department, you could be subject to penalties up to $10,000 pursuant to s. 283.91(4), Wis. Stats.

Use one form per outfall.

Quarterly visual inspections at each storm water discharge outfall on your site can be a valuable assessment tool and are required by the Tier 1 and Tier 2 Industrial Storm Water General Permits. This inspection should be performed when sufficient runoff occurs during daylight hours. Try to make observations within the first 30 minutes after runoff begins discharging from the outfall, or as soon as practical, but no later than 60 minutes. If you find visible pollution, note the probable source and list any possible Best Management Practices that could be used to reduce or eliminate the problem.

Make any necessary changes to your **Storm Water Pollution Prevention Plan** as needed.

Facility Name **Dairyland Power Cooperative Alma Offsite**			
Street Address **State Highway 35 and River Road**	City **Alma**	State **WI**	ZIP Code **54610**
Name of Person Conducting Inspection		Inspection Date	
Employer **Dairyland Power Cooperative**		Telephone Number	
Outfall Number (make reference to site map) **SW-4**	Description of Outfall (e.g., ditch, concrete pipe, grassed swale, etc.) **Culvert immediately south of Phase III. (see map)**		
Time of Rainfall Event	Time of Visual Inspection	**Optional**: Amount of rainfall at time of observation (nearest tenth of an inch)	

Describe your observations. An easy way to conduct this inspection is to use a glass jar to collect a sample of the storm water being discharged from the facility and visually inspect the water. Include any observations of color, odor, turbidity, floating solids, foam, oil sheen or any other visual indicators of storm water pollution and the probable sources of any observed storm water contamination.

Color:	☐ Clear	☐ Red	☐ Yellow	☐ Brown	☐ Other:
Odor:	☐ None	☐ Musty	☐ Sewage	☐ Rotten Egg	☐ Other:
Clarity:	☐ Clear	☐ Cloudy	☐ Opaque	☐ Suspended Solids	☐ Other:
Floatables:	☐ None	☐ Foam	☐ Garbage	☐ Oily Film	☐ Other:
Deposits/Stains:	☐ Clear	☐ Red	☐ Yellow	☐ Brown	☐ Other:

Comments:

This outfall could not be evaluated during this quarter due to the following reason:

4th Quarter

State of Wisconsin
Department of Natural Resources

Quarterly Visual Inspection – Field Sheet

Form 3400 – 176A (R 3/01)

This form is for your own use and should be kept as part of your Storm Water Pollution Prevention Plan. It does not have to be submitted to the Department unless requested. If false information from quarterly visual inspections is reported to the Department, you could be subject to penalties up to $10,000 pursuant to s. 283.91(4), Wis. Stats.

Use one form per outfall.

Quarterly visual inspections at each storm water discharge outfall on your site can be a valuable assessment tool and are required by the Tier 1 and Tier 2 Industrial Storm Water General Permits. This inspection should be performed when sufficient runoff occurs during daylight hours. Try to make observations within the first 30 minutes after runoff begins discharging from the outfall, or as soon as practical, but no later than 60 minutes. If you find visible pollution, note the probable source and list any possible Best Management Practices that could be used to reduce or eliminate the problem.

Make any necessary changes to your **Storm Water Pollution Prevention Plan** as needed.

Facility Name
Dairyland Power Cooperative Alma Offsite

Street Address	City	State	ZIP Code
State Highway 35 and River Road	**Alma**	**WI**	**54610**

Name of Person Conducting Inspection	Inspection Date

Employer	Telephone Number
Dairyland Power Cooperative	

Outfall Number (make reference to site map)	Description of Outfall (e.g., ditch, concrete pipe, grassed swale, etc.)
SW-5	**Half-culvert located at base of Phase II, north side. (see map)**

Time of Rainfall Event	Time of Visual Inspection	**Optional**: Amount of rainfall at time of observation (nearest tenth of an inch)

Describe your observations. An easy way to conduct this inspection is to use a glass jar to collect a sample of the storm water being discharged from the facility and visually inspect the water. Include any observations of color, odor, turbidity, floating solids, foam, oil sheen or any other visual indicators of storm water pollution and the probable sources of any observed storm water contamination.

Color:	☐ Clear	☐ Red	☐ Yellow	☐ Brown	☐ Other:
Odor:	☐ None	☐ Musty	☐ Sewage	☐ Rotten Egg	☐ Other:
Clarity:	☐ Clear	☐ Cloudy	☐ Opaque	☐ Suspended Solids	☐ Other:
Floatables:	☐ None	☐ Foam	☐ Garbage	☐ Oily Film	☐ Other:
Deposits/Stains:	☐ Clear	☐ Red	☐ Yellow	☐ Brown	☐ Other:

Comments:

This outfall could not be evaluated during this quarter due to the following reason:

4th Quarter

State of Wisconsin Department of Natural Resources	**Quarterly Visual Inspection – Field Sheet** Form 3400 – 176A (R 3/01)

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Use one form per outfall.

Quarterly visual inspections at each storm water discharge outfall on your site can be a valuable assessment tool and are required by the Tier 1 and Tier 2 Industrial Storm Water General Permits. This inspection should be performed when sufficient runoff occurs during daylight hours. Try to make observations within the first 30 minutes after runoff begins discharging from the outfall, or as soon as practical, but no later than 60 minutes. If you find visible pollution, note the probable source and list any possible Best Management Practices that could be used to reduce or eliminate the problem.

Make any necessary changes to your **Storm Water Pollution Prevention Plan** as needed.

Facility Name **Dairyland Power Cooperative Alma Offsite**			
Street Address **State Highway 35 and River Road**	City **Alma**	State **WI**	ZIP Code **54610**
Name of Person Conducting Inspection		Inspection Date	
Employer **Dairyland Power Cooperative**		Telephone Number	
Outfall Number (make reference to site map) **SW-6**	Description of Outfall (e.g., ditch, concrete pipe, grassed swale, etc.) **End of culvert located at base of Phase IV Sedimentation Basin # 1. (see map)**		
Time of Rainfall Event	Time of Visual Inspection	**Optional**: Amount of rainfall at time of observation (nearest tenth of an inch)	

Describe your observations. An easy way to conduct this inspection is to use a glass jar to collect a sample of the storm water being discharged from the facility and visually inspect the water. Include any observations of color, odor, turbidity, floating solids, foam, oil sheen or any other visual indicators of storm water pollution and the probable sources of any observed storm water contamination.

Color:	☐ Clear	☐ Red	☐ Yellow	☐ Brown	☐ Other:
Odor:	☐ None	☐ Musty	☐ Sewage	☐ Rotten Egg	☐ Other:
Clarity:	☐ Clear	☐ Cloudy	☐ Opaque	☐ Suspended Solids	☐ Other:
Floatables:	☐ None	☐ Foam	☐ Garbage	☐ Oily Film	☐ Other:
Deposits/Stains:	☐ Clear	☐ Red	☐ Yellow	☐ Brown	☐ Other:

Comments:

This outfall could not be evaluated during this quarter due to the following reason:

4th Quarter

State of Wisconsin Department of Natural Resources	**Quarterly Visual Inspection – Field Sheet** Form 3400 – 176A (R 3/01)

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Use one form per outfall.

Quarterly visual inspections at each storm water discharge outfall on your site can be a valuable assessment tool and are required by the Tier 1 and Tier 2 Industrial Storm Water General Permits. This inspection should be performed when sufficient runoff occurs during daylight hours. Try to make observations within the first 30 minutes after runoff begins discharging from the outfall, or as soon as practical, but no later than 60 minutes. If you find visible pollution, note the probable source and list any possible Best Management Practices that could be used to reduce or eliminate the problem.

Make any necessary changes to your **Storm Water Pollution Prevention Plan** as needed.

Facility Name
Dairyland Power Cooperative Alma Offsite

Street Address	City	State	ZIP Code
State Highway 35 and River Road	**Alma**	**WI**	**54610**

Name of Person Conducting Inspection	Inspection Date
NA	**NA**
Employer **Dairyland Power Cooperative**	Telephone Number

Outfall Number (make reference to site map)	Description of Outfall (e.g., ditch, concrete pipe, grassed swale, etc.)
SW-7	**End of culvert located at base of Phase IV Sedimentation Basin # 2. (see map)**

Time of Rainfall Event	Time of Visual Inspection	**Optional**: Amount of rainfall at time of observation (nearest tenth of an inch)
NA	**NA**	

Describe your observations. An easy way to conduct this inspection is to use a glass jar to collect a sample of the storm water being discharged from the facility and visually inspect the water. Include any observations of color, odor, turbidity, floating solids, foam, oil sheen or any other visual indicators of storm water pollution and the probable sources of any observed storm water contamination.

Color:	☐ Clear	☐ Red	☐ Yellow	☐ Brown	☐ Other:
Odor:	☐ None	☐ Musty	☐ Sewage	☐ Rotten Egg	☐ Other:
Clarity:	☐ Clear	☐ Cloudy	☐ Opaque	☐ Suspended Solids	☐ Other:
Floatables:	☐ None	☐ Foam	☐ Garbage	☐ Oily Film	☐ Other:
Deposits/Stains:	☐ Clear	☐ Red	☐ Yellow	☐ Brown	☐ Other:

Comments:

This inspection location has not been constructed.

This outfall could not be evaluated during this quarter due to the following reason:

4th Quarter

State of Wisconsin Department of Natural Resources	**Quarterly Visual Inspection – Field Sheet** Form 3400 – 176A (R 3/01)

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Use one form per outfall.

Quarterly visual inspections at each storm water discharge outfall on your site can be a valuable assessment tool and are required by the Tier 1 and Tier 2 Industrial Storm Water General Permits. This inspection should be performed when sufficient runoff occurs during daylight hours. Try to make observations within the first 30 minutes after runoff begins discharging from the outfall, or as soon as practical, but no later than 60 minutes. If you find visible pollution, note the probable source and list any possible Best Management Practices that could be used to reduce or eliminate the problem.

Make any necessary changes to your **Storm Water Pollution Prevention Plan** as needed.

Facility Name
Dairyland Power Cooperative Alma Offsite

Street Address	City	State	ZIP Code
State Highway 35 and River Road	**Alma**	**WI**	**54610**

Name of Person Conducting Inspection	Inspection Date
NA	**NA**
Employer **Dairyland Power Cooperative**	Telephone Number

Outfall Number (make reference to site map)	Description of Outfall (e.g., ditch, concrete pipe, grassed swale, etc.)
SW-8	**End of culvert located at base of Phase IV Temporary Sedimentation Basin for Cell 2A. (see map)**

Time of Rainfall Event	Time of Visual Inspection	**Optional**: Amount of rainfall at time of observation (nearest tenth of an inch)
NA	**NA**	

Describe your observations. An easy way to conduct this inspection is to use a glass jar to collect a sample of the storm water being discharged from the facility and visually inspect the water. Include any observations of color, odor, turbidity, floating solids, foam, oil sheen or any other visual indicators of storm water pollution and the probable sources of any observed storm water contamination.

Color:	☐ Clear	☐ Red	☐ Yellow	☐ Brown	☐ Other:
Odor:	☐ None	☐ Musty	☐ Sewage	☐ Rotten Egg	☐ Other:
Clarity:	☐ Clear	☐ Cloudy	☐ Opaque	☐ Suspended Solids	☐ Other:
Floatables:	☐ None	☐ Foam	☐ Garbage	☐ Oily Film	☐ Other:
Deposits/Stains:	☐ Clear	☐ Red	☐ Yellow	☐ Brown	☐ Other:

Comments:

This inspection location has not been constructed.

This outfall could not be evaluated during this quarter due to the following reason:

4th Quarter

State of Wisconsin Department of Natural Resources	**Quarterly Visual Inspection – Field Sheet** Form 3400 – 176A (R 3/01)

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Use one form per outfall.

Quarterly visual inspections at each storm water discharge outfall on your site can be a valuable assessment tool and are required by the Tier 1 and Tier 2 Industrial Storm Water General Permits. This inspection should be performed when sufficient runoff occurs during daylight hours. Try to make observations within the first 30 minutes after runoff begins discharging from the outfall, or as soon as practical, but no later than 60 minutes. If you find visible pollution, note the probable source and list any possible Best Management Practices that could be used to reduce or eliminate the problem.

Make any necessary changes to your **Storm Water Pollution Prevention Plan** as needed.

Facility Name
Dairyland Power Cooperative Alma Offsite

Street Address	City	State	ZIP Code
State Highway 35 and River Road	**Alma**	**WI**	**54610**

Name of Person Conducting Inspection	Inspection Date
Employer **Dairyland Power Cooperative**	Telephone Number

Outfall Number (make reference to site map)	Description of Outfall (e.g., ditch, concrete pipe, grassed swale, etc.)
SW-9	**Soil borrow area number 2. (see map)**

Time of Rainfall Event	Time of Visual Inspection	**Optional**: Amount of rainfall at time of observation (nearest tenth of an inch)

Describe your observations. An easy way to conduct this inspection is to use a glass jar to collect a sample of the storm water being discharged from the facility and visually inspect the water. Include any observations of color, odor, turbidity, floating solids, foam, oil sheen or any other visual indicators of storm water pollution and the probable sources of any observed storm water contamination.

Color:	☐ Clear	☐ Red	☐ Yellow	☐ Brown	☐ Other:
Odor:	☐ None	☐ Musty	☐ Sewage	☐ Rotten Egg	☐ Other:
Clarity:	☐ Clear	☐ Cloudy	☐ Opaque	☐ Suspended Solids	☐ Other:
Floatables:	☐ None	☐ Foam	☐ Garbage	☐ Oily Film	☐ Other:
Deposits/Stains:	☐ Clear	☐ Red	☐ Yellow	☐ Brown	☐ Other:

Comments:

This outfall could not be evaluated during this quarter due to the following reason:

4th Quarter

State of Wisconsin Department of Natural Resources	**Quarterly Visual Inspection – Field Sheet** Form 3400 – 176A (R 3/01)

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Use one form per outfall.

Quarterly visual inspections at each storm water discharge outfall on your site can be a valuable assessment tool and are required by the Tier 1 and Tier 2 Industrial Storm Water General Permits. This inspection should be performed when sufficient runoff occurs during daylight hours. Try to make observations within the first 30 minutes after runoff begins discharging from the outfall, or as soon as practical, but no later than 60 minutes. If you find visible pollution, note the probable source and list any possible Best Management Practices that could be used to reduce or eliminate the problem.

Make any necessary changes to your **Storm Water Pollution Prevention Plan** as needed.

Facility Name
Dairyland Power Cooperative Alma Offsite

Street Address	City	State	ZIP Code
State Highway 35 and River Road	**Alma**	**WI**	**54610**

Name of Person Conducting Inspection	Inspection Date
Employer **Dairyland Power Cooperative**	Telephone Number

Outfall Number (make reference to site map)	Description of Outfall (e.g., ditch, concrete pipe, grassed swale, etc.)
SW-10	**Soil borrow area number 1. (see map)**

Time of Rainfall Event	Time of Visual Inspection	**Optional**: Amount of rainfall at time of observation (nearest tenth of an inch)

Describe your observations. An easy way to conduct this inspection is to use a glass jar to collect a sample of the storm water being discharged from the facility and visually inspect the water. Include any observations of color, odor, turbidity, floating solids, foam, oil sheen or any other visual indicators of storm water pollution and the probable sources of any observed storm water contamination.

Color:	☐ Clear	☐ Red	☐ Yellow	☐ Brown	☐ Other:
Odor:	☐ None	☐ Musty	☐ Sewage	☐ Rotten Egg	☐ Other:
Clarity:	☐ Clear	☐ Cloudy	☐ Opaque	☐ Suspended Solids	☐ Other:
Floatables:	☐ None	☐ Foam	☐ Garbage	☐ Oily Film	☐ Other:
Deposits/Stains:	☐ Clear	☐ Red	☐ Yellow	☐ Brown	☐ Other:

Comments:

This outfall could not be evaluated during this quarter due to the following reason:

Semi-Annual, Non-Storm Water Discharge Field Sheet

Dairyland Power Cooperative – Alma Offsite

Evaluation Scope: Pick a dry day to perform the evaluation, preferably several days after the most recent rain. Go to each outfall location and look for the presence of water. Fill out the form below and explain any "yes" answers.

Outfall Number	Evaluation Date	Method Used to Evaluate Outfall	Non-storm Water Present?		Comments
			Yes	No	
SW-1		visual			
SW-2		visual			
SW-3		visual			
SW-4		visual			
SW-5		visual			
SW-6		visual			
SW-7	NA	visual			Does not exist yet.
SW-8	NA	visual			Does not exist yet.
SW-9		visual			
SW-10		visual			

Print Name: ______________________ Signature: ______________________

Explain any "yes" answers below:

State of Wisconsin
Department of Natural Resources
dnr.wi.gov

Annual Facility Site Compliance Inspection Report (AFSCI)

For Storm Water Discharge Associated With Industrial Activity Under Wisconsin Pollutant Discharge Elimination System (WPDES) Permit

Form 3400-176 (R 3/05)

Notice: This form is authorized by s. NR 216.29(2), Wis. Adm. Code. Submittal of a completed form to the Department is mandatory for industrial facilities covered under a tier 1 storm water general permit. Facilities covered under a tier 1 permit are not required to submit AFSCI reports after submittal of the second AFSCI report, unless so directed by the department. However, these inspections and quarterly visual inspections shall still be conducted and results shall be kept on site for department inspection. Facilities covered under a tier 2 storm water general, industry-specific general or individual permit shall keep the results of their AFSCI and quarterly visual inspections on site for department inspection. Failure to comply with these regulations may result in fines up to $25,000 per day pursuant to s. 283.91, Wis. Stats. Personally identifiable information on this form may be used for other water quality program purposes.

Facility Information

Facility Name
Dairyland Power Cooperative Alma Off-site

Street Address	City	State	ZIP Code
State Hwy 35 and River Road	**Alma**	**WI**	**54610**

County	Facility Contact Person
Buffalo	**Ty Johnson**

Signature

This form must be signed by an official representative of the permitted facility, in accordance with s. 216.29(8), Wis. Adm. Code.

IF THIS FORM IS NOT SIGNED, OR IS FOUND TO BE INCOMPLETE, IT WILL BE RETURNED

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature of Authorized Representative	Date Signed

Type or print name	Position Title
George Miller	**Site Manager**

Company Name	Telephone Number
Dairyland Power Cooperative	**608-685-6610**

Mailing Address	City	State	ZIP Code
500 Old State Highway 35	**Alma**	**WI**	**54610**

The first level of storm water monitoring consists of a comprehensive annual facility site compliance inspection (AFSCI) to determine if your facility is operating in compliance with your Storm Water Pollution Prevention Plan (SWPPP). You should use the results of this inspection to determine the extent to which your SWPPP needs to be updated to prevent pollution from new source areas, as well as to correct any inadequacies that the plan may have in handling existing source areas. This first level of monitoring is addressed in Section III of this Annual Report.

The second level of storm water monitoring consists of quarterly visual observations of storm water leaving the site during runoff events caused by snow-melt or rainfall. This is a practical, low cost tool for identifying obvious contamination of storm water discharges, and can also help identify which practices are ineffective. The goal of quarterly inspections is to obtain results from a set of four inspections that are distributed as evenly as possible throughout the year and which depict runoff quality during each of the four seasons. This second level of monitoring is addressed in Section IV of this Annual Report.

DNR Use Only	
FID	
FIN	

Annual Facility Site Compliance Inspection

The Annual Facility Site Compliance Inspection shall be adequate to verify that; your Storm Water Pollution Prevention Plan (SWPPP) remains current, potential pollution sources at your facility are identified, the facility site map and drainage map remain accurate, and Best Management Practices prescribed in your SWPPP are being implemented, properly operated, and adequately maintained.

Name of Person Conducting Inspection	Inspection Date
Employer **Dairyland Power Cooperative**	Telephone Number

Your inspection should start with a review of your written SWPPP kept at your facility. The SWPPP should be amended if, through these inspections, you find that the provisions in your SWPPP are ineffective in controlling contaminated storm water from being discharged from your facility.

Has your SWPPP been updated to include current Non-Storm Water Discharge Evaluation results?	☐ N/A	☐ No	☐ Yes
Has your SWPPP been amended for any new construction that would effect the site map or drainage conditions at the facility?	☐ N/A	☐ No	☐ Yes
Has your SWPPP been amended for any changes in facility operations that could be identified as new source areas for contamination of storm water?	☐ N/A	☐ No	☐ Yes
Are there any materials at the facility that are handled, stored, or disposed in a manner to allow exposure to storm water that are not currently addressed in your SWPPP?	☐ N/A	☐ No	☐ Yes
Are there any maintenance or material handling activities conducted outdoors that have not been addressed in your SWPPP?	☐ N/A	☐ No	☐ Yes
Are outside areas kept in a neat and orderly condition?	☐ N/A	☐ No	☐ Yes
Are regular housekeeping inspections made?	☐ N/A	☐ No	☐ Yes
Do you see spots, pools, puddles, or other traces of oils, grease, or other chemicals on the ground?	☐ N/A	☐ No	☐ Yes
Are particulates on the ground from industrial operations or processes being controlled?	☐ N/A	☐ No	☐ Yes
Do you see leaking equipment, pipes or containers?	☐ N/A	☐ No	☐ Yes
Do drips, spills, or leaks occur when materials are being transferred from one source to another?	☐ N/A	☐ No	☐ Yes
Are drips or leaks from equipment or machinery being controlled?	☐ N/A	☐ No	☐ Yes
Are cleanup procedures used for spilled solids?	☐ N/A	☐ No	☐ Yes
Are absorbent materials (floor dry, kitty litter, etc.) regularly used in certain areas to absorb spills?	☐ N/A	☐ No	☐ Yes
Can you find discoloration, residue, or corrosion on the roof or around vents or pipes that ventilate or drain work areas?	☐ N/A	☐ No	☐ Yes
Are Best Management Practices implemented to reduce or eliminate contamination of storm water from source areas at the facility?	☐ N/A	☐ No	☐ Yes
Are Best Management Practices adequately maintained?	☐ N/A	☐ No	☐ Yes
Are there significant changes that will have to made to your SWPPP to correct any inadequacies that the plan may have to effectively control a discharge of contaminated storm water from your facility?	☐ N/A	☐ No	☐ Yes

Comments:

As of 1/7/2018:

1. **Mississippi River at Alma is 303(b) listed as Impaired Water Body for Total Phosphorus, Mercury, PCBs, and PFOs. Activities at the Alma Offsite should not contribute any of the chemicals of concern in the storm water runoff.**
2. **Mississippi River at Alma has no TMDL's Listed. Waumandee Creek Watershed, which includes the Cochrane Ditch "Rose Valley" Subwatershed is located east and south of the Offsite, and does have an approved TMDL for Sediment, however the Offsite is not located within the watershed.**

Quarterly Visual Inspection Reports

Quarterly Visual Inspections at each storm water discharge outfall on your site can be a valuable assessment tool and are required by the Tier 1, Tier 2, and Nonmetallic Mining Industrial Storm Water General Permits. These inspections should be performed when sufficient runoff occurs during daylight hours. Try to make observations within the first 30 minutes after runoff begins discharging from the outfall or soon thereafter as practical, but no later than 60 minutes. If you find visible pollution, note the probable source and list any possible Best Management Practices that could be used to reduce or eliminate the problem. Make any necessary changes to your Storm Water Pollution Prevention Plan as needed. If you were unable to evaluate an outfall during a specific quarter, this should be indicated along with a reason as to why this could not be done.

	Date of Inspection			
Outfall Number	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
SW-1				
SW-2				
SW-3				
SW-4				
SW-5				
SW-6				
SW-7	**NA**	**NA**	**NA**	**NA**
SW-8	**NA**	**NA**	**NA**	**NA**
SW-9				
SW-10				

Briefly summarize what you found when conducting your Quarterly Visual Inspections. (Include any observations of color, odor, turbidity, floating solids, foam, oil sheen, or any other indications of storm water pollution and the probable sources of any observed storm water contamination.)

Attachment 4

Loadout Station

Loadout Station Photo Log

Photographic Log

Client Name:	Site Location:	Project No.:
Dairyland Power Cooperative	Phase IV Landfill Loadout Station	525154.000

Photo No.	Date
01	11/16/2023

Description
View of loadout station, curb, and inlet to Pond Water Pump/Leachate Tank Discharge Pit.

Photo No.	Date
02	11/16/2023

Description
View of curb and inlet entrance for loadout station.

Photographic Log

Client Name:	Site Location:	Project No.:
Dairyland Power Cooperative	Phase IV Landfill Loadout Station	525154.000

Photo No.	Date	
03	11/16/2023	
Description View of inlet to manhole/pit.		

Loading Procedure

RECORD AND CONTROL OF INITIAL ISSUE, REVISIONS & PERIOD REVIEWS			
REVISION NO.	PREPARED BY OR REVIEWED BY	ADMINISTRATIVE SUPERVISOR	APPROVED & ISSUED EFFECTIVE DATE OF ISSUE
	SIGNATURE / DATE	SIGNATURE / DATE	SIGNATURE / DATE
0	Don Loock 9/20/2023	Diana Baker 00/00/00	Name 00/00/00

Review/Revision History:

Date:	Action:
09/20/2023	Rev. 0: Written by Don Loock, new procedure.

1.0 PURPOSE

1.1 To establish a procedure for loading leachate at the Alma Offsite.

2.0 PREREQUISITES

2.1 None

3.0 REFERENCES

3.1 Alma Offsite Loading Leachate Qual Card

4.0 DEFINITIONS

4.1 AOS: Alma Offsite

4.2 Leachate: Water that has percolated through the ash in the Alma Offsite landfill requiring proper usage and disposal.

4.3 WWTP: Abbreviation for Waste Water Treatment Plant

4.4 CCR: Coal Combustion Residuals

4.5 Ash Landfill: Landfill containing Coal Combustion Residuals (CCR)

4.6 Monofil Landfill: landfills that are intended to be used for only one type of waste, in this case CCR's.

5.0 RESPONSIBILITIES

5.1 JPM or AOS qualified personnel are responsible for performing this procedure.

6.0 REQUIREMENTS / PROCEDURE

6.1 Determine if leachate is destined for WWTP, Ash Mixing, or dust control within the landfill footprint only.

6.2 Determine which vehicle will be utilized for leachate hauling dependent upon usage.

6.2.1 Leachate destined for a WWTP and/or ash mixing it is preferred to use semi-tanker truck.

6.2.2 Leachate is to be used for dust control within the landfill area only, the AOS water truck is preferred.

6.3 Align truck inlet or manhole with downspout and ensure downspout is correctly placed inside either truck inlet or downspout.

6.4 Check leachate tank level.

6.5 Go to Leachate/Pond Pump Control Panel. Turn the Leachate switch to the "ON" position.

6.6 Visually monitor truck during loading process.

6.7 Turn the Leachate switch to the "OFF" position on the Leachate/Pond Pump Control Panel when truck is loaded.

6.7.1 **Semi-Tanker:** the gauge reads **6,900 gallons**.

6.7.2 **Water Truck**: the site gauge on water truck bulkhead shows **Full**.

7.0 RECORDS

7.1 Document gallons loaded.

7.1.1 If leachate is taken to a WWTP or ash mixing, document gallons on whiteboard located in AOS office.

7.1.2 If water to be utilized for dust suppression, document gallons on Fugitive Dust Log located in AOS office.

7.1.2.1 Form 7778 - AOS Fugitive Dust Plan Inspection Log

8.0 ATTACHMENTS

8.1 None

Attachment 5

Construction Quality Assurance Plan

CQA Plan

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

July 2003
Revised February 2007, January 2024

Prepared For:

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

Prepared By:

TRC
999 Fourier Dr., Suite 101
Madison, Wisconsin 53717

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TABLES

REVISION HISTORY

Revision Number	Revision Date	Section Revised	Summary of Revisions
01	01/2024	1-12	Revised text; included final cover in soil barrier layer testing, and updated geosynthetics

1.0 Introduction

1.1 Project Background

This plan presents the Construction Quality Assurance (CQA) Plan for the Dairyland Power Cooperative (DPC) Phase IV Ash Disposal Facility (Phase IV Landfill). The Phase IV Landfill consists of approximately 32.1 acres and is owned by DPC. This site is in the NE ¼ of the NE ¼ of Section 19 and portions of Sections 18 and 20, T21N, R12W Town of Belvidere, Buffalo County, Wisconsin. This CQA Plan is intended to be a "working" document that is updated to reflect changes in specific materials, installation practices, industry standards, or tests and testing methods as the site develops.

1.2 Purpose and Scope

The purpose of this CQA Plan is to address the quality assurance procedures and requirements for the construction at the Phase IV Landfill, including earthen materials and synthetic materials. Extreme care and detailed documentation are required in the selection and installation of soil materials and the production and installation of the synthetic materials used in waste containment applications.

The scope of this plan includes general CQA requirements regarding the roles, responsibilities, and qualifications of parties involved; the preconstruction activities; and the general inspection and documentation procedures. Specifically, this CQA Plan establishes requirements for construction procedures and observation, field and laboratory testing frequencies and methods, and acceptance criteria for each component of the composite liner and cover. Testing and acceptance criteria are based on Chapter NR 500, Wisconsin Administrative Code (WAC), requirements where applicable. Geomembrane testing and acceptance criteria are based on the Geosynthetic Research Institute (GRI) and American Society for Testing and Materials (ASTM) standards, and on current acceptable industry standards and practice.

The CQA Plan addresses the construction of the following systems within the landfill facility:

- Composite Liner
- Leachate collection system
- Composite final cover
- Perimeter Berms
- Access Roads
- Surface water management system

1.3 Quality Assurance and Quality Control

Quality assurance and quality control are defined as follows:

- <u>Quality Assurance</u> - A planned and systematic pattern of means and actions designed to provide adequate confidence that materials or services meet contractual and regulatory requirements. This is typically performed to confirm for the purchaser, Owner, and/or regulatory agencies that delivered materials or services are of desired quality.

- Quality Control - Those actions that provide a means to measure and regulate the characteristics of a material or service to meet contractual and regulatory requirements. This typically is performed by, or for, the provider of materials or services as a control mechanism on the quality of the provider's efforts.

In the context of this manual, the terms are further defined as follows:

- Quality Assurance refers to the means and actions employed by the CQA Officer to document conformity of the systems' installation with the CQA Plan and the construction plans and specifications. Quality assurance is primarily provided by an independent third party (consultant or laboratory) under the oversight of the CQA Officer.
- Quality Control refers to those actions taken by the Manufacturer, Fabricator, or Contractor/Installer to provide materials and workmanship that meet the requirements of the CQA Plan and the construction plans and specifications. Some testing efforts required by this CQA Plan may serve as both quality control and quality assurance measures.

1.4 General Testing Requirements

This CQA Plan includes references to test procedures of the American Society for Testing and Materials (ASTM) and the Geosynthetics Research Institute (GRI). Test procedure references are always to the latest approved version up to the date of this document, unless specifically stated otherwise in this document.

Tests will be performed in strict accordance with the referenced test procedure and the description included in this CQA Plan, unless indicated otherwise. Deviations to test procedures called out in this CQA Plan must be approved, in writing, by the CQA Officer prior to commencement of work.

2.0 CQA Roles, Responsibilities, and Qualifications

2.1 CQA Officer

The CQA Officer will supervise and be responsible for observation, testing, and related construction documentation as described in this CQA Plan. The CQA Officer will be responsible for preparing the construction documentation report to certify substantial compliance with appropriate sections of Chapter NR 500. The CQA Officer will be a Professional Engineer registered in the State of Wisconsin.

The CQA Officer may delegate daily observation and documentation, testing, and sampling duties to a qualified technician or engineer with experience in the assigned aspect of construction who will serve as the Resident Project Representative (RPR). Although these duties may be delegated, the CQA Officer will retain the responsibility for these activities.

2.2 Resident Project Representative (RPR)

The RPR will carry out daily observation, testing, and sampling duties under the direct supervision of the CQA Officer as required by NR 516.04. The RPR will be a qualified technician or engineer with experience in the assigned aspect of construction. The RPR will observe and document construction and installation procedures. The RPR will prepare daily summary reports and will routinely transmit these to the CQA Officer. The RPR will notify the CQA Officer of problems or deviations from the CQA Plan or construction plans and specifications. Reporting, documentation, and resolution of problems and deficiencies will be carried out as described in Section 4. The RPR will not have authority to approve design or specification changes without the consent of the CQA Officer.

2.3 Soil Testing Laboratory

The Soil Testing Laboratory retained will be experienced in landfill construction soil testing, the ASTM standards, and other applicable standards. The selected laboratory will be required to be responsive to the project needs by providing test results within reasonable time frames. This will include providing verbal communication on the status of ongoing tests and immediate communication of test results as needed to facilitate ongoing construction. Such information may include hydraulic conductivity test data, maximum dry density and optimum moisture content values, and borrow source characterization data. Final laboratory reports will be certified by the soil testing laboratory and submitted to the CQA Officer.

2.4 Geosynthetics Testing Laboratory/Laboratories

The Geosynthetics Testing Laboratory/Laboratories will have experience in testing geosynthetics in accordance with standards developed by ASTM, GRI, and other applicable test standards. The selected laboratory/laboratories will be required to be responsive to the project needs by providing test results within reasonable time frames. Final laboratory reports will be certified by the geosynthetics testing laboratory/laboratories and will be submitted to the CQA Officer.

2.5 Construction Contractor

The Construction Contractor's role will be to furnish earthwork, construction, and piping installation, and to provide overall construction responsibility for the completion of the landfill facility. The Construction Contractor will be experienced in solid waste landfill construction, knowledgeable about low-permeability soil liner construction techniques, and familiar with geosynthetic installations. The term "Contractor" is used interchangeably with "Construction Contractor" in this CQA Plan.

2.6 Geosynthetics Installers

The Geosynthetics Installer is the company hired by the Construction Contractor or owner to install the geosynthetic components referenced in this manual and to perform the nondestructive seam testing of the geomembrane as required by this CQA Plan. The term "Installer" is used throughout this CQA Plan when reference is made to the tasks and responsibilities of a Geosynthetics Installer.

The Installer will be trained and qualified to install the various geosynthetic components covered by this CQA plan. The Installer of the geomembranes will be approved and/or licensed by the Manufacturer.

Prior to confirmation of any contractual agreements, the Installer of the geomembrane and geosynthetic clay liner (GCL) will provide the CQA Officer with the following written information, which must be approved by the CQA Officer:

- Corporate background information.
- Installation capabilities.
  - Information on equipment and personnel
  - Quality control manual for installation
- A list of at least 10 completed facilities, totaling a minimum of 2,000,000 square feet for which the Installer has completed the installation of polyethylene geomembrane. For each installation, the following information will be provided:
  - Name and purpose of facility, its location, and date of installation
  - Name of owner, project manager, designer, manufacturer, and fabricator (if any)
  - Thickness and type of polyethylene geomembrane and the surface area of the installed geomembrane
- A list of at least 10 completed facilities, totaling a minimum of 1,000,000 square feet for which the Installer has completed the installation of GCL. For each installation, the following information will be provided:
  - Name and purpose of facility, its location, and date of installation
  - Name of owner, project manager, designer, manufacturer, and fabricator (if any)
  - Type of GCL and the surface area of the installed GCL

The Installer will provide a copy of the field tensiometer certification, indicating the date on which the tensiometer was calibrated prior to the start of seaming operations. The Installer is responsible for delays caused to the project until tensiometer certification is delivered to the RPR.

Tensiometers used in the state of Wisconsin are required to be calibrated within 3 months prior to the start of geomembrane installation. The Installer is responsible for meeting this requirement, and must supply a copy of the certification at the time of mobilization to the job site.

Personnel performing geomembrane seaming operations will be qualified by experience or by successfully passing seaming tests for the seaming methods to be used. At least one seamer will have experience seaming a minimum of 2,000,000 square feet of polyethylene geomembrane using the same type of seaming apparatus in use at the site. The most experienced seamer, the "master seamer," will provide direct supervision, as required, over less experienced seamers. No field seaming will take place without an experienced seamer (meeting the seaming criteria stated above) being present.

The Installer will provide the CQA Officer with a list of proposed seaming and testing personnel, and their professional records, prior to installation of the geosynthetics. This document will be reviewed by the CQA Officer. Any proposed seaming personnel deemed insufficiently experienced will not be accepted by the CQA Officer or will be asked to pass a seaming test.

The Installer will designate one representative as the Superintendent, who will represent the Installer at all site meetings and who will be responsible for acting as the Installer's spokesperson on-site. This Superintendent will be prequalified for this role, based on experience, management ability, and authority.

3.0 Preconstruction Activities

3.1 Preconstruction Meeting

Prior to commencement of each phase of liner or final cover construction at the landfill facility, a preconstruction meeting will be held. This meeting will include the parties involved in the earthwork construction, including the CQA Officer or designated representative, the RPR, the Construction Contractor, and the Owner.

The purpose of this meeting is to begin the planning and coordination of construction tasks; to identify potential problems that might cause difficulties and delays in construction; to properly interpret the design intent by the Contractor(s); and to present the CQA Plan to the parties involved. It is important that the rules regarding tasks such as testing, repairs, inspections, be known and accepted by each party.

Specific topics considered for this meeting include the review of following:

- Critical design details of the project, including the plans and specifications.
- Measures for surface water runoff and runon diversion control, including sump locations, siltation control, and pumping requirements.
- Appropriate modifications to the CQA Plan; develop project-specific addendums (if necessary).
- The responsibilities of each party.
- Lines of authority and communication.
- Methods for documenting and reporting and for distributing documents and reports.
- Requirements of the soil testing laboratory and the geosynthetics testing laboratory regarding sample sizes, methods of collection, and shipment. Also, review turn times for sample data and their implications on the construction schedule, pending receipt of acceptance data.
- The number and locations of the tests required for soil and geosynthetic components.
- Precautions to be taken to maximize bonding between lifts of compacted soil.
- The method for splicing segments of the compacted soil liner and cover.
- Precautions to be taken to minimize desiccation cracking of the subbase layer surfaces.
- Methods of subbase layer surface preparation and approval prior to GCL placement.
- The time schedule for all operations.
- Procedures for deployment of materials over completed GCL and geomembranes emphasizing protection of both layers. Specific discussion will address the deployment of textured geomembrane over the GCL and the deployment of select granular fill on the sidewalls.
- Where the site survey benchmarks are located, and review methods for maintaining vertical and horizontal control.
- Permit documentation requirements.

- The survey documentation tables and plans that identify the locations where survey documentation information is required.
- Material storage locations and general conditions relative to construction.
- Set up a time and place for regular construction progress meetings.

The meeting will be documented by the RPR or CQA Officer, and minutes will be distributed to all parties involved in the construction project.

3.2 Preconstruction Submittal

A preconstruction report will be prepared for each phase of construction of the composite liner and each phase of the composite final cover. The preconstruction report will be submitted to the WDNR a minimum of 15 days prior to the preinstallation meeting, refer to Section 3.3. The preconstruction submittal will include the following information required under s. NR 516.04(5), including the following items:

- Revisions and detail diagrams incorporating all changes between the Owner, installer, and the quality assurance contractor.
- Identification of the manufacturer of the geosynthetics used in construction, manufacturer qualifications, technical specifications for each item, and results of the manufacturer's quality control tests for products supplied to the project.
- Results of a shear test conducted, in accordance with ASTM D5321 on the soils and geosynthetic materials selected for use in construction of the liner and the final cover.
- A Quality Control Plan which provides all information specified in s. NR 514.07(1)(i), as well as the identification of the installation contractor, contractor qualifications, and on-site supervisory staff.
- A Quality Assurance Plan which provides all information specified in s. NR 514.07(1)(j), as well as identification of the professional engineer and qualified technician who will be providing quality assurance and a summary of their qualifications and related work experience.

3.3 Preinstallation Meeting

Prior to commencement of the geomembrane installation for each phase of construction of the composite liner and final cover, a preinstallation meeting will be held in accordance with s. NR 516.04(4). This meeting will include the parties involved in the construction, including the appropriate WDNR district or central staff the CQA Officer or designated representative the RPR, the Construction Contractor, the Installer, and the Owner.

The purpose of this meeting is to begin the planning and coordination of geosynthetic installation tasks, identify potential problems that might cause difficulties and delays during the installation, to properly interpret the design intent, and to present the CQA Plan to all the parties involved. It is important that the rules regarding testing, repairs, etc., be known and accepted by each party.

Specific topics considered for this meeting include the following:

- Review critical design details of the project, including the plans and specifications.
- Review measures for surface water controls and pumping requirements.
- Clarify or confirm design changes.
- Confirm acceptability of selected geosynthetic materials.
- Clarify construction concepts or practices required by the approved plans and preinstallation submittal.
- Make appropriate modifications to the CQA Plan; develop project-specific addendums (if necessary).
- Review the responsibilities of each party.
- Review lines of authority and communication.
- Review methods for documenting and reporting and for distributing documents and reports.
- Establish rules for writing on the geomembrane (*i.e.*, who is authorized to write, what can be written, and in which color); and outline procedures for packaging and storing archive samples.
- Review GCL and geomembrane panel and seam layout diagrams and numbering systems.
- Establish procedures for use of the geomembrane welding apparatus.
- Establish appropriate intervals for geomembrane seamers to record operating and ambient data.
- Finalize geomembrane field cutout sample sizes.
- Review geosynthetic repair procedures.
- Review the time schedule for all operations.
- Establish procedures for deployment of materials over completed GCL and geomembranes emphasizing protection of both layers. Specific discussion will address the deployment of textured geomembrane over the GCL and the deployment of select granular fill on the sideslopes.
- Review permit documentation requirements.

The meeting will be documented by the RPR or CQA Officer, and minutes will be distributed to all parties involved in the construction project.

4.0 General Construction Observation and Documentation

This section describes progress meetings, general documentation procedures to be implemented, including the use of forms, the identification and resolution of problems or deficiencies, and photographic documentation.

4.1 Progress Meetings

Progress meetings will be held regularly at the work area. At a minimum, the meeting will be attended by field supervisory and CQA personnel. The purposes of the meeting are as follows:

- Review health and safety issues.
- Review the work activity since the last progress meeting.
- Discuss the Contractor's and Installer's personnel and equipment assignments.
- Review the work schedule.
- Discuss possible problems.
- Review new test data.
- Review data documentation requirements.

The meetings will be documented by a person designated at the beginning of the meeting, and minutes will be transmitted to all appropriate parties involved in the construction project.

4.2 Daily Reports

A daily summary report will be prepared by the CQA Officer, or the RPR under direct supervision of the CQA Officer, for each day of activity and will include the following information:

- Date, project name, location, report preparer's name, and the names of representatives on-site performing CQA under the supervision of the CQA Officer.
- Time work starts and ends each construction workday, along with the duration and reason for work stoppages (*e.g.*, weather delay, equipment shortage, labor shortage, unanticipated conditions encountered).
- Data on weather conditions, including temperature, humidity, wind speed and direction, cloud cover, and precipitation.
- Construction Contractor's work force, equipment in use, and materials delivered to, or removed from, the job site.
- Chronological description of work in progress, including locations and type of work performed.
- Summary of meetings held and a list of those in attendance.
- A description of materials used and references or results of testing and documentation.
- Discussion of problems/deficiencies identified, and corrective actions taken as described in Subsection 4.4. (Problem/Deficiency Identification and Corrective Action).
- Identification/List of laboratory samples collected, marked, and delivered to laboratories, or clear reference to the document containing such information.

- An accurate record of calibrations, recalibrations, or standardizations performed on field testing equipment, including actions taken because of recalibrations, plus the results of other data recording, such as geomembrane seam barrel temperature.
- Subgrade acceptance reports submitted by the Geosynthetic Installer.

Field data sheets containing the following information, as necessary, will be prepared daily by each representative:

- Test or sample location and elevation.
- Type of documentation (e.g., field moisture/density test).
- Procedures used.
- Test data (e.g., Proctor value).
- Test results.
- Personnel involved in the documentation and sampling activities.
- Signature of the person performing the documentation.

4.3 Forms, Checklists, and Data Sheets

Additional forms may be developed during the project to provide specific needs, such as geomembrane or GCL CQA documentation, or simply to improve the efficiency of data collection. New forms will be approved by the CQA Officer prior to their use.

4.4 Problem/Deficiency Identification and Corrective Action

Problem and/or deficiency identification and corrective action will be documented in the daily report when a construction material or activity is observed or tested that does not meet the requirements set forth in this CQA Plan. The daily report should clearly reference other reports, photographs, or forms that contain data or observations leading to the determination of a problem or deficiency. Problem and/or deficiency identification and corrective action documentation may include the following information:

- A description of the problem or deficiency, including reference to supplemental data or observations responsible for determining the problem or deficiency.
- The location of the problem or deficiency, including how and when the problem or deficiency was discovered, and an estimate of how long the problem or deficiency has existed.
- An opinion as to the probable cause of the problem or deficiency.
- A recommended corrective action for resolving the problem or deficiency. If the corrective action has already been implemented, then the observations and documentation to show that the problem or deficiency has been resolved should be included. If the problem or deficiency has not been resolved by the end of the day upon which it was discovered, then the report will clearly state that it is an unresolved problem or deficiency. Subsequent daily reports will indicate the status of problems or deficiencies until they are resolved.

If the problem or deficiency has not been resolved, then the CQA Officer and the RPR will discuss the necessary corrective actions. The CQA Officer will work with the Owner and Construction

Contractor to implement actions as necessary to resolve the problem or deficiency. A description of such problems or deficiencies and corrective actions implemented will be provided in the Construction Documentation Report.

The CQA Officer, working with the Owner and Construction Contractor, will determine if the problem or deficiency is an indication of a situation that might require changes to the plans and specifications and/or the CQA Plan. Revisions to the plans or specifications or the CQA Plan must be approved by the CQA Officer and the site Owner after consultation with the WDNR. Documentation of the WDNR's concurrence and/or conditions regarding proposed changes will be incorporated into the Construction Documentation Report.

4.5 Photographic Documentation

Photographs will be taken to document observations, problems, deficiencies, corrective actions, and work in progress. Photographs will be in print format or digital and will be filed in chronological order in a permanent protective file or electronic file by the CQA Officer or the RPR.

The following information will be documented in the daily report or a logbook for each photograph:

- Date and time.
- Orientation description (e.g., looking south).
- Subject matter description.
- Unique identifying number .

4.6 Surveying

Documentation surveying requirements for each composite liner or cover component are described in their respective report sections. Required surveying will be performed by personnel experienced in construction surveying. Surveys will be based on survey control points previously established at the site. Elevations will be based on mean sea level (M.S.L.) datum, and coordinates will be based on the Wisconsin State Plane Coordinate System. The location of field tests and samples will be recorded. Generally, these locations can be determined by reference to nearby construction stakes or markings; however, if such convenient reference is not readily available, the CQA Officer or the designated RPR will be responsible to provide or request survey control.

5.0 Soil Barrier Layer

5.1 General

This section includes the quality assurance requirements for placement, backfilling, and compaction of the compacted select 2-foot soil barrier layer (also known as low-permeability subbase soil layer). The soil barrier layer will be used in the following manner:

- Constructing the landfill liner.
- Constructing the final cover.

The soil barrier layer material will be generally obtained from on-site excavations of loess material. If onsite sources are not available during liner or final cover construction, off-site approved borrow sources may be used. Field tests and soil sample types will be recorded in the daily construction reports (see Subsection 4.2) including locations (by coordinates or survey point reference number) and elevation or lift number of field tests and laboratory sample points.

5.2 Procedures and Observation

The RPR will observe the soil barrier layer construction activities and will document relevant observations to support certification of the following requirements:

- The RPR will confirm the subbase is acceptable and ready for soil barrier layer placement prior to placement of the soil barrier layer over the subbase. Procedures for determining subbase acceptance are discussed in Subsection 6.2.
- The RPR will confirm the uniformity of the excavated or imported soil to be used as the soil barrier layer. Soil placement will be monitored for segregation and removal of unsuitable material and for changes in soil type, color, texture, and moisture content.
- The Construction Contractor will segregate and/or remove unsuitable materials, such as soil not meeting acceptance criteria, boulders, cobbles, and organic material. Due to the thin and laterally discontinuous nature of the loess material, special care will be taken during the excavation of the soil barrier layer. As determined necessary during construction, the cleanest loess deposits will be segregated for use in the final lift (below the GCL). In addition, a provision for screening will be included in the technical specifications to allow processing of the loess material if the material specifications cannot otherwise be achieved.
- The RPR will observe the placement of the soil barrier layer and will measure field densities and moisture contents, using methods described in Subsection 5.3 (Sampling Requirements and Acceptance Criteria), to document that the soil is in substantial conformance with the placement specifications and that soil placement has been conducted in a manner to achieve a uniform, homogeneous mass.
- The RPR will backfill voids created by nuclear density gauge (NDG) probes or as the result of Shelby tube samples with granular bentonite, or a bentonite-soil mixture.

- The RPR will document areas of unacceptable density or moisture content, as defined by Subsection 5.3 (Sampling Requirements and Acceptance Criteria). The Contractor will perform corrective action that will consist of the moisture-conditioning of the soil and/or additional compactive effort, as necessary. Methods for moisture-conditioning soil are described below. The RPR will retest the area, following corrective actions.
- The Contractor will place each lift of barrier layer material in approximate 1-foot lifts.
- The RPR will obtain documentation to verify that compaction equipment has a minimum static weight of 30,000 pounds or has a minimum static weight of 15,000 pounds that is capable of vibrating to produce a minimum dynamic compaction force of 30,000 pounds.
- The RPR will verify that compaction equipment used to compact the barrier layer has compaction feet a minimum of 6 inches long.
- If necessary, surfaces of liner to receive successive lifts of soil barrier material will be moisture-conditioned either by scarification and addition of water where desiccated, or by discing and air drying where saturated to promote effective bonding of lifts. Following scarification, water will be applied with a spray bar applicator or equivalent method to achieve uniform distribution.
- Soil placement will be performed in a manner to achieve continuous and complete keying together of low-permeable layer construction areas. Stepped joints will be utilized to connect lateral segments of soil barrier layer construction.
- No frozen soil will be used to construct the soil barrier layer. Frozen soil in the compaction work area will be removed.
- Stones and other penetrating objects 1 inch or larger from the upper one-foot or protruding from the surface of the final lift of soil barrier layer will be removed to avoid puncturing the GCL and/or geomembrane. The RPR will observe the liner during this process and will document the removal of stones and other objects by the Contractor. Voids made by the removal of stones will be filled with soil barrier layer or bentonite, and the entire liner surface will be rolled with a smooth-drum compactor by the Contractor.
- Preconstruction planning will be undertaken to sequence construction activities to minimize the length of time any portion of the soil barrier layer surface will be exposed prior to receiving protective cover. Protective cover will be provided by the installation of the GCL and the geomembrane.

5.3 Sampling Requirements and Acceptance Criteria

This section describes the required analyses, methods, sample frequencies, and acceptance limits. Field and laboratory sampling frequencies are based on the area or volume of material placed, as specified in s. NR 516.07. The RPR will perform field tests and will collect soil samples for laboratory analysis. The RPR will record the field sample locations in the daily construction reports or field data sheets as record construction data, including locations and lift locations of the laboratory sample points.

5.3.1 *Field Testing*

The following field testing methods will be used by the RPR during construction:

Parameter	Method
Moisture content	ASTM D3017
Field density	ASTM D2922 Method B

Field density and moisture content tests will be performed in accordance with NR 516.07(2m)(b)(1) using a nuclear density gauge on a 100-foot grid pattern for each 1-foot thickness of compacted soil barrier layer placed. The testing grid pattern will be offset on each subsequent layer of tests. In confined areas where compaction equipment is hindered or hand compaction is necessary, a minimum of two field density and moisture content tests will be performed for each 1-foot thickness of low-permeable soil placed.

5.3.1.1 Field Testing Acceptance Criteria

Acceptance criteria for field density will require soil compaction to a minimum of 90 percent of the Modified Proctor (ASTM D1557) maximum dry density. Moisture content requirements will be at least wet of optimum. The acceptable range will be based on Proctor moisture-density relationships and compaction versus permeability relationships.

5.3.2 *Laboratory Testing*

Routine laboratory testing of the soil barrier layer will be performed on samples from the soil borrow area and on the in-place soil samples collected by the RPR. Samples for determining in-place properties will be collected by pushing Shelby tubes. Soil characteristics will be determined from representative samples and from Shelby tube samples.

5.3.2.1 Undisturbed Sample Analysis

One undisturbed sample will be taken for each acre or less for every 1-foot thickness of soil placed and will be submitted to the Soil Testing Laboratory.

The following analyses will be performed on all undisturbed samples obtained:

Parameter	Test Method
Moisture content and dry density	ASTM D2216

5.3.2.2 Representative Sample Analysis

Representative (grab) samples will be obtained based on three criteria. First, an initial sample will be obtained from the borrow source and analyzed prior to construction. This will confirm soil characteristics and provide an initial maximum dry density and optimum moisture content for field moisture/density testing. Second, routine samples will be obtained for every 1,500 cubic yards placed. Third, if changes in physical appearance or soil characteristics are observed, a sample will be obtained and analyzed. The maximum dry density and optimum moisture content values used for compaction testing may be adjusted during liner construction based on the results of the above sampling.

The following laboratory analyses will be performed on all representative samples obtained:

Parameter	Test Method
Moisture-density relationship using Modified/Standard Proctor compaction	ASTM D1557[a, b]/ ASTM D698[a, b]
Grain-size analysis	ASTM D422[c]
Atterberg Limits	ASTM D4318

Notes:

[a] Five-point Proctor analysis required for first and second sampling criteria.

[b] A one-point Proctor analysis may be utilized for representative samples collected for the third sampling criteria (apparent changes in soil quality) to verify applicability of previously analyzed moisture-density relationships. If the result does not verify applicability, then a five-point analysis will be performed in accordance with the first sampling criteria.

[c] Distribution to be reported through 0.002 mm particle size

5.3.2.3 Laboratory Testing Acceptance Criteria

The following acceptance criteria will apply to the compacted low permeability soil.

- A minimum 80 percent by weight that passes the No. 60 screen and 40 percent by weight that passes the 200 sieve.
- Compacted to at least 90% Modified Proctor density.
- Meets USCS classifications of either: ML, CL, CH, SM, or SC.
- The upper foot of the barrier layer will have a maximum particle diameter of 1-inch and the lower 1-foot of the barrier layer will have a maximum particle diameter of 4 inches.

5.4 Thickness Documentation

For the base liner: The top and bottom of the soil barrier layer grades will be surveyed on a 50-foot grid pattern (same location for the top and bottom of barrier layer) and at other key locations (e.g., breaks in slope, toe of slopes, top of slope, limits of construction) to determine that minimum as-constructed soil barrier layer thicknesses were achieved.

In the alignment for leachate collection lines, bottom and top of liner elevations of the trench will be surveyed at 25-foot intervals (maximum 50-foot intervals if a total station, laser equipment, or survey quality global positioning system equipment is used).

For the final cover system: The bottom of the final cover barrier layer (top of waste) will be surveyed on a maximum 100-foot grid pattern (maximum 50-foot grid pattern if the final cover construction is less than 4 acres) and at key locations on the final cover. Key locations include breaks in grade, top of slopes, and limits of final cover construction. The barrier layer thickness will be determined at top of waste surveyed locations and reported in a tabular fashion in the Construction Documentation Report.

The soil barrier layer thickness will be determined at surveyed locations and reported in a tabular fashion. The minimum acceptable liner/final cover thickness will be 2 feet (-0.0/+0.1 foot) vertical.

6.0 General Soil

6.1 General

This section includes the quality assurance requirements for placement, compaction, and grading of general soil (i.e., general fill). General soil may be any inorganic soil. General soil will be used in the construction of the following landfill components:

- Final cover
- Access roads
- Landfill perimeter berms

Field tests, soil sample types, and survey measurements will be recorded in the daily summary reports (see Subsection 4.2) as record construction data, including locations (by coordinates) and elevations of lifts of field tests and laboratory sample points.

6.2 Procedures and Observation

The RPR will observe general soil placement activities and will document relevant observations to support certification of the following requirements:

- The RPR will periodically observe loads of general fill for general conformance to material specifications and may randomly sample loads. The RPR will perform routine conformance sampling as defined in Subsection 6.3.2.
- No frozen soil will be used for backfilling. Any frozen soil in the compaction work area will be removed.
- Loose lift thickness for general soil compaction will not exceed 18 inches.
- General soil used as structural fill (e.g., access roads and perimeter landfill berms) will be placed with a compacted effort to achieve a minimum of 90 percent or 95 percent of the maximum dry density as determined by the Modified or Standard Proctor test, respectively.
- Unacceptable compaction density, as defined above, will be reported to the CQA Officer by the RPR. Corrective action will consist of moisture-conditioning of the soil and/or additional compactive effort as necessary.
- The RPR will confirm the subbase is acceptable and ready for soil barrier layer material placement prior to placement over the subbase. The RPR will notify the Engineer of any soft appearing areas of the subbase during subbase development and prior to soil barrier layer placement.

Field densities using methods described in Subsection 6.3.1 will be measured to document that the in-place soil is in substantial conformance with the required density.

6.3 Sampling Requirements and Acceptance Criteria

Testing is required for general soil used as structural fill (recompacted soil used in subgrade and berm construction). No field or laboratory testing of general soil will be required for placement in the final cover. Sampling and testing of structural fill will be conducted in accordance with NR 516.07(1m).

6.3.1 Field Testing

The following field-testing method will be used by the RPR during construction:

Parameter	Test Method
Moisture content	ASTM D3017
Soil density	ASTM D2922 Method B

Field density and moisture content tests will be performed on a 100-foot grid pattern as much as reasonably possible for each 1-foot thickness of compacted structural fill placed. The testing pattern will be offset on alternate lifts as much as reasonably possible. In confined areas where compaction equipment is hindered or hand compaction is necessary, a minimum of two field density and moisture content tests will be performed for each 1-foot thickness of structural fill placed.

6.3.1.1 Field Testing Acceptance Criteria

Acceptance criteria for field density will require soil compaction to a minimum of 90 percent of the Modified Proctor (ASTM D1557) maximum dry density, or a minimum of 95 percent of the Standard Proctor (ASTM D698) maximum dry density.

6.3.2 Laboratory Testing

Routine laboratory testing of the structural fill will be performed on representative samples collected from the general fill borrow area and/or general fill stockpiles. Soil characteristics will be determined from representative samples.

6.3.2.1 Representative Sample Analysis

Representative (grab) samples of the structural fill will be obtained at a minimum frequency of one sample for every 5,000 cubic yards placed and a sample will be collected if changes in physical appearance or soil characteristics are observed. The maximum dry density values used for compaction testing may be adjusted during the course construction based on the results of the above sampling.

The following laboratory analyses will be performed on all representative samples obtained:

Parameter	Test Method
Moisture-density relationship using Modified or Standard Proctor compaction	ASTM D1557[(a)]/ ASTM D698[(a)]
Atterberg limits[(c)]	ASTM D4318
Grain-size analysis	ASTM D422[(b)]

Notes:

(a) A one-point Proctor analysis may be utilized for representative samples collected for the third sampling criterion (apparent changes in soil quality) to verify applicability of previously analyzed moisture-density relationships. If the result does not verify applicability, then a five-point analysis will be performed in accordance with the first sampling criterion.

(b) Distribution is to be reported through the 0.002 mm particle size.

(c) Atterberg limits are only applicable when the sample is fine grain soil.

6.3.2.2 Laboratory Testing Acceptance Criteria

There are no laboratory acceptance criteria for general fill.

6.4 Thickness Documentation

Top of subbase grades will be documented on an approximate 50-foot grid, and at other key locations, such as breaks in grade, toes of slope, mid-points, and tops of slopes. In the alignment for leachate collection undercuts, the bottom of trench undercut elevations will be surveyed at maximum 25-foot intervals (maximum 50-foot intervals if total station, laser equipment, or survey grade global positioning system equipment is used). The allowable tolerance in subbase elevation will be -0.1 foot or as allowed by the CQA Officer.

The rooting zone thickness of the final cover will be surveyed on an approximate 100-foot grid (for cells larger than 4 acres or on an approximate 50-foot grid for cells smaller than 4 acres) and at other key locations, such as breaks in grade and toes of slopes. The minimum acceptable thickness will be 1.50 foot. The allowable tolerance in elevation will be +0.1 foot

In addition to survey measurements for elevation, measurements for horizontal location will also be performed using previously established horizontal control to document the boundaries and alignment of the general soil placement.

7.0 Granular Soil

7.1 General

Granular soil includes select granular fill and select aggregate fill. Select granular fill refers to material used for the granular drainage layer overlying the geomembrane liner and for the granular drainage layer in the final cover. The select aggregate fill refers to the pipe bedding material for leachate collection pipes and final cover drain outlets for the drainage layer and perimeter toe drains. The select aggregate fill is used for structural support of the leachate collection pipes. Limestone and dolomite stone will not be used in the leachate collection system unless no other suitable material is reasonably available. The gravel should be rounded to subangular.

7.2 Procedures and Observation

The RPR will observe granular soil placement activities and will document relevant observations to support certification of the following requirements:

- The RPR will periodically observe loads of granular soil for general conformance to material specifications and may randomly sample loads. The RPR will perform routine conformance sampling as defined in Subsection 7.3.
- Guidance will be provided to the machine operators placing soil on the geomembrane by the use of an observer with an unobstructed view of the advancing lift of granular soil.
- No trucks or heavy equipment will travel directly on the geomembrane. Only low-ground pressure tracked equipment (< 5 psi) may operate over the geomembrane when there is a minimum 12-inch–thick layer of select granular fill in-place. Flotation tire-equipped vehicles and tracked vehicles may not travel over the geomembrane unless a minimum of 2 feet of select granular fill are in place. Traditional rubber-tired equipment may not travel over the geomembrane unless a minimum of 3 feet of select granular fill are in place. Procedures for deployment of pipe, sand, gravel, and/or geotextiles overlying geomembranes will be planned at the preconstruction meeting. Special requirements for geomembrane protection and equipment necessary to deploy materials must be approved by the CQA Officer.
- Care will be exercised during placement of granular soil to prevent undue damage to pipes, geomembrane, and geotextiles. Stone will not be dropped from a height greater than 3 feet above the pipe trench.
- A geotextile cushion will be placed between the geomembrane and the select aggregate (pipe bedding) material placed in the leachate collection trenches.
- A minimum of 4 inches of select aggregate (pipe bedding) material will be placed under leachate collection pipes prior to pipe placement, and a minimum of 12 inches of select aggregate will be placed over the top of the leachate collection pipes.
- If granular soil is stockpiled on-site prior to use, measures will be taken to minimize contamination by fines such as wind-blown particles and surface soil during loading operations.

7.3 Sampling Requirements and Acceptance Criteria

Field sampling and laboratory testing frequencies are based on proportionate sampling of construction areas or volumes of material placed as specified by s. NR 516.06. This section describes the required analyses, methods, sampling frequencies, and acceptance limits. The RPR will collect soil samples for laboratory analysis.

7.3.1 Field Testing

No field testing will be required for select granular fill or select aggregate fill. However, as stated in Subsection 7.2 above, the RPR will perform a visual inspection of this soil for conformance to material specifications and may randomly sample deliveries.

7.3.2 Laboratory Testing

Representative (grab) samples will be obtained from the proposed select granular fill and select aggregate fill sources prior to delivery of the material. The source sampling frequency will be dependent on the apparent uniformity of the source and must be approved by the CQA Officer.

Grab samples of granular material placed will be collected and analyzed as follows:

Soil Type	Frequency	Parameter	Test Method
Select granular fill (drainage blanket)	1/1,000 CY[a, b]	Grain size	ASTM D422[c]
Select granular fill (drainage blanket)	1/2,500 CY[b, d]	Remolded hydraulic conductivity	ASTM D2434
Select aggregate fill pipe bedding material (perforated pipes)	1/1,000 LF of trench[e]	Grain size	ASTM D422[c]
Pipe bedding material (solid-wall leachate or transfer pipes)	1/1,000 LF of trench[e]	Grain size	ASTM D422[f]

Notes:

(a) For lesser volumes, a minimum of four samples will be tested.

(b) This frequency may be reduced for uniform sources. Proposed reductions will be submitted for WDNR approval prior to implementation.

(c) Testing is required only to the #200 sieve.

(d) For lesser volumes, a minimum of two samples will be tested.

(e) For documentation areas with less than 3,000 feet of pipe trench, a minimum of three samples will be tested.

(f) Testing is required only to the #4 sieve.

7.3.2.1 Laboratory Testing Acceptance Criteria

Select granular fill material utilized in the leachate drainage blanket:

- No more than 5 percent by weight of fines passing the #200 sieve,
- Uniformity coefficient less than 4 for gravelly soil and less than 6 for sandy soil, and
- Remolded hydraulic conductivity of 1 x 10^{-2} cm/s or greater at the anticipated field density.

Select granular fill with material retained on the #4 sieve will require a geotextile cushion between the geomembrane and select granular fill (see Section 9).

Select granular fill used in the final cover drainage layer will have a remolded hydraulic conductivity of 1 x 10^{-3} cm/s or greater at the anticipated field density.

Select aggregate fill pipe bedding material for the leachate collection line will have a uniformity coefficient less than 4, will contain no more than 5 percent by weight passing the #4 sieve, will have a maximum particle diameter of ½ inch, and will have a rounded to subangular particle shape.

Select aggregate fill pipe bedding material used in the final cover toe drains will have a remolded hydraulic conductivity of 1 x 10^{-2} cm/s or greater at the anticipated field density.

7.4 Thickness Documentation

The finished elevation of the select granular fill drainage layer portion of the composite liner system will be surveyed on a 50-foot grid, which coincides with the grid used for the liner soil barrier layer. The finished elevation of the select granular fill drainage layer portion of the final cover system will be surveyed on a 100-foot grid (50-foot grid for areas less than 4 acres). The minimum acceptable drainage layer thickness will be 12 inches (-0.0/+0.2 foot).

Select aggregate fill pipe bedding placed along collection pipe alignments will be surveyed for elevation prior to pipe placement and following pipe backfilling at 25-foot intervals (50-foot intervals if a total station or laser equipment is used to set elevation) to document the thickness of gravel placed below pipe inverts and above the top of pipe. The minimum acceptable stone thickness will be 4 inches below and 12 inches above the leachate collection piping.

8.0 Topsoil

8.1 General

This section includes the quality assurance requirements for the excavation and placement of the topsoil and for the fertilization, seeding, mulching, and watering of the topsoil layer for vegetation. Topsoil is the final layer of soil material installed on the final cover, along the outside slopes of the perimeter berms, along the ditches, and on other perimeter areas. Topsoil will be obtained from on-site stockpiles created by the clearing of the landfill footprint and associated disturbed perimeter areas or will be hauled in from an off-site borrow source.

8.2 Procedures and Observation

Work covered by this section will be performed in accordance with the construction plans and specifications. The RPR will observe topsoil placement activities and will document relevant observations to support certification of the following requirements:

- The RPR will confirm the source and uniformity of topsoil used. Soil excavation and placement will be monitored for minimization of inorganic soil not compatible for establishment of vegetation.
- Prior to seeding, the topsoil will be worked to prepare a suitable seedbed.
- Fertilizing, seeding, and mulching will be performed in a timely manner.

8.3 Sampling Requirements and Acceptance Criteria

The topsoil will be suitable for the establishment and long-term maintenance of the selected vegetation seed mix with appropriate fertilization. At the RPR's discretion, or if required by the construction specifications, samples will be collected for laboratory testing.

8.4 Surveying

The thickness of topsoil placement will be documented on a 100-foot grid for cells larger than 4 acres, or on a 50-foot grid for cells smaller than 4 acres, by surveying or by hand shoveling and measuring the observed thickness of topsoil.

9.0 Geomembrane

9.1 General

This section of the CQA Plan applies to the high-density polyethylene (HDPE) geomembrane used in the landfill composite liner and the linear low density polyethylene (LLDPE) geomembrane, or equal, used in the composite final cover.

The geomembrane will be supplied to the site in factory rolls. No factory seams will be used to prepare larger panels of geomembrane for delivery to the site. This plan, therefore, does not contain Quality Assurance or Quality Control requirements for factory seaming.

The remainder of this section is divided into four major subheadings, which cover the CQA requirements for the preinstallation, installation, field seaming, and post-installation. The terms preinstallation, installation, field seaming, and post-installation are applicable only to the geomembrane installation and do not apply to the overall construction of the landfill facility.

9.2 Preinstallation

This section describes the quality control measures that are applicable to the polyethylene (PE) Resin Manufacturers and Geomembrane Manufacturers, and finished geomembrane roll delivery to the site prior to installation.

The geomembrane must be fabricated from polyethylene resin. The resin shall be virgin material with no more than 10 percent rework. If rework is used, it must be of the same formulation as the parent material. No post-consumer resin (PCR) of any type shall be added to the formulation.

If, during construction, geomembrane materials are obtained from a different manufacturer or are made from different resins, seam samples formed by joining the original and the proposed geomembrane will be tested to confirm the construction compatibility of the two geomembrane materials. Prior to the use of the new geomembrane material, a minimum of two seamed samples (as described above) will be submitted to the geosynthetics laboratory for destructive seam testing as described in Subsection 9.4.5. The CQA Officer will review the testing results prior to authorizing the use of the new geomembrane material.

9.2.1 Manufacturing

9.2.1.1 Material Specifications

The following list specifies the required membrane materials for liner and final cover construction:

- Base liner sideslopes (3H:1V typical) — 60-mil HDPE-textured
- Base liner — 60-mil HDPE smooth (textured optional)
- Final cover top (5 percent slope or less) — 40-mil LLDPE smooth (textured optional)
- Final cover sideslopes (4H:1V typical) — 40-mil LLDPE-textured

9.2.1.2 Quality Control Requirements

Prior to the delivery of any geomembrane rolls to the site, the Geomembrane Manufacturer will provide the CQA Officer with the following information:

- The Resin Supplier's name, the location of the Resin Supplier's production plant(s), and the resin brand name and product number.
- Any results of tests conducted by the Geomembrane Manufacturer's and/or the Resin Manufacturer's testing laboratories to document the quality of the resin used in fabricating the geomembrane.
- The Quality Control Plan that the Geomembrane Manufacturer will be using for the geomembrane being supplied.

Every roll of geomembrane for delivery to the site must be manufactured and inspected by the Geomembrane Manufacturer according to the following requirements:

- First quality polyethylene resin must be used.
- The geomembrane must contain no more than a maximum of 1 percent by weight of additives, fillers, or extenders, excluding carbon black.
- Carbon black for ultraviolet protection shall be added during manufacturing of the geomembrane.
- The geomembrane must be free of holes, blisters, undispersed raw materials, or other sign of contamination by foreign matter.

The Geomembrane Manufacturer will routinely perform specific gravity (ASTM D792, method B or ASTM D1505) and melt index (ASTM D1238) tests on the raw resin to document the quality of the HDPE and LLDPE resin used to manufacture the geomembrane rolls assigned to this project. The resin from which the geomembrane is made will have a density range of 0.932 g/ml or higher for HDPE and 0.926 g/ml or less for LLDPE. In addition, the geomembrane will have a melt index value of less than 1.0 g per 10 minutes. The results will be submitted to the CQA Officer, prior to the acceptance of the geomembrane.

9.2.1.3 Manufacturer's Certification

The Geomembrane Manufacturer will test the geomembrane produced for the site according to the test methods and frequencies listed in Table 9-1, 9-2, 9-3, and 9-4 or in accordance with the most current version of GM13 and GM17. The Geomembrane Manufacturer will provide certification, based on tests performed by either the Geomembrane Manufacturer's laboratory or other outside laboratory contracted by the Geomembrane Manufacturer, that the geomembrane supplied under this CQA Plan will meet the specifications presented in Tables 9-1, 9-2, 9-3, and 9-4. Additionally, the Geomembrane Manufacturer will provide certification that the Manufacturer's Quality Control Plan was fully implemented for the geomembrane material supplied under this CQA Plan. The Geomembrane Manufacturer will provide documentation to verify results of the Manufacturer's Quality Control Plan implementation if requested by the CQA Officer.

Table 9-1: HDPE Geomembrane – Smooth Test Frequency and Acceptance Criteria

Properties	ASTM Test Method	Test Value (60 mils)	Manufacturer's Testing Frequency (minimum)(1)	Minimum Conformance Testing Frequency(2)
Thickness (min. average) • Lowest individual of 10 values	D5199	Nom. -10%	Per roll	5 places/roll
Density mg/L (minimum average)	D1505/ D792	0.940 g/cc	200,000 lb	1/100,000 sf(3)
Melt flow index – g/10 min (max.)	D1238	1.0	1/batch	1/100,000 sf(3)
Tensile Properties (min. average)(4) • Yield strength • Break strength • Yield elongation • Break Elongation	D6693 Type IV	 126 lb/in. 228 lb/in. 12% 700%	20,000 lb	1/100,000 sf(5)
Tear Resistance (min. average)	D1004	42 lb	45,000 lb	Not required
Puncture Resistance (min. average)	D4833	108 lb	45,000 lb	Not required
Stress Crack Resistance(6)	D5397	500 hr.	per GRI-GM10	(7)
Carbon Black Content (range)	D4218(8)	2.0–3.0%	20,000 lb	Not required
Carbon Black Dispersion	D5596	Note(9)	45,000 lb	Not required
Oxidative Induction Time (OIT) (min. average)(10) • Standard OIT —or— • High Pressure OIT	 D8117 D5885	 100 min. 400 min.	200,000 lb	Not required
Oven Aging at 85°C(10)(11) • Standard OIT (min. average) - % retained after 90 days —or— • High Pressure OIT (min. average) - % retained after 90 days	D5721 D8117 D5885	 55% 80%	Per each formulation	Not required

Table 9-1: HDPE Geomembrane – Smooth Test Frequency and Acceptance Criteria

Properties	ASTM Test Method	Test Value (60 mils)	Manufacturer's Testing Frequency (minimum)[(1)]	Minimum Conformance Testing Frequency[(2)]
UV Resistance[(12)]	D7238		Per each formulation	Not required
• Standard OIT (min. average)	D8117	N.R.[(13)]		
—or—				
• High Pressure OIT (min. average) - % retained after 1,600 hours[(14)]	D5885	50%		

Notes:

(1) The Geomembrane Manufacturer will perform quality control testing at the specified frequencies (minimum) on geomembrane rolls to be supplied for this project.

(2) CQA Officer to coordinate conformance testing at the specified frequencies (minimum) on the geomembrane rolls supplied to the project.

(3) In addition to the minimum frequency noted, a minimum of one test for each batch of resin used to manufacture the rolls delivered on site must be performed, unless documentation is provided which shows the manufacturer performed testing at the same frequencies.

(4) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.

- Yield elongation is calculated using a gauge length of 1.3 inches.
- Break elongation is calculated using a gauge length of 2.0 inches.

(5) In addition to the minimum frequency noted, a minimum of one test for each batch of resin used to manufacture the rolls delivered on site must be performed.

(6) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(7) A minimum of one test for each batch of HDPE resin used to manufacture rolls delivered on site unless documentation is provided that shows manufacturer performed testing at the same frequency.

(8) Other methods such as D1603 (tube furnace) or D6370 (TGA) are acceptable if an appropriate correlation to D4218 (muffle furnace) can be established.

(9) Carbon black dispersion (only near spherical agglomerates) for 10 different views:

- Nine in Categories 1 or 2, and 1 in Category 3.

(10) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(11) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90-day response.

(12) The condition of the test should be 20-hour UV cycle at 75°C, followed by 4-hour condensation at 60°C.

(13) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(14) UV resistance is based on percent retained value of the original HP-OIT value.

Table 9-2: HDPE Geomembrane – Textured Test Frequency and Acceptance Criteria

Properties	ASTM Test Method	Test Value (60 mils)	Manufacturer's Testing Frequency (minimum)(1)	Minimum Conformance Testing Frequency(2)
Thickness (min. average) • Lowest individual for 8 out of 10 values • Lowest individual for any of the 10 values	D5994	Nom. -10% -15%	Per roll	5 places/roll
Asperity Height (min. average)	D7466	16 mil	Every second roll(15)	Not Required
Density mg/L (minimum average)	D1505/ D792	0.940 g/cc	200,000 lb	1/100,000 sf(3)
Melt flow index – g/10 min (max.)	D1238	1.0	1/batch	1/100,000 sf(3)
Tensile Properties (min. average)(4) • Yield strength • Break strength • Yield elongation • Break Elongation	D6693 Type IV	126 lb/in. 90 lb/in. 12% 100%	20,000 lb	1/100,000 sf(5)
Tear Resistance (min. average)	D1004	42 lb	45,000 lb	Not required
Puncture Resistance (min. average)	D4833	90 lb	45,000 lb	Not required
Stress Crack Resistance(6)	D5397	500 hr.	per GRI-GM10	(7)
Carbon Black Content (range)	D4218(8)	2.0–3.0%	20,000 lb	Not required
Carbon Black Dispersion	D5596	Note(9)	45,000 lb	Not required
Oxidative Induction Time (OIT) (min. average)(10) • Standard OIT —or— • High Pressure OIT	D8117 D5885	100 min. 400 min.	200,000 lb	Not required
Oven Aging at 85°C(10)(11) • Standard OIT (min. average) - % retained after 90 days —or— • High Pressure OIT (min. average) - % retained after 90 days	D5721 D8117 D5885	55% 80%	Per each formulation	Not required

Table 9-2: HDPE Geomembrane – Textured Test Frequency and Acceptance Criteria

Properties	ASTM Test Method	Test Value (60 mils)	Manufacturer's Testing Frequency (minimum)(1)	Minimum Conformance Testing Frequency(2)
UV Resistance(12) • Standard OIT (min. average) —or— • High Pressure OIT (min. average) - % retained after 1,600 hours(14)	D7238 D8117 D5885	 N.R.(13) 50%	Per each formulation	Not required

Notes:

(1) The Geomembrane Manufacturer will perform quality control testing at the specified frequencies (minimum) on geomembrane rolls to be supplied for this project.

(2) CQA Officer to coordinate conformance testing at the specified frequencies (minimum) on the geomembrane rolls supplied to the project.

(3) In addition to the minimum frequency noted, a minimum of one test for each batch of resin used to manufacture the rolls delivered on site must be performed, unless documentation is provided which shows the manufacturer performed testing at the same frequencies.

(4) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.

- Yield elongation is calculated using a gauge length of 1.3 inches.
- Break elongation is calculated using a gauge length of 2.0 inches.

(5) In addition to the minimum frequency noted, a minimum of one test for each batch of resin used to manufacture the rolls delivered on site must be performed.

(6) SP-NCTL per ASTM D5397 Appendix is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet materials. The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(7) A minimum of one test for each batch of HDPE resin used to manufacture rolls delivered on site unless documentation is provided that shows manufacturer performed testing at the same frequency.

(8) Other methods such as D1603 (tube furnace) or D6370 (TGA) are acceptable if an appropriate correlation to D4218 (muffle furnace) can be established.

(9) Carbon black dispersion (only near spherical agglomerates) for 10 different views:

- Nine in Categories 1 or 2, and 1 in Category 3.

(10) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(11) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90-day response.

(12) The condition of the test should be 20-hour UV cycle at 75°C, followed by 4-hour condensation at 60°C.

(13) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(14) UV resistance is based on percent retained value of the original HP-OIT value.

(15) Alternate the measurement side for double-sided textured sheet.

Table 9-3: LLDPE Geomembrane – Smooth Test Frequency and Acceptance Criteria

Properties	ASTM Test Method	Test Value (40 mils)	Manufacturer's Testing Frequency (minimum)(1)	Minimum Conformance Testing Frequency(2)
Thickness (min. average) • Lowest individual of 10 values	D5199	Nom. -10%	Per roll	5 places/roll
Density mg/L (minimum average)	D1505/ D792	0.939 g/cc	200,000 lb	1/100,000 sf(3)
Melt flow index – g/10 min (max.)	D1238	1.0	1/batch	1/100,000 sf(3)
Tensile Properties (min. average)(4) • Break strength • Break Elongation	D6693 Type IV	 152 lb/in. 800%	20,000 lb	1/100,000 sf(5)
2% Modulus (max.) – lb/in	D5323	2400	Per formulation	Not required
Tear Resistance (min. average)	D1004	22 lb	45,000 lb	Not required
Puncture Resistance (min. average)	D4833	56 lb	45,000 lb	Not required
Axi-Symmetric Break Resistance Strain (min) - %	D5397	30	Per formulation	Not required
Carbon Black Content (range)	D4218(6)	2.0–3.0%	20,000 lb	Not required
Carbon Black Dispersion	D5596	Note(7)	45,000 lb	Not required
Oxidative Induction Time (OIT) (min. average)(8) • Standard OIT —or— • High Pressure OIT	 D8117 D5885	 100 min. 400 min.	200,000 lb	Not required
Oven Aging at 85°C(8)(9) • Standard OIT (min. average) - % retained after 90 days —or— • High Pressure OIT (min. average) - % retained after 90 days	D5721 D8117 D5885	 35% 60%	Per each formulation	Not required

Table 9-3: LLDPE Geomembrane – Smooth Test Frequency and Acceptance Criteria

Properties	ASTM Test Method	Test Value (40 mils)	Manufacturer's Testing Frequency (minimum)(1)	Minimum Conformance Testing Frequency(2)
UV Resistance(10) • Standard OIT (min. average) —or— • High Pressure OIT (min. average) - % retained after 1,600 hours(12)	D7238 D8117 D5885	 N.R.(11) 35%	Per each formulation	Not required

Notes:

(1) The Geomembrane Manufacturer will perform quality control testing at the specified frequencies (minimum) on geomembrane rolls to be supplied for this project.

(2) CQA Officer to coordinate conformance testing at the specified frequencies (minimum) on the geomembrane rolls supplied to the project.

(3) In addition to the minimum frequency noted, a minimum of one test for each batch of resin used to manufacture the rolls delivered on site must be performed, unless documentation is provided which shows the manufacturer performed testing at the same frequencies.

(4) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.

- Break elongation is calculated using a gauge length of 2.0 inches.

(5) In addition to the minimum frequency noted, a minimum of one test for each batch of resin used to manufacture the rolls delivered on site must be performed.

(6) Other methods such as D1603 (tube furnace) or D6370 (TGA) are acceptable if an appropriate correlation to D4218 (muffle furnace) can be established.

(7) Carbon black dispersion (only near spherical agglomerates) for 10 different views:

- Nine in Categories 1 or 2, and 1 in Category 3.

(8) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(9) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90-day response.

(10) The condition of the test should be 20-hour UV cycle at 75°C, followed by 4-hour condensation at 60°C.

(11) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(12) UV resistance is based on percent retained value of the original HP-OIT value.

Table 9-4: LLDPE Geomembrane – Textured Test Frequency and Acceptance Criteria

Properties	ASTM Test Method	Test Value (40 mils)	Manufacturer's Testing Frequency (minimum)(1)	Minimum Conformance Testing Frequency(2)
Thickness (min. average) • Lowest individual for 8 out of 10 values • Lowest individual for any of the 10 values	D5994	Nom. -10% -15%	Per roll	5 places/roll
Asperity Height (min. average)	D7466	16 mil	Every second roll(13)	Not Required
Density mg/L (minimum average)	D1505/ D792	0.939 g/cc	200,000 lb	1/100,000 sf(3)
Melt flow index – g/10 min (max.)	D1238	1.0	1/batch	1/100,000 sf(3)
Tensile Properties (min. average)(4) • Break strength • Break Elongation	D6693 Type IV	60 lb/in. 250%	20,000 lb	1/100,000 sf(5)
2% Modulus (max.) – lb/in	D5323	2400	Per formulation	Not required
Tear Resistance (min. average)	D1004	22 lb	45,000 lb	Not required
Puncture Resistance (min. average)	D4833	44 lb	45,000 lb	Not required
Axi-Symmetric Break Resistance Strain (min) - %	D5397	30	Per formulation	Not required
Carbon Black Content (range)	D4218(6)	2.0–3.0%	20,000 lb	Not required
Carbon Black Dispersion	D5596	Note(7)	45,000 lb	Not required
Oxidative Induction Time (OIT) (min. average)(8) • Standard OIT —or— • High Pressure OIT	D8117 D5885	100 min. 400 min.	200,000 lb	Not required
Oven Aging at 85°C(8)(9) • Standard OIT (min. average) - % retained after 90 days —or— • High Pressure OIT (min. average) - % retained after 90 days	D5721 D8117 D5885	35% 60%	Per each formulation	Not required

Table 9-4: LLDPE Geomembrane – Textured Test Frequency and Acceptance Criteria

Properties	ASTM Test Method	Test Value (40 mils)	Manufacturer's Testing Frequency (minimum)(1)	Minimum Conformance Testing Frequency(2)
UV Resistance(10)	D7238		Per each formulation	Not required
• Standard OIT (min. average)	D8117	N.R.(11)		
—or—				
• High Pressure OIT (min. average) - % retained after 1,600 hours(12)	D5885	35%		

Notes:

(1) The Geomembrane Manufacturer will perform quality control testing at the specified frequencies (minimum) on geomembrane rolls to be supplied for this project.

(2) CQA Officer to coordinate conformance testing at the specified frequencies (minimum) on the geomembrane rolls supplied to the project.

(3) In addition to the minimum frequency noted, a minimum of one test for each batch of resin used to manufacture the rolls delivered on site must be performed, unless documentation is provided which shows the manufacturer performed testing at the same frequencies.

(4) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.

- Yield elongation is calculated using a gauge length of 1.3 inches.
- Break elongation is calculated using a gauge length of 2.0 inches.

(5) In addition to the minimum frequency noted, a minimum of one test for each batch of resin used to manufacture the rolls delivered on site must be performed.

(6) Other methods such as D1603 (tube furnace) or D6370 (TGA) are acceptable if an appropriate correlation to D4218 (muffle furnace) can be established.

(7) Carbon black dispersion (only near spherical agglomerates) for 10 different views:

- Nine in Categories 1 or 2, and 1 in Category 3.

(8) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(9) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90-day response.

(10) The condition of the test should be 20-hour UV cycle at 75°C, followed by 4-hour condensation at 60°C.

(11) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(12) UV resistance is based on percent retained value of the original HP-OIT value.

(13) Alternate the measurement side for double-sided textured sheet.

9.2.2 *Delivery, Handling, and Storage of Geomembrane Rolls*

The geomembrane will be protected during shipment from excessive heat or cold, puncture, cutting, or other damaging or deleterious conditions. The geomembrane rolls will be stored on-site in a designated area and will be protected from long-term ultraviolet exposure prior to actual installation.

Each geomembrane roll will be marked by the Geomembrane Manufacturer with the following information (on a durable gummed label, or equivalent, on the inside of core):

- Name of manufacturer
- Product type and identification number (if any)
- Roll length
- Roll width
- Batch (or lot) number
- Nominal product thickness
- Date of manufacture
- Roll (or field panel) number

When cores are required for preparing the geomembrane for shipment, the Manufacturer will use cores with sufficient crushing strength to prevent collapse or other damage while in use.

The following practices will be used as a minimum in receiving and storing geomembrane rolls in the designated storage area at the job site:

- While unloading or transferring the geomembrane rolls from one location to another, care will be taken to prevent damage to the geomembrane itself. The preferred method involves using a spreader-bar, straps, and a loader. Rolls will not be dragged.
- Geomembrane rolls will be stored in a manner so as to ensure that they are adequately protected from the following:
  - Equipment damage
  - Strong oxidizing chemicals, acids, or bases
  - Flames, including welding sparks.
  - Temperatures more than 160°F
  - Dust and dirt

The RPR will observe and document, throughout the preinstallation, installation, and post-installation periods that the Installer provides adequate handling equipment for moving geomembrane rolls and that the equipment and the handling methods used do not pose unnecessary risk of damage. The Installer will be responsible for the means and methods to implement the work.

The Installer will be responsible for ensuring that all materials installed meet specifications (*i.e.*, that the roll marking label information indicates required specifications and properly represents materials). The RPR will maintain a log of geomembrane roll deliveries. The log will contain the roll numbers, date of delivery, and bath (lot) numbers.

9.3 Installation

This section includes discussions of geomembrane roll testing requirements, earthwork required for geomembrane placement, placement of the geomembrane, defects and repairs of geomembrane, and requirements applicable to other materials in contact with the geomembrane. Subsection 9.4 describes the installation and testing requirements for geomembrane seams.

All parties involved in the installation of the geomembrane will be familiar with geomembrane and will focus on protecting the geomembrane from damage during construction activities.

9.3.1 Testing Requirements

This subsection describes the test methods, including sampling procedures and frequencies, and the role of the geosynthetics testing laboratory in testing the geomembrane roll samples. Subsection 9.2.1, under Quality Control Requirements, describes the test methods that are performed on an infrequent basis to demonstrate the uniformity of resin used to fabricate geomembrane shipped to the job site. Seam testing is described in Subsections 9.4.4 and 9.4.5.

9.3.1.1 Test Methods

A representative of the geosynthetics testing laboratory at the Geomembrane Manufacturer's plant may collect geomembrane roll samples. Conformance samples will be collected at the rate of one sample per 100,000 square feet (or per requirements of NR 516.07(2)(a)) of geomembrane produced for delivery to the site. At least one sample will also be obtained for each geomembrane production batch. Samples for thickness testing or measurements will collected on every roll for delivery to the site. The Installer will not ship to, or receive at, the site, geomembrane from more than two production batches in any single shipment without the prior written approval of the CQA Officer.

Samples collected will be the size determined by the geosynthetics testing laboratory. The laboratory technician will indicate the machine direction on the sample.

Tables 9-1 through 9-4 list the tests and the test methods to be performed on the HDPE and LLDPE geomembrane roll samples. At a minimum, the minimum number of tests required by s. NR 516.07(2)(a) or approved by the WDNR will be conducted on the samples. The specifications and methods used in evaluating the results are discussed below under Procedures for Determining Geomembrane Roll Test Failures. Unless specified otherwise, sample specimens will be prepared in accordance with the referenced test method. The results for tear resistance and each of the tensile property tests will be reported for both the machine and cross direction, if these tests are conducted.

9.3.1.2 Role of Testing Laboratory

The geosynthetics testing laboratory will be responsible for performing the tests on samples submitted to them as described above under Test Methods, or as determined by the CQA Officer. The results of the tests performed will be reported to the CQA Officer and the RPR.

Retesting of geomembrane rolls for quality assurance purposes because of failure to meet any or all of the acceptance specifications listed in Tables 9-1 through 9-4 can only be authorized by the CQA Officer.

The Geomembrane Manufacturer and/or Installer may perform their own tests according to the methods and procedures defined in Tables 9-1 through 9-4; however, the results will only be applicable to their own quality control needs. These results will not be substituted for the quality assurance testing described herein.

9.3.1.3 Procedures For Determining Geomembrane Roll Test Failures

Tables 9-1, 9-2, 9-3, 9-4, 9-6 and 9-7 list the acceptance specifications for HDPE and LLDPE geomembranes. The HDPE geomembrane values listed in the acceptance specifications of Tables 9-1 and 9-2 are from the GRI Test Method GM13. The LLDPE geomembrane acceptance values listed in Tables 9-3 and 9-4 are from the GRI Test Method GM17. The most current versions of GM13 and GM17 will supersede the acceptance specifications in the tables. Acceptance specifications apply to both smooth and textured geomembranes. For those tests where results are reported for both machine and cross direction, each result will be compared to the listed specification to determine acceptance.

The following procedure will be used for interpreting results:

- If the test values meet the specifications stated in Tables 9-1 through 9-4, then the roll and the lot will be accepted for use at the job site. If the sample represents all rolls from an entire shipment, then the entire shipment will also be considered accepted.
- If the result does not meet the specifications, then the roll and the batch may be retested using specimens either from the original roll sample or from another sample collected by the geosynthetics laboratory technician or the RPR. For retesting, two additional tests will be performed for the failed test procedure. (Each additional test will consist of multiple specimen tests if multiple specimens are called for in the test procedure.) If both retests are acceptable, then the roll and batch will be considered to have passed this particular acceptance test; if either of the two additional tests fail, then the roll and batch will be considered unsuitable without further recourse. The CQA Officer may obtain samples from other rolls in the batch. Based on testing these samples, the CQA Officer may choose to accept a portion of the batch while rejecting the remainder.
- If retesting does not result in passing test results as defined in the preceding paragraph, or if there is any other nonconformity with the material specifications, then the Installer will withdraw the rolls from use in the project at the Installer's sole risk and expense. The Installer will be responsible at his/her sole risk, cost, and expense for removing this geomembrane from the site and replacing it with acceptable geomembrane.

9.3.2 Earthwork

The Construction Contractor will be responsible for preparing the supporting soil according to the plans and specifications. The geomembrane will be deployed directly above the geosynthetic clay liner (GCL). For each day of installation of the GCL/geomembrane, the installer, the Contractor, and the RPR will observe the surface and certify that the surface is acceptable for installations. The Installer will prepare and sign a subgrade acceptance form for each day of deployment. This certification of acceptance will be reported by the Installer prior to the start of GCL/geomembrane installation in the area under consideration. Unacceptable areas noted by the Installer will be immediately reported to the RPR.

The soil surface will also be examined by the RPR to evaluate any areas softened by precipitation or cracked due to desiccation. The daily observation will be documented in the daily report. Areas determined to be unacceptable will be reworked by the Construction Contractor until acceptable.

9.3.3 Placement

9.3.3.1 Location and Panel Layout Drawing

A panel layout drawing for the geomembrane installation covered by this CQA Plan will be prepared by the Installer prior to installation and submitted to the CQA Officer, showing the proposed location and orientation of geomembrane panels to be installed in relation to slope, collection trenches, anchor trench and phase boundaries, and phase boundaries. This panel layout drawing will be submitted to the WDNR in a preconstruction or preinstallation submittal prior to construction. The CQA Officer will review the proposed panel layout drawing and document that it is consistent with accepted practice and the construction plans and specifications.

9.3.3.2 Installation Techniques

Geomembrane panels will be installed by placing one at a time, and each panel will be seamed by the end of the day on which it was placed.

The RPR will document that the condition of the supporting surface has not changed detrimentally during installation. The RPR will notify the Installer and Construction Contractor of damage done to the supporting surface prior to the panel seaming.

It is the responsibility of the Installer to remove the deployed panel to allow the Construction Contractor to repair the supporting surface. The RPR will observe and document the repair. The RPR will inform the Installer that the method of deployment will be observed during further deployment, and if damage to the GCL and/or supporting surface continues, deployment will be stopped and an alternative means of deployment is to be developed. The RPR will document these events and conversations in the daily report. The RPR will record the roll number, location, and date of each geomembrane panel installed.

The Installer will ensure the following while installing the geomembrane:

- Equipment used does not damage the geomembrane by the way it is handled, by excessive heat, by leakage of hydrocarbons, or by other means.

- Personnel working on the geomembrane do not smoke, wear damaging clothing, or engage in other activities that could damage the geomembrane.
- The method used to unroll the geomembrane does not cause scratches or crimps in the geomembrane and does not damage the GCL or supporting soil.
- The method used to place the rolls minimizes wrinkles (especially differential wrinkles between adjacent panels).
- Adequate temporary loading or anchoring (continuously placed, if necessary), which will not damage the geomembrane, is placed to prevent uplift by the wind.
- Direct contact with the geomembrane is minimized. The geomembrane will be protected by geotextile, extra geomembrane, or other suitable materials, in areas where excessive traffic may be expected.
- Only approved equipment is allowed on the surface of the geomembrane (e.g., generators, test equipment). The use of motorized ATV vehicles is not permitted without approval from the CQA Officer.

9.3.3.3 Weather Conditions

Geomembrane will not be placed in an area of ponded water, during precipitation events, or in the presence of excessive winds (greater than 20 mph). The Installer must receive written approval to deploy geomembrane in temperatures below 32°F. The RPR will document that this condition is fulfilled. The CQA Officer will stop or postpone geomembrane placement when conditions are unacceptable.

9.3.3.4 Damages

The RPR will examine each panel for damage after placement and will determine which panels, or panel portions, should be rejected, repaired, or accepted. Damaged panels or panel portions that have been rejected will be marked, and their removal from the site will be recorded by the RPR.

Panel repairs will be made according to the procedures described in Subsection 9.3.4.

9.3.4 Defects and Repairs

This section applies to defects and repairs resulting from examinations, tests, or visual observations performed on the geomembrane material itself and on the seams.

9.3.4.1 Identification

All geomembrane areas will be examined and documented by the RPR for identification of defects, holes, blisters, undispersed raw materials, and signs of contamination by foreign matter. Because light reflected by the geomembrane helps to detect defects, the surface of the geomembrane will be clean at the time of examination. The RPR will complete the final examination of the geomembrane in areas in which both the Installer and the RPR have completed their QC and CQA, respectively. The RPR and the Installer will perform final examination over the entire geomembrane at the completion of the project. The Installer and/or the Construction Contractor will clean any area that is insufficiently clean to complete the final examination.

9.3.4.2 Evaluation

Each suspect area identified will be nondestructively tested using the vacuum box test method described in Subsection 9.4.4. Each location that fails the nondestructive tests will be marked by the RPR and repaired by the Installer.

9.3.4.3 Repair Procedures

Any portion of the geomembrane exhibiting a flaw or failing a destructive or nondestructive test will be repaired. Several procedures exist for the repair of these areas. The procedures available include the following:

- Patching is used to repair large holes, tears, undispersed raw materials, and contamination by foreign matter.
- Grinding and rewelding are used to repair small sections of extruded seams.
- Spot welding or seaming is used to repair small tears, pinholes, or other minor, localized flaws.
- Capping is used to repair large lengths of failed seams.
- Topping is used to repair areas of inadequate seams that have an exposed edge.
- Other procedures may be used at the recommendation of the Installer if agreed upon by the CQA Officer and the RPR.

The repair procedures, materials, and techniques will be approved in advance of the specific repair by the CQA Officer, RPR, and Installer. At a minimum, the following provisions will be satisfied:

- Patches or caps will extend at least 6 inches beyond the edge of the defect, and all corners of patches will be rounded with a radius of at least 3 inches.
- The geomembrane below large caps will be appropriately cut to avoid water or gas collection between the two sheets.
- The type of geomembrane (i.e., smooth or textured) used for repairs will be approved by the RPR prior to completing the repairs.

9.3.4.4 Examination of Repairs

Each repair will be numbered and logged by the RPR. Each repair will be nondestructively tested according to Subsection 9.4.4. Repairs that pass the above testing will be adequate, except that large caps may be of sufficient extent to require destructive seam sampling and testing, at the discretion of the RPR, according to the provisions of Subsection 9.4.5.

Failed tests indicate that the repair was inadequate, and the repair will be redone and retested until a passing result is obtained. The RPR will document that all repairs have been subjected to nondestructive testing and will record the number of each repair, the date, and the test outcome.

9.3.4.5 Large Wrinkles

When seaming of the geomembrane is completed, the RPR will examine the geomembrane for wrinkles and determine which wrinkles should be cut and reseamed by the Installer. The wrinkle repair will be done in accordance with the equipment and procedures described in Subsections 9.4.2 and 9.4.3 (General Seaming Procedures), respectively, and it will be nondestructively tested using the vacuum box test method described in Subsection 9.4.4.

9.3.5 Materials In Contact With Geomembranes - Anchor Trench System and Backfilling

The anchor trench for the geomembrane will be excavated by the Construction Contractor, unless otherwise specified, to the lines and grades shown on the plans and specifications. The trench will use a “U” configuration. No more than the amount of trench required for the geomembrane to be anchored in 1 day will be excavated to minimize the desiccation potential of the anchor trench soil unless moisture content is maintained. The anchor trench will be adequately drained to prevent ponding or softening of the adjacent soil while the trench is open.

The anchor trench will be backfilled and compacted by the Contractor. Care will be taken when backfilling the trenches to prevent any damage to the geomembrane or other geosynthetics that may also be placed in the trench prior to backfilling.

The RPR will observe the backfilling and compacting operations and will advise the Construction Contractor of the adequacy of the soil installation. The RPR will also advise the CQA Officer of observed problems.

9.4 Field Seaming

This section covers the quality assurance procedures on seams used to join the rolls of geomembrane into a continuous layer. The installation of each of the geomembranes at the landfill facility will include 100 percent nondestructive testing of all field seams for joining adjacent rolls of geomembranes to document that no openings or gaps exist between geomembrane sheets. In addition, destructive testing will be performed at a routine interval for determining the strength and mode of failure of field seams in both the shear and peel modes.

The allowable field seam methods, equipment, personnel qualifications, and destructive and nondestructive testing methods are described in this section.

9.4.1 Panel/Seam Layout

No horizontal seams will be allowed on slopes greater than 5 horizontal to 1 vertical. In corners and at other odd-shaped geometric intersections, the number of horizontal seams will be minimized. A seam numbering system comparable and compatible with the panel numbering system will be agreed upon at the preinstallation meeting (Subsection 3.3).

9.4.2 Seaming Equipment

The approved processes for production field seaming panels and repairs are the dual hot wedge (fusion-type) seam method and the extrusion fillet weld process. Dual hot wedge seaming method will be used on linear seams (production seams). Corners, butt seams, tie-in, and long repairs will be dual hot wedge seamed, where possible. Specialty seams and repair seams (nonproduction) will be done by the extrusion fillet weld process. No other processes can be used without prior written authorization from the CQA Officer and the RPR. Only equipment that has been specifically approved by make and model will be used.

9.4.2.1 Dual Hot Wedge Process

The Installer will meet the following requirements regarding the use, availability, and cleaning of the equipment to be used at the job site:

- An automated self-propelled type of apparatus will be used.
- The welding apparatus will be equipped to continuously monitor applicable temperatures.
- One spare operable seaming device will be always maintained on-site.
- Equipment used for seaming will not damage the geomembrane.
- The geomembrane will be protected in areas of heavy traffic to prevent damage as discussed in Subsection 9.3.3.
- For cross seams, the edge of the cross seams will be ground to a smooth incline (top and bottom) prior to welding.
- For cross seams, the intersecting dual hot wedge seam will be patched using the extrusion fillet process described below.
- The electric generator for the equipment will be placed on a smooth base in such a way that no damage occurs to the geomembrane. Similarly, a smooth insulating plate or fabric will be placed beneath the hot equipment after use.

The Installer will keep records for each seamer performing dual hot wedge seaming, including welding machine I.D. number, ambient air temperature, and machine operating pressures and temperatures. These data will be recorded at intervals as agreed upon at the preinstallation meeting.

9.4.2.2 Extrusion Fillet Process

The Installer will meet the following requirements regarding the use, availability, and cleaning of extrusion welding equipment to be used at the job site:

- The welding apparatus will be equipped to continuously monitor temperature at the nozzle.
- One spare operable seaming device will be always maintained on-site.
- Equipment used for seaming will not damage the geomembrane.
- The geomembrane will be protected in areas of heavy traffic to prevent damage.
- The extruder will be cleaned and purged prior to beginning seaming, and at any time during which seaming operations are stopped, until all heat-degraded extrudate has been removed from the barrel.
- The electric generator for the equipment will be placed on a smooth base in such a way that no damage occurs to the geomembrane. Similarly, a smooth insulating plate or fabric will be placed beneath the hot equipment after use.

- Geomembrane surfaces will not be ground for welding preparation more than 1 hour prior to seaming.
- Welding rod will be kept clean and be of the correct type for the specific material being welded.

The Installer and, if applicable, the Geomembrane Manufacturer will provide documentation to the CQA Officer regarding the quality of the extrudate used in the welding apparatus. At a minimum, the extrudate will be compatible with the base liner material and will contain the same grade and quality of polyethylene resin as used in the base material.

The Installer will keep records for each seamer performing extrusion weld seaming, including welding machine I.D. number, extrudate, and ambient air temperatures. These data will be recorded at intervals as agreed upon at the preinstallation meeting.

9.4.3 Initial Requirements

9.4.3.1 Personnel Qualifications

Personnel performing seaming operations will be qualified by experience or by successfully passing seaming tests for the type of seaming equipment to be used. At least one seamer will have experience in seaming a minimum of 2,000,000 square feet of polyethylene geomembrane using the same type of seaming apparatus to be used at the landfill facility. The most experienced seamer, the “master seamer,” will have direct supervisory responsibility at the job site over less experienced seamers.

The Installer will provide a list of proposed seaming personnel and their experience records to the CQA Officer and the RPR for their review and approval.

9.4.3.2 Weather Conditions

The weather conditions under which geomembrane seaming can be performed are as follows:

- Unless otherwise authorized in writing by the CQA Officer, no seaming will be attempted or performed at an ambient temperature below 32°F (0°C) or above 104°F (40°C).
- Between ambient temperatures of 32°F (0°C) and 50°F (10°C), seaming will be performed only if the geomembrane is preheated by either sun or a hot air device, provided there is no excessive ambient cooling resulting from high winds.
- Above 50°F (10°C), no preheating of the geomembrane will be required.
- Geomembrane will be dry and protected from the wind.
- Seaming will not be performed during any precipitation event unless the Installer erects satisfactory shelter to protect the geomembrane areas for seaming from water and/or moisture.
- Seaming will not be performed in areas where ponded water has collected below the surface of the geomembrane.

If the Installer wishes to use methods that may allow seaming at ambient temperatures below 32°F or above 104°F, the Installer will demonstrate and certify that the methods and techniques used to perform the seaming produce seams that are entirely equivalent to seams produced at temperatures above 50°F and below 104°F, and that the quality of the geomembrane is not adversely affected.

The RPR will document the following items:

- Ambient temperature at which seaming is performed.
- Precipitation events occurring at the site, including the time of such occurrences, the intensity, and the amount of precipitation.

The RPR will inform the CQA Officer if the conditions relating to the weather are not being fulfilled. The CQA Officer will stop or postpone the geomembrane seaming when weather conditions are unacceptable.

9.4.3.3 Overlapping and Temporary Bond

The Installer will be responsible for ensuring that the following requirements are met:

- Panels of geomembrane will have a finished overlap of a minimum of 3 inches for extrusion welding and 4 inches for fusion welding; but, in any event, sufficient overlap will be provided to allow peel tests to be performed on the seam.
- No solvents or adhesives will be used on the geomembrane unless the product has been approved in writing by the CQA Officer. Approval can only be obtained by submitting samples and data sheets to the CQA Officer for testing and evaluation.
- Procedures used to temporarily bond adjacent geomembrane rolls must not damage the geomembrane; in particular, the temperature of the hot air at the nozzle of any spot welding apparatus will be controlled such that the geomembrane is protected at all times against potential damage.

9.4.3.4 Trial Seams

Trial seams will be made on fragments of geomembrane to document that seaming conditions are adequate. Trial seams will be performed on the surface that the geomembrane will be deployed on (e.g., top of GCL). Such trial seams will be made at the beginning of each seaming period, following work interruptions, at changes in weather, and at least once for every 5 hours of seaming activities, for each seaming apparatus used that day. A minimum of one trial seam per welding machine will be made at the start of each day by each seaming technician performing welding that day. Each seamer will be required to complete at least one trial seam each day prior to seaming. Trial seams are to utilize the same materials that the seaming will be performed on (i.e., smooth to smooth, smooth to textured, textured to textured). At a minimum, one trial seam per welding machine will be made at the start of each day by each seaming technician performing welding that day.

The trial seams will be examined by the Installer and the RPR for squeeze-out, foot pressure applied by the seaming equipment, and general appearance, and will be tested using a field tensiometer. If the seam fails any of these examinations, it will be repeated. If the second trial seam fails these examinations, the welding apparatus and seamer are not allowed to seam until the Installer can demonstrate the cause of the failure. Once the Installer has made the necessary corrections to the welding equipment, the seamer and the apparatus are required to pass two trial seams prior to beginning seaming. The RPR will document the reason for the failure and all subsequent trial seams.

The trial seam samples will be at least 3 feet long by 1 foot wide after seaming, with the seam centered lengthwise. Seam overlap will be as indicated above in Section 9.4.3.3. Trial seams shall be welded under the same conditions as production seaming is to take place.

Five adjoining specimens, each 1 inch wide, will be cut from each end of the trial seam sample by the Installer. The specimens will be tested by the Installer in shear (5 field shear) and peel (5 field peel [inner and outer seams for dual hot wedge]), respectively, using a field tensiometer.

The remainder of the trial seam sample will be identified and marked by the RPR as follows:

- The sample will be assigned a number and marked as to the welding apparatus used and the seamer's name.
- The date, time, applicable operating temperatures of the welding equipment, and ambient temperature at the time of seaming will be noted.
- Whether the sample passes or fails will be indicated.

The RPR will observe trial seam procedures, and record them on the field log forms. The sample itself will be cut into three pieces, one for the Owner's record, one to be retained by the RPR, and one to be made available to the Installer.

The RPR may randomly select trial seam samples for destructive testing by the geosynthetics testing laboratory according to the test procedures described in Subsection 9.4.5. The frequency for trial seam laboratory testing will be at the discretion of the RPR and the CQA Officer.

If a trial seam sample fails a destructive test performed by the geosynthetics testing laboratory, according to the acceptance criteria stated in Subsection 9.4.5, then a destructive test seam sample(s) will be taken from each of the seams completed by the seamer during the shift related to the failed trial seam test. These samples will be forwarded by the RPR to the geosynthetics testing laboratory and, if any of them fails the tests, then the procedures described in Subsection 9.4.5 will apply. The conditions of this paragraph will be considered met if a destructive seam test sample, collected and tested according to the provisions under Location and Sampling Frequency and Sampling Procedure of Subsection 9.4.5, has already been taken and has passed.

9.4.3.5 Seam Preparation

The Installer will ensure that the following conditions for each of the geomembrane installations covered by this plan are met:

- Prior to seaming, the seam area is clean and free of moisture, dust, dirt, debris of any kind, and foreign material.

- If seam overlap grinding is required, then the grinding process will be completed according to the Geomembrane Manufacturer's instructions within 1 hour of the seaming operation, and in a way that will not damage the geomembrane or cause excessive striation of the geomembrane surface.
- Seams will be aligned to minimize the number of wrinkles and "fishmouths."

9.4.3.6 General Seaming Procedure

Unless otherwise specified, the general seaming procedure to be used by the Installer for each of the geomembrane installations covered by this CQA Plan, and observed by the RPR, will be as follows:

- A firm substrate will be provided to achieve proper support for seaming.
- Fishmouths or wrinkles at the seam overlaps will be cut along the ridge of the wrinkle to achieve a flat overlap. The cut fishmouths or wrinkles will be seamed, and any portion where the overlap is inadequate will then be patched with the same geomembrane (including thickness) extending a minimum of 6 inches beyond the cut in all directions.
- If seaming operations are to be conducted at night, adequate illumination will be provided.

9.4.4 Nondestructive Testing

Each field seam will be nondestructively tested over its full length using one of the methods described in this section. The purpose of nondestructive testing is to determine the continuity of the seams. Nondestructive testing, at this stage of development, does not provide any information on the strength of seams. Seam strengths will be determined by destructive testing methods that are described in Subsection 9.4.5. Failure of nondestructive or destructive tests will require the repair of the failed section according to the procedures contained in Subsection 9.3.4.

Nondestructive testing as described in this section will be performed on seams for every geomembrane installation covered by this CQA Plan. The recommended test methods for conducting the nondestructive seam testing are the air pressure test for dual hot wedge seams and the vacuum box test for extrusion fillet welds. These two nondestructive testing methods are described below.

The RPR will perform the following documentation tasks:

- Observe nondestructive seam testing, and examine seams for squeeze-out, foot pressure, and general appearance. Failure of these criteria will be considered as failure of the seam, and repair or reconstruction will be required.
- Document location, date, test unit number, name or number of tester, and outcome of all testing.
- Inform the Installer and CQA Officer of required repairs.
- Document that appropriate repairs are made and that the repairs are retested nondestructively with passing results.

9.4.4.1 Air Pressure Testing

The following test procedure is applicable only to dual hot wedge seams. The equipment for performing the test should meet the following minimum requirements:

- An air compressor or hand pump equipped with a pressure gauge and regulator capable of producing and sustaining a pressure between 25 to 30 psig and mounted on a cushion to protect the geomembrane surface.
- Fittings, rubber hose, and valves to operate the equipment, and a sharp hollow needle or other approved pressure feed device.

Air pressure testing will be performed according to the following procedure:

1. Seal both ends of the seam to be tested.
2. Insert needle or other approved pressure feed device into the air space at one end of the dual hot wedge seam.
3. Energize the air compressor or hand pump to a pressure indicated in Table 9-5, based on the material type and thickness. Maintain the indicated pressure during a 2-minute stabilization period. At the end of the stabilization period, record the time and the pressure in the seam.
4. Remove the flexible hose that connects the pressure gauge to the air pump. Observe the pressure gauge for the evaluation period indicated in Table 9-5. Record the time and pressure in the seam at the end of the test period.
5. If the pressure difference between the two readings exceeds the maximum allowable pressure drop indicated in Table 9-5, or if the pressure does not stabilize within the evaluation period, one more pressure-monitoring interval is allowed.
6. If the pressure loss over both intervals exceeds the allowable pressure drop or if the pressure does not stabilize, then consider the seam as having failed the test.
7. If the pressure loss over either interval does not exceed the allowable pressure drop, then consider the seam as having passed the test.
8. The Installer must verify that the air channel tested was not obstructed by noting a release of air pressure at the end of the tested seam interval opposite the pressure gauge. If this does not happen, the air channel is blocked and the Installer must take the appropriate steps to ensure that the entire seam passes a non-destructive test.

For any seam interval that fails the air pressure nondestructive test, additional nondestructive testing or visual inspection will be used to identify, if possible, the faulty area of the seam. The faulty area will be repaired and retested. If the faulty area cannot be identified, then the entire seam will be repaired and retested.

Table 9-5: Geomembrane Air Pressure Testing Standards and Acceptance Values[1]

Geomembrane Type[2]	Air Inflation Schedule		Evaluation Time (Minutes)[3]	Maximum Allowable Pressure Drop (psi)
	Minimum Pressure (psi)	Maximum Pressure (psi)		
40-mil LLDPE	20	30	2	4.0
60-mil HDPE	27	30	5	3.0

Notes:

(1) Values are based on GRI Test Method GM6, revised 1994.

(2) Values apply to both smooth and textured geomembrane for the type and thickness indicated.

(3) Evaluation time starts after the initial 2-minute stabilization period

9.4.4.2 Vacuum Box Test

Vacuum box testing is to be used on those seams made by the extrusion fillet process, to locate precisely the defects identified from air pressure testing, or to evaluate suspect seam and nonseam areas as discussed in Subsection 9.3.4.

Vacuum box testing equipment must meet the following minimum standards:

- A five-sided vacuum box with an open bottom, a clear viewing panel on top, and a pliable gasket attached to the bottom.
- A vacuum pump and gauge capable of achieving a minimum vacuum of 2 pounds psig [4 inches of mercury (Hg)] and a maximum vacuum of 5 psig.

The following procedure will be used in performing the vacuum box test:

1. Clean the seams to be tested so that they are relatively free from soil or foreign objects that might prohibit a good seal from being formed between the vacuum chamber and the geomembrane.
2. Energize the vacuum pump to a minimum of 4 inches of Hg of vacuum (approximately 2 psig).
3. Wet a strip of geomembrane approximately twice the size of the vacuum box with the soapy solution.
4. Place and center the vacuum box with the gasket in contact with the geomembrane surface over the wetted area of the seam.
5. Applying a normal force to the top of the vacuum box, close the bleed valve and open the vacuum valve. Check to make certain that a tight seal is created between the geomembrane and the vacuum box. A minimum vacuum of 5 inches will be used for testing with the maximum allowable testing pressure never exceeding 10 inches of vacuum.
6. With the vacuum drawn, use the viewing panel to examine the geomembrane seam for bubbles resulting from the flow of air through the seam. Continue this examination for not less than 10 seconds.
7. Remove the vacuum box by first closing the vacuum valve and then opening the bleed valve. Proceed to Step 8 if bubbles appear in Step 6. If no bubbles appear in Step 6, then proceed directly to Step 9.
8. If bubbles appear through the geomembrane, mark the defective area for repair according to the provisions of Subsection 9.3.4. All repairs will be tested until nondestructive results are passed.
9. Move the vacuum box along the seam to be tested, overlapping the previously tested area by no less than 3 inches.

9.4.5 Destructive Seam Testing

Destructive seam testing will be performed on the geomembrane seams covered by this plan. Destructive seam testing is performed to determine the strength of the seam in both shear and peel failure modes. Destructive seam testing will be performed within 48 hours of sampling either in an on-site laboratory by personnel under the direction of the CQA Officer or at the geosynthetics testing laboratory.

9.4.5.1 Location and Sampling Frequency

The RPR will select locations where seam samples will be cut out for the destructive testing. The RPR will mark the locations and record on the seam sample the assigned sample number, seam number, welder ID, machine number, and date welded. Test locations will be determined during seaming at the RPR's discretion. Suspicion of excess crystallinity, contamination, offset welds, or any other potential causes of an imperfect seam may prompt selection of such locations. The Installer will not be informed in advance of any location where seam samples will be taken.

The minimum frequency of sample collection will be one test location per every 500 linear feet of seam length.

9.4.5.2 Sampling Procedure

Samples will be cut under the direction of the RPR as the seaming progresses. For each sample location, the following information will be documented:

- Assigned sample number and reason for collecting the sample (e.g., as part of statistical testing program, suspicious seam).
- Seam number.
- Welder ID.
- Machine #.
- Date Welded.
- Sample location on layout drawing
- For the peel test, which geomembrane is the top and which is the bottom with respect to seams performed using dual hot wedge (fusion) weld techniques.

Specimens for qualitative field testing will be taken prior to removal of the laboratory sample. Samples for field tensiometer testing will be a minimum of 12 inches wide by 12 inches long with the seam centered parallel to the width. From this sample, a total of 10 specimens will be cut for field tensiometer testing. Five specimens will be tested in peel (inner and outer seams for dual hot wedge samples) and five specimens will be tested in shear. If all 10 specimens pass the field tensiometer test described below under Field Test Methods, then the sample for laboratory testing will be taken according to the procedure described below.

The qualitative field-testing sample and the laboratory sample will be collected immediately adjacent to one another. The laboratory sample will be a minimum of 12 inches wide by 42 inches long with the seam centered lengthwise. The sample will be cut by the Installer into three parts and distributed as follows:

- A sample, 12 inches by 14 inches at minimum, will be kept by the Installer for testing if so desired.
- A sample, 12 inches by 12 inches, at minimum, will be given to the Owner for record storage.
- A sample, 12 inches by 16 inches at minimum, will be transmitted to the geosynthetic testing laboratory or on-site testing laboratory by the RPR.

The Installer in accordance with the repair procedures described in Subsection 9.3.4 will immediately repair all holes cut into the geomembrane resulting from destructive seam sampling. The repaired area will be nondestructively tested in accordance with the requirements of Subsection 3.4.4.

9.4.5.3 End-of-Seam Sampling

In addition to the 42-inch sample cut for laboratory testing, an additional sample will be cut from each end of each fusion seam weld greater than 100 feet in length for field testing as described below. These samples, often referred to as “bones”, need to be only 1 inch wide and can be cut from the portion of the seam that extends into/past the anchor trench so as not to require an additional repair. A minimum of one bone will be field tested in shear mode and a minimum of one bone will be field tested in peel mod (inner and outer seam).

9.4.5.4 Field Test Methods

The samples described above under Sampling Procedure as well as the end-of-seam samples described above under End-of Seam Sampling will be field-tested for both peel and shear. Testing will be performed using a field tensiometer or equivalent device. Seam testing acceptance criteria for the field testing of the destructive samples and end of seam samples is contained in Tables 9-6 or 9-7. The seam will be considered as having passed if the failure in both peel and shear does not occur within the seam. If the samples fail the field tensiometer test, then the repair procedures of Subsection 9.3.4 for the holes left by the cut-out samples, and the seam reconstruction procedures for the repair of the defective seam, discussed later in this subsection, will be implemented.

Table 9-6: 60-mil HDPE Geomembrane Seam Acceptance Criteria

Property	Test Method	Units	Type of Criterion	Acceptance Values[1]	
				Non-Textured	Textured[2]
Shear strength[3]	ASTM D6392	ppi	Minimum	120	120
Shear elongation[3][4]	GRI GM19a	%	Minimum	50	50
Peel strength[3] Fusion	ASTM D6392	ppi	Minimum	91	91
Peel strength[3] Extrusion	ASTM D6392	ppi	Minimum	78	78
Peel separation[3][5]	GRI GM19a	%	Maximum	25	25

Notes:

(1) The following are unacceptable break codes:
- Hot wedge: AD and AD-Brk >25%
- Extrusion fillet: AD1, AD2 and AD-WLD

(2) If the lengthwise edges of the textured geomembrane panels are nontextured, then the nontextured specifications shall apply for the testing of seams made along these edges.

(3) Five out of the five test specimens must meet these requirements (including locs of break).

(4) Omit elongation measurements for field testing.

(5) Maximum Acceptance Value for five out of the five test specimens.

Table 9-7: 40-mil LLDPE Geomembrane Seam Acceptance Criteria

Property	Test Method	Units	Type of Criterion	Acceptance Values: Non-Textured[(1)(5)]	Acceptance Values: Textured[(1)(5)]
Shear strength[(2)]	ASTM D6392	ppi	Minimum	60	60
Shear elongation[(2)(3)]	GRI GM19a	%	Minimum	50	50
Peel strength[(2)] Fusion	ASTM D6392	ppi	Minimum	50	50
Peel strength[(2)] Extrusion	ASTM D6392	ppi	Minimum	44	44
Peel separation[(2)(4)]	GRI GM19a	%	Maximum	25	25

Notes:

(1) If the lengthwise edges of the textured geomembrane panels are nontextured, then the nontextured specifications shall apply for testing of seams made along these edges. For double fusion welded seams, both tracks shall be tested for compliance with values listed.

(2) Five out of the five test specimens must meet these requirements (including locus of break).

(3) Omit elongation measurements for field testing.

(4) Maximum Acceptance Value for five out of the five test specimens.

(5) The following are unacceptable break codes:

- Hot wedge: AD and AD-Brk >25%
- Extrusion fillet: AD1, AD2 and AD-WLD
- Separation in plane (SIP) is acceptable if strength, shear elongation, and peel separation criteria are met.

9.4.5.5 Laboratory Test Methods

Laboratory testing of the destructive seam samples will be performed by the geosynthetics testing laboratory or an on-site testing laboratory under the direction of the CQA Officer. All destructive seam tests, whether performed on trial seam samples (as described above) or on samples cut out from production seams, will be performed in general accordance with the methodology of ASTM D6392, which stipulates that at least five specimens will be tested in shear and five in peel. Samples will be cut in alternating order (*e.g.*, shear and peel, peel and shear) and will also be tested in the order of cutting, to determine if any trend in seam quality along the length of the sample exists. All specimens will be cut as 1-inch–wide strips to ensure that the seam does not exceed the test gauge length of the specimen.

The following tests will be performed on each seam sample submitted for laboratory testing:

- <u>Shear and peel maximum tension</u> is the maximum load per unit width of a 1-inch–wide specimen expressed in pounds per inch of width in both the shear and peel mode, according to ASTM D6392 and GRI GM19a.
- <u>Shear elongation at break</u> is the extension at break expressed as a percentage of the initial distance between the edge of the fused track and the nearer grip. This distance should be the same on both sides of the seam and is usually 2 inches. No referenced ASTM test exists for this procedure as defined; however, the specimen will be elongated to a maximum of 100 percent with any failures of individual specimens noted. For specimens that fail below 100 percent elongation, the value at which failure occurred will be noted in the results.
- <u>Peel seam separation</u> estimates the area of seam interface separation expressed as a percentage of the original area.

Also, for both the seam shear and peel tension tests, an indication will be given for each specimen tested that defines the locus of the failure. The loci will be defined in accordance with GRI GM19a.

For shear tests, the following values will be reported for each specimen tested:

- Maximum tension in pounds per inch
- Elongation at break indicating at what percentage the specimen failed (up to a tested maximum of 100)
- The locus of failure using the above designations

For peel tests, the following values will be reported for each specimen tested:

- Maximum tension in pounds per inch
- Seam separation expressed as percent of original seam area
- Locus of failure

For each set of five specimens, the mean will be calculated and reported for the shear maximum tension and the peel maximum tension.

9.4.5.6 Role of Testing Laboratory

The geosynthetics testing laboratory or on-site testing laboratory will be responsible for performing the tests on samples submitted to them as described above. The results of tests performed will be reported to the CQA Officer and the RPR. Retesting of seams, because of failure to meet any or all the specifications listed below, can only be authorized by the CQA Officer.

The Geomembrane Manufacturer and/or the Installer may perform their own quality control testing in accordance with the methods and procedures defined above under Laboratory Test Methods; however, the results, if substantially different from those obtained by the geosynthetics testing laboratory or on-site laboratory, may only be used to request a retesting by the geosynthetics testing laboratory or on-site testing laboratory. All quality assurance test results from the geosynthetics testing laboratory or on-site laboratory govern over any test results from the Geomembrane Manufacturer or Installer. Only the CQA Officer is authorized to approve a retesting request.

9.4.5.7 Procedures For Determining Destructive Seam Test Failures

The procedures described in this section apply to the procedures for destructive testing defined above under Field Test Methods and Laboratory Test Methods. Procedures for repairing failed seams are given in Subsection 9.3.4 of this CQA Plan.

The results from the shear and peel tests for the HDPE geomembranes will be evaluated against the criteria tabulated in Table 9-6, and the LLDPE geomembrane will be evaluated against the criteria presented in Table 9-7.

All the tabular criteria for each respective geomembrane type must be met for a given seam to be considered acceptable.

The Installer has the following two options in determining the repair boundary whenever a seam has failed either the field tensiometer testing or laboratory destructive testing:

1. The seam can be reconstructed between any two previously tested and passed destructive seam test locations.
2. The Installer can trace the welding path to an intermediate location (at a 10-foot minimum from the point of the failed test in each direction) and request that field tensiometer tests be performed at these intermediate locations. If the field tensiometer sample results are acceptable, then full laboratory samples will be taken and tested. If either sample fails, then the process will be repeated until acceptable destructive seam tests have been performed in both directions away from the original failed sample location. All retesting of seams, according to this procedure will use the sampling methodology described earlier in this CQA Plan under Sampling Procedure.

   The tracing of a failed seam test will continue until the seaming path boundaries are located, tracking will continue into the previous day's work if needed and into the next day's welding as well.

Seams reconstructed due to a failing destructive seam sample that are more than 50 feet long will be destructive tested, an additional sample taken from the reconstructed zone must pass destructive seam testing.

The RPR will be responsible for documenting all actions, including test results submitted by the geosynthetics testing laboratory, taken in conjunction with seam testing. The RPR will also be responsible for keeping the CQA Officer informed of seam testing results and seaming progress.

9.5 Post-installation

Each geomembrane covered by this CQA Plan will be examined by the RPR. Defects, whether due to failed seams, pinholes, or other penetrations, will be repaired.

Placement of the select granular fill drainage layer material will proceed as soon as practical following the RPR's testing and acceptance of completed geomembrane areas. The granular layer will provide ultraviolet protection, thermal insulation, and protection from physical damage.

Low-ground pressure tracked equipment (< 5 psi) will be used to place the drainage layer material over the geomembrane. At a minimum, 1 foot of cover material is required between the geomembrane and low-ground pressure equipment, 2 feet of cover soil are required between the geomembrane and other tracked or floatation wheeled equipment, and 3 feet of cover soil are required between the geomembrane and rubber-tired vehicles.

9.6 Leak Location Testing

Upon completion of construction of the leachate collection system for each phase of development, an electrical resistivity leak detection survey will be performed over the entire surface of the lined area in accordance with ASTM D7007 or an equivalent method approved by the CQA Officer.

9.6.1 Electrical Resistivity Contractor Requirements

The electrical resistivity testing contractor shall have a minimum of 5 years of experience in performing electrical leak location surveys including surveying at least one million square feet of geomembrane using this method on at least five different projects, unless otherwise approved by the Owner.

9.6.2 Test Procedure

The leak location contractor shall demonstrate in a manner acceptable to the CQA Officer that the leak detection equipment and field procedures are capable of detecting a 0.25-inch- diameter leak using an actual or artificial leak. The leak detection capability must be demonstrated when the leak is midway between four measurement grid points; detecting the leak when the measurement is directly over the leak will not be sufficient. The peak-to-peak signal amplitude must be at least three times the peak-to-peak signal obtained under the same conditions with the excitation signal disconnected. The leak location survey must be conducted such that the leak detection measurements are no further apart than the spacing used to demonstrate the leak detection capability.

The Contractor will prepare the lined area for the leak location survey, including performing the following tasks:

- Insulating the edges of the geomembrane by leaving a width of dry exposed geomembrane around the perimeter of the geomembrane. This can be accomplished by only partially backfilling the anchor trench, leaving a strip uncovered around the perimeter, or extending the geomembrane outside the anchor trench and leaving its edge exposed.
- Isolating any other electrical paths, if present, that connect the drainage layer on the geomembrane to earth ground.
- Removing standing water on the surface of the drainage layer covering the primary liner. The survey cannot be done if the ground is frozen or if there is ice or snow on top of the drainage layer.
- If necessary, wetting the area to be surveyed with water (via water truck, hoses, or other method approved by the CQA Officer) to maintain good electrical contact with the drainage layer material during the survey.

If leaks are indicated by the leak location survey, the Contractor shall excavate the drainage layer around the area of the leak, open the geotextile, and electrically isolate the leak from the surrounding drainage material. The leak location contractor will then record measurements in the area around the excavation to determine if additional leaks are in the area. The Geomembrane Installer shall repair the leak, vacuum box test the repair, and repair the geotextile. The Contractor will then backfill the area around the repaired leak. Resistivity testing shall be completed over repaired areas to confirm additional leaks in the area are not present/marked by original detected defect.

The CQA Officer will observe the electrical resistivity testing.

9.6.3 Reports

Upon completion of each leak survey, the electrical resistivity contractor shall submit a report to the CQA Officer documenting the results of the leak location survey. The report shall document the methodology used, the locations and descriptions of the leaks, and a diagram of the facility showing the approximate leak locations.

10.0 Geotextile

10.1 General

This section of the CQA Plan applies to nonwoven geotextile used throughout the landfill facility. Geotextile will be installed in the following systems of the landfill facility:

- Leachate collection system (LCS)
- Geotextile filter around select aggregate fill for final cover drainage layer discharge pipe

Geotextile may also be used within roadways and spillways for reinforcement. Specifications for the reinforced geotextile will be included with the project plans and specifications for each construction project.

This section is divided into three major subheadings, which cover the quality assurance requirements for preinstallation (which includes Geotextile Manufacturers), installation, and post-installation (which includes the final examination of the geotextiles prior to placing the appropriate material above the geotextile). The terms preinstallation, installation, and post-installation are applicable only to the geotextile and do not apply to the overall construction of the landfill facility.

10.2 Preinstallation

10.2.1 Manufacturing

The geotextile will be supplied to the site in factory rolls. Prior to the delivery of any geotextile rolls to the site, the Geotextile Manufacturer will provide the CQA Officer with the Manufacturer's Quality Control Plan used for production of the geotextile rolls.

Every roll of geotextile for delivery to the site will be manufactured and inspected by the Geotextile Manufacturer, according to the following requirements:

- The geotextile must contain no needles used for punching.
- The geotextile must be free of holes and any other sign of contamination by foreign matter.

The Geotextile Manufacturer will provide certification, based on tests performed in accordance with the methods listed in Table 10-1 that the geotextile cushion supplied under this CQA Plan will meet the material specifications listed in Table 10-2. These tests may be performed by the Geotextile Manufacturer's laboratory or a laboratory contracted by the Geotextile Manufacturer. Additionally, the Geotextile Manufacturer will provide certification that the Manufacturer's Quality Control Plan was fully implemented for the geotextile materials supplied under this plan. The Geotextile Manufacturer will provide documentation to verify the results of the Manufacturer's CQA Plan implementation if required by the CQA Officer.

The geotextile rolls will be tested and evaluated prior to acceptance. The CQA Officer may perform/require additional testing (*i.e.*, conformance testing) as required by detailed specifications or as required in the judgment of the CQA Officer to verify that the geotextile meets the specifications.

Table 10-1: Geotextile Tests and Test Methods

Property	Test Method
Grab tensile strength(1)(2)	ASTM D4632
Grab elongation(1)(2)	ASTM D4632
Puncture strength (pin)(1)(2)(4)	ASTM D4833
Puncture Strength (CBR)(1)(2)(4)	ASTM D6241
Trapezoidal tear(1)(2)	ASTM D4533
Apparent opening size(1)	ASTM D4751
Permittivity(1)	ASTM D4491
Water flow rate(1)	ASTM D4491
UV resistance(3)	ASTM D4355/D7238

Notes:

(1) Testing is required for geotextile filter.

(2) Testing is required for geotextile cushion.

(3) Testing is required only if the geotextile is to be uncovered for more than 30 days.

(4) Geotextile to meet puncture (pin) resistance or puncture (CBR) strength.

Table 10-2: Geotextile Tests, Test Methods, and Acceptance Criteria

Property[1][2]	Test Method	Units	Value	6 oz. [3]	8 oz. [3]	10 oz. [3]	12 oz. [3] [5]	16 oz. [3][6]
Grab tensile strength	ASTM D4632	lb	MARV	160	205	250	300	380
Grab elongation	ASTM D4632	%	MARV	50	50	50	50	50
Puncture strength (pin)[4]	ASTM D4833	lb	MARV	85	110	150	175	240
Puncture strength (CBR)[4]	ASTM D6241	lb	MARV	400	500	700	800	900
Trapezoidal tear	ASTM D4533	lb	MARV	60	85	100	115	150
Apparent opening size	ASTM D4751	Sieve	MARV	70	80	100	100	100
Permittivity	ASTM D4491	Sec-1	MARV	1.4	1.2	1.0	0.7	0.5
Water flow rate	ASTM D4491	gpm/ft2	MARV	110	95	75	50	45
UV resistance	ASTM D7238/ D4355	% Retained @ 500 hrs	Typical[2]	70	70	70	70	70

Notes:

[1] Values are based on discussions with acceptable manufacturers and represent production values at the time this document was prepared.

[2] Values reported in weaker principal direction. All values listed are Minimum Average Roll Values (MARV) except UV resistance. UV resistance is a typical value.

[3] Ounce values indicate MARV's in ounce per square yard as determined in accordance with test method ASTM D5261.

[4] Geotextile to meet puncture (pin) resistance or puncture (CBR) strength.

[5] For geotextile cushion, approximate maximum particle size of 1 inch for fracture count up to 100%. Approximate maximum particle size of 1 ½ inches for fracture count up to approximately 20%.

[6] For geotextile cushion, approximate maximum particle size of 1 ½ inches for fracture count up to approximately 70%.

[7] For geotextile cushion, approximate maximum particle size of 1 ½ inches for fracture count up to 100%. Approximate maximum particle size of 2 inches for fracture count up to approximately 20%.

10.2.2 Delivery, Handling, and Storage of Geotextile Rolls

Each geotextile roll to be used at the landfill facility will be marked by the Geotextile Manufacturer with the following information and in the following manner:

- When fabric is rolled on a core, each roll will be identified with a durable gummed label, or an equivalent, on the inside of the core and on the outside of the protective wrapping for the roll.
- Each roll label will contain the following information at a minimum:
  - Name of manufacturer (or supplier)
  - Style and type number
  - Roll length
  - Roll width
  - Batch (or lot) number
  - Nominal product thickness
  - Date of manufacture
  - Roll number

The Geotextile Manufacturer will use the following guidelines in packaging, wrapping, and preparing all geotextile rolls for shipment:

- When cores are required, those that have a crushing strength sufficient to avoid collapse or other damage while in use will be used.
- Each roll will be covered with a wrapping material that will protect the geotextile from damage due to shipment, water, sunlight, or contaminants.

The following practices will be used as a minimum in receiving and storing geotextile rolls in the designated storage area at the job site:

- While unloading or transferring the geotextile rolls from one location to another, care will be taken to prevent damage to the wrapping or to the geotextile itself. If practicable, the Installer/Contractor may use forklift trucks fitted with poles that can be inserted into the cores of rolls. The poles will be at least two-thirds the length of the rolls, to prevent breaking the cores and possibly damaging the geotextile. Rolls will not be dragged.
- The geotextile rolls will be stored in such a manner to ensure that they are adequately protected from the following:
  - Precipitation
  - Ultraviolet radiation, including sunlight
  - Strong oxidizing chemicals, acids or bases
  - Flames, including welding sparks
  - Temperatures in excess of 160°F
  - Soiling

Throughout the preinstallation, installation, and post-installation periods, the RPR will observe and document that the Installer provides adequate handling equipment for moving geotextile rolls and that the equipment and handling methods do not pose unnecessary risk of damage. The Installer/Contractor will be responsible for the means and methods to implement the work.

The Installer will be responsible for ensuring that all materials installed meet specifications. The RPR will maintain a log of geotextile roll deliveries. The following information, at a minimum, will be recorded on the log for each shipment received at the job site:

- Date of delivery at job site
- For each geotextile roll, the following information:
  - Roll number
  - Batch (lot) number

10.3 Installation

This section describes the quality assurance requirements applicable to the installation, observation, and documentation of geotextile.

10.3.1 Placement

The Installer will install all geotextile in such a manner as to ensure that it is not damaged and in a manner that complies with the following requirements:

- On sideslopes, the geotextile will be securely anchored and then rolled down the slope in such a manner as to continually keep the geotextile in tension.
- In the presence of wind, all geotextile will be secured by suitable methods. The temporary securing material will be left in place until replaced with cover material as shown on the design plans and specifications.
- In-place geotextile will be cut with special care to protect other materials from damage that could be caused by the cutting of the geotextile.
- The Installer will take necessary precautions to prevent damage to any underlying layers during placement of the geotextile.
- During placement of geotextile, care will be taken not to entrap in the geotextile any stones, excessive dust, or moisture that could damage the geotextile, or generate clogging of drains or filters.
- A visual examination of the geotextile will be carried out over the entire surface after installation by the Installer to ensure that no potentially harmful foreign objects, such as needles, are present.
- The edges of the geomembrane between phases will be protected with a geotextile wrap and/or an overlying protective material until the edges are spliced together with the liner system of the adjacent phase.

10.3.2 Seams and Overlaps

The following requirements will be met regarding seaming and overlapping of geotextile rolls:

- Geotextile seams will be continuously heat-bonded or sewn (spot heat bonding or sewing will not be allowed). Geotextile will be overlapped 6 inches prior to seaming. The sewing method and stitch type will be per the Manufacturer's recommendation but must be approved by the CQA Officer. Overlapping of geotextile without sewing may be acceptable for certain applications (e.g., under riprap emergency spillways) with approval from the CQA Officer.
- No horizontal seams will be allowed on slopes steeper than 5 horizontal to 1 vertical (*i.e.*, seams will be along, not across, the slope), except as part of a geotextile repair.
- Sewing will be performed with thread made from the same base material as the geotextile, or suitable equivalent.
- The Installer will pay particular attention to seams to ensure that no earthen materials could be inadvertently trapped beneath the geotextile.

The RPR will be responsible for observing and documenting that the above provisions are performed by the Installer in an acceptable manner.

10.4 Post-installation

10.4.1 Final Examination

The RPR will perform a final geotextile examination after the installation of each geotextile layer has been completed. The objectives of the final examination are as follows:

- To examine for the presence of holes, tears, or other deterioration
- To examine for excessive tension due to stretching of the fabric during installation
- To examine for the presence of foreign objects (i.e., stones, soil clods) beneath the geotextile

If there will be an extended time delay between completion of the geotextile and the start of the installation of any overlying cover, then the Installer will make provisions, by temporarily securing the geotextile using suitable methods to protect it from wind uplift. The RPR will document in the daily report the placement of the temporary securing methods used.

10.4.2 Placement of Soil Materials

The Construction Contractor will place all soil materials located on top of a geotextile in such a manner as to minimize the following:

- Damage to the geomembrane
- Slippage of the geotextile on underlying layers
- Excessive tensile stresses imposed on the geotextile

11.0 Geosynthetic Clay Liner

11.1 Introduction

This section is divided into three major subheadings, which cover the quality assurance requirements for preinstallation (includes the GCL Manufacturer), installation, and post-installation (includes the final examination of GCL prior to the placement of the geomembrane). The terms preinstallation, installation, and post-installation are applicable only to the GCL installation and do not apply to the overall construction of the landfill facility.

11.2 Preinstallation

Preinstallation activities are designed to help ensure that a high-quality product is being manufactured and that it is properly delivered, handled, and stored to maintain its quality.

11.2.1 Manufacturer's Quality Control Plan (MQCP)

The manufacturer of each component of the GCL and the GCL itself will have a Manufacturer's Quality Control Plan (MQCP) to ensure that their product meets all the stated minimum properties. These manufacturers include the Bentonite Supplier, the Geotextile Manufacturer, and the GCL Manufacturer.

11.2.1.1 Bentonite Supplier

The Bentonite Supplier will have a MQCP that will be adhered to in the manufacturing process. This plan will include the following information:

- Documentation that the bentonite is sodium bentonite
- Testing that demonstrates that the bentonite meets specified gradation requirements
- Testing that demonstrates that the bentonite meets specified index test requirements
- Testing that demonstrates that the bentonite has not been treated with synthetic chemicals or polymers

11.2.1.2 Geotextile Manufacturer

The Geotextile Manufacturer will have an MQCP that will be adhered to in their manufacturing process. This plan will include the following provisions:

- Testing that demonstrates that the product is made of specified polymers
- Testing that demonstrates that the product meets certain minimum average roll values (for geotextiles)

11.2.1.3 GCL Manufacturer

The GCL manufacturer will have an MQCP that describes the procedures for accomplishing quality in the final product. At a minimum, the tests shown in Table 11-1 shall be performed by the Manufacturer.

Table 11-1: GCL Material Tests, Test Methods, and Acceptance Criteria

	Property	Test Method[1]	Units	Value	Minimum Conformance Testing Frequency[5][6]
Bentonite properties	Swell Index	ASTM D5890	ml/2 g min	24 (min)	1/100,000 sf
	Moisture Content	ASTM D4643	%	12 (max)	Not required
	Fluid loss	ASTM D5891	ml	18(max)	Not required
Geotextile (as received)	Non-woven (mass per unit area)	D5261	oz/yd^2	5.9 (MARV)	Not required
	Woven (Mass per unit area)	D5261	oz/yd^2	3.0 (MARV)	Not required
Physical GCL properties	Bentonite mass per unit area[1] @ 0% moisture	ASTM D5993	lb/ft^2	0.75 (MARV)	1/40,000 sf
	Tensile Strength[2]	ASTM D5993	lb/in	30 (MARV)	1/100,000 sf
	Peel Strength	ASTM D6768	lb/in	3.5 (MARV)	1/100,000 sf
	Hydraulic Conductivity[3]	ASTM D5887	cm/sec	5×10^{-9} (max)	Not required
	Index Flux[3]	ASTM D5887	$m^3/m^2/sec$	1×10^{-8} (max)	1/100,000 sf
	Internal Shear Strength[4]	ASTM D6243	psf	83.4 (min)	Note 7

Notes:

(1) At 0% moisture content

(2) Tested in machine direction

(3) Deaired, deionized water @ 5 psi maximum effective confining stress and 2 psi head pressure

(4) GCL hydrated for 48 hours under 300 psf and for 24 hours under load prior to shear.

(5) CQA Officer to coordinate conformance testing at the specified frequencies (minimum) on the GCL rolls supplied to the project.

(6) Conformance testing is not required if GCL manufacturer provides testing documentation at the required frequency prior to shipping.

(7) Refer to Section 3.2 for shear test requirements.

This MQCP will also dictate the following requirements:

- Overlap alignment lines are to be marked on the edges.
- Completed rolls are to be securely wrapped in plastic.
- Completed rolls are to be stored indoors, and provisions are to be in place to prevent rolls from being stacked too high, to ensure that they are kept dry, and to prevent damage during handling.
- Quality control certificates are to be provided.

11.2.2 Materials

The GCL will consist of a layer of pure sodium bentonite clay encapsulated between two geotextiles and will comply with all of the manufacturing processes and physical/chemical criteria listed in this section.

The bentonite clay utilized in the manufacture of the GCL, as well as any accessory bentonite clay (e.g., Volclay® granular sodium bentonite or approved equivalent) provided for seaming and detail work, will meet the manufacturer's minimum requirements, as specified in the MQCP.

The geotextile component of the GCL, and the geosynthetic clay liner itself, will meet the minimum requirements of the respective MQCPs.

11.2.3 GCL Delivery, Handling, and Storage

The GCL panels will be supplied to the site in factory-produced rolls, which are of standard factory roll dimensions.

Each roll of GCL supplied to the site will be labeled with the following information:

- Name and date of manufacturer
- Product type and identification number (if any)
- Lot (Batch) number
- Roll number

The GCL Manufacturer will ensure that the crushing strength of all GCL roll cores will be sufficient to avoid collapse or other damage while in use.

The rolls of GCL will be carefully unloaded by the Contractor upon arrival at the site. At a minimum, the following practices will be followed in receiving and storing GCL rolls in the covered storage area at the job site:

- While unloading or transferring the GCL rolls from one location to another, prevent damage to the GCL.
- For standard rolls, insert a steel support pipe through the cardboard roll core. Attach the slings or lifting chains at one end to the support pipe and at the other end to the bucket of a front-end loader or lifting device. Use a spreader bar to support and spread the slings. The bar and support pipe must be long enough to prevent damage to the edges of the GCL during hoisting.

- Alternatively, modify the forklift trucks to lift the rolls with a steel bar, securely attached to the fork lift and inserted into the roll core. Do not lift the rolls by sliding the forks under the roll.
- Store the rolls of GCL in their original, unopened, wrapped cover in a clean, dry area. Store the material off the ground on pallets or by other suitable techniques that provide continuous support over the entire length of the roll. Cover the roll with a heavy, protective tarpaulin, or store the roll beneath a roof. Care will be used to protect the GCL from the following:
  - Precipitation
  - Ultraviolet radiation, including sunlight
  - Strong oxidizing chemicals, acids or bases
  - Flames, including welding sparks
  - Temperatures in excess of 160°F

Throughout the preinstallation, installation, and post-installation periods, the RPR will be responsible for observing and documenting that the Installer provides adequate handling equipment for moving GCL rolls and that the equipment and handling methods do not pose any risk of damage.

The RPR will be responsible for making certain that the name of the manufacturer, the type, and the thickness of each roll (as noted on the roll marking label described above) are correct. The RPR will also maintain a log of GCL roll deliveries. The following information, at a minimum, will be recorded on the log for each shipment received at the job site:

- Date of receipt of delivery at job site
- For each GCL roll, the following information will be noted:
  - Roll number
  - Batch (lot) number

11.2.4 Submittals

Submittals will be made prior to installation of the GCL concerning the GCL Manufacturer/production information and the GCL installer information.

The GCL Manufacturer/production information will include the following:

- Manufacturer's corporate background information.
- Manufacturer's Quality Control Plan (MQCP) for bentonite, geotextile, and GCL manufacturers.
- Project reference list consisting of the principal details of at least 10 projects totaling at least 8 million square feet of GCL installation (if required by the RPR or CQA Officer).
- Results of tests conducted by the Bentonite and Geotextile Supplier documenting the quality of materials used to manufacture the GCL rolls assigned to the project.
- Copy of quality control certificates, signed by a responsible entity of the Manufacturer. Certificates to include roll identification numbers and results of quality control tests (refer to Subsection 11.2.1 for minimum testing requirements).

- Manufacturer's written certification that the GCL meets the project specifications, that the GCL has been continuously inspected and found to be needle-free, that the bentonite will not shift during transportation or installation, and that the bentonite and geotextile materials meet the Manufacturer's specifications.

GCL Installer information will include the following:

- Corporate background information
- Project reference list consisting of the principal details of at least five projects totaling at least 1 million square feet, if required by the RPR or CQA Officer
- List of personnel performing field operations, along with pertinent experience information, if required by the RPR or CQA Officer

The proposed panel layout diagram identifying placement of the GCL panels and seams, as well as any variances or additional details that deviate from the engineering drawings will be submitted prior to installation. The layout will be drawn to scale, will include information such as dimensions and details, and will be adequate for use as a construction plan.

11.3 Installation

The following installation procedures are designed to ensure the effectiveness of the GCL in meeting its design requirements and to simplify the deployment procedures. These procedures are to be followed by the Installer unless the Installer proposes alternative procedures in writing and the CQA Officer approves them in writing prior to installation.

11.3.1 Testing Requirements

This subsection describes the test methods, including sampling procedures and frequencies, and the role of the Geosynthetic Testing Laboratory in testing the GCL roll samples. Unless specified otherwise, all sampling procedures will be performed in accordance with the referenced test method defined in this section.

GCL roll samples will be collected by the Contractor at the discretion of, and under the direction of, the RPR, at a rate specified by the RPR.

Samples will be 3 feet long by the full width of the roll and will not include the first 3 feet of any roll.

Table 11-1 lists the tests and the test methods that may be performed on GCL roll samples. The specifications and methods used in evaluating the results are discussed later in this subsection. At a minimum, the testing required by NR516.07(2m)(a) will be conducted on the GCL.

11.3.1.1 Role of Testing Laboratory

The Geosynthetic Testing Laboratory will be responsible for performing the tests on samples submitted to them. The results of tests performed will be reported to the RPR and CQA Officer.

Retesting of GCL rolls for quality assurance purposes, because of failure to meet any or all of the acceptance specifications in this section, can only be authorized by the CQA Officer.

The GCL Manufacturer and/or Installer may perform their own tests according to the methods and procedures defined in Table 11-1; however, the results will only be applicable to their own quality control needs. These results will not be substituted for the quality assurance testing described herein.

11.3.1.2 Procedure For Determining GCL Roll Test Failures

Table 11-1 lists the specifications that are applicable to the GCL. For any referenced test method that requires the testing of multiple specimens, the criteria in Table 11-1 will be met based on the average results of the multiple specimen tests.

The following procedure will be used for interpreting the results relative to acceptance or rejection of rolls, lots, and shipments of GCL to the site:

1. If the test values meet the stated specifications, then the roll and batch will be accepted for use at the job site. If the sample represents all rolls from an entire shipment, then the entire shipment will also be considered accepted.
2. If the results do not meet the specification, then the roll and the batch will be retested at the Contractor's expense using specimens either from the original roll sample or from another sample collected by the RPR. For retesting, two additional tests will be performed for the failed test procedure. (Each additional test will consist of multiple specimen tests if multiple specimens are called for in the failed test procedure.) If both retests are acceptable, then the roll and batch will be considered as having passed this particular acceptance test; if either of the two additional tests fail, then the roll and batch will be considered as being unsuitable without further recourse. The RPR may obtain samples from other rolls in the batch. Based on testing these samples, the CQA Officer may choose to accept a portion of the batch while rejecting the remainder.
3. If retesting does not result in passing test results as defined in the preceding paragraph, or if there is any other nonconformity with the material specifications, then the Contractor will withdraw the rolls from use in the project at Contractor's sole risk, cost, and expense. Once withdrawn, the same rolls will not be resubmitted for use. Expenses for removing this GCL from the site and replacing it with acceptable GCL will be the sole risk and responsibility of Contractor.

11.3.2 Required Equipment

The following installation equipment is required on-site:

- Front end loader, crane, or other similar equipment. The selected piece of equipment will not cause damage to the subgrade, such as rutting. The Installer will verify in the presence of the RPR that the selected piece of equipment does not damage the subgrade
- A spreader bar to prevent slings from damaging the ends of the rolls.
- Several steel pipes to be inserted into the roll's core for lifting.
- Wooden pallets for aboveground storage of the GCL rolls.
- Heavy waterproof tarps for protecting all GCL rolls.

- Sandbags for securing the GCL during installation and for securing the tarps.
- Adhesive or tape for securing patches.
- Granular bentonite for seams and patches, and for securing around penetrations and structures as shown on the drawings.

11.3.3 Surface/Subgrade Preparation

GCL liner installation will not begin until a proper subbase has been prepared to accept the bentonite liner. Base material, including material in the vee trenches constructed for the leachate collection system piping, will be fine-grained soil free from angular rocks, roots, grass, and vegetation. Foreign materials and protrusions will be removed, and all cracks and voids will be filled; the surface will be made smooth and uniformly sloping. Unless otherwise required by the contract specifications and drawings, the prepared surface will be free from excessive moisture, loose earth, rocks or clay clods larger than 1 inches in diameter, rubble, and other foreign matter. The subgrade will be uniformly compacted to a minimum of 90 percent Modified Proctor density (ASTM D1557), to ensure against localized settlement and rutting under wheel loads and will be smoothed with a smooth drum or vibratory roller.

The surface on which the liner is to be placed will be maintained in a firm, clean, and smooth condition, free of standing water, during liner installation.

11.3.4 Deployment

As each roll is moved from the storage area, the labels will be removed by the Installer or RPR for storage in the project file.

The rolls of GCL will be brought to the area to be lined with a front-end loader, and support pipe will be set up such that the roll of liner is fully supported across its length. A spreader bar or similar device will be used to prevent the lifting chains or slings from damaging the edges. Dragging of the GCL liner will be minimized.

The Contractor will ensure, and the RPR will verify, that the following criteria are being met:

- The equipment used does not damage the GCL by handling, excessive heat, leakage of hydrocarbons, or by other means.
- The prepared surface underlying the GCL has not deteriorated since previous acceptance, and it is still acceptable at the time of GCL placement.
- Personnel working on the GCL do not smoke, wear damaging clothing, or engage in other activities that could damage the GCL.
- The method used to unroll the GCL does not cause damage to the GCL, and/or the subgrade.
- The method used to place the rolls minimizes wrinkles (especially wrinkles between adjacent panels).

GCL must not be placed during precipitation events, in the presence of excessive moisture, in any area of ponded water, or during excessive winds. The GCL must be dry when installed and must be dry when covered.

The proper side of the GCL, as per the manufacturer's recommendation, will face upward (unless otherwise dictated by project requirements). The liner will be placed over the prepared surface such that material handling will be minimized.

The GCL panels will be placed in a manner that ensures sufficient overlap as described in Subsection 11.3.5. Horizontal seams will not occur on slopes steeper than 7 horizontal:1 vertical.

The cover material (i.e., geomembrane) will be placed over the bentonite liner during the same day as the placement of the GCL. Only those GCL rolls that can be covered that same day will be unpacked and placed in position.

When wind conditions could affect installation, the GCL liner installation will be started at the upwind side of the project and will proceed downwind. The leading edge of the liner will be secured at all times with sandbags or other means sufficient to hold it down during high winds.

The GCL will be installed in a relaxed condition and will be free of tension or stress upon completion of the installation. Stretching of the liner to fit will not be allowed. Deployed rolls (panels) will be straightened by the installation personnel to smooth out creases or irregularities.

The RPR will visually inspect the geotextile's quality, the bentonite uniformity, and the degree of hydration, if any, of the GCL. Any areas in need of repair will be marked.

11.3.5 Seaming

Once the first panel has been deployed, adjoining panels will be laid with a 6-inch minimum overlap on longitudinal seams, and 24 inches on the panel end seams, depending on project specifications. To assist in obtaining the proper overlap, 6-inch overlap lines will be marked on the liner. All dirt, gravel, or other debris will be removed from the overlap area of the GCL.

Seam overlaps, whenever possible, will be placed such that the direction of flow is from the top panel to the underlying panel to form a shingle effect.

If the GCL requires a granular bentonite seam, then the overlapping panel edge will be pulled back and granular Volclay® (or approved equivalent) sodium bentonite will be poured continuously along all seams and lap areas from the panel edge to the 6-inch lap line, at a minimum application rate of ¼ pound per linear foot or as recommended by the manufacturer.

11.3.6 Patches/Repairs

Irregular shapes, cuts, or tears in the installed GCL will be covered with sufficient liner to provide a 12-inch overlap in all directions beyond the damaged area. A layer of granular bentonite will be placed in the overlap zone in accordance with the Manufacturer's recommendations. An epoxy-based adhesive, or other approved method, will be used to secure the patch during backfill operations. Alternatively, the patch can be placed underneath the defective liner.

11.3.7 Penetration Seals

The GCL will be sealed around penetrations, pipes, and structures in accordance with the recommendations of the GCL Manufacturer.

Pipe penetrations will incorporate a collar of GCL wrapped around the pipe and securely fastened. A bentonite or mastic grout will be placed around the corners for additional protection.

An additional GCL skirt placed over the bentonite grout is also recommended to provide a third level of protection and to prevent the bentonite grout from being displaced.

If the seal requires granular bentonite, then a 1- to 2-inch cut will be excavated around the circumference of the pipe, into the subgrade at least 12 inches out from the pipe. Volclay® sodium bentonite (or approved equivalent) will then be packed around the pipe in the subgrade excavation and on adjacent areas so that the pipe is surrounded with granular bentonite.

The GCL panel will then be placed over the pipe by penetrating the GCL with slits in a "pie" configuration where the pipe is to protrude in a manner that will create a snug fit between the GCL and the pipe.

More sodium bentonite will then be spread around the cut edges of the GCL against the pipe and over adjacent areas.

To complete the pipe penetration seal, a collar of GCL will be cut in a manner similar to that made on the main panel and will be fit around the pipe, with additional Volclay® sodium bentonite (or approved equivalent) being applied into any gaps that may remain.

11.3.8 Covering GCL

Only the amount of GCL that can be inspected, repaired, and covered in the same day will be installed. The GCL must be covered with geomembrane or alternate temporary cover the same day on which it is installed.

11.3.8.1 Geosynthetics

When covering the GCL, precautions will be taken to prevent damage to the GCL by restricting heavy equipment traffic. If a textured geomembrane is to be placed over the GCL, the RPR may require a slip sheet (such as 20-mil smooth HDPE) will be placed over the GCL to allow the textured geomembrane to slide into its proper position. The slip sheet will be removed after the geomembrane is in place.

11.3.8.2 Soil

The following requirements apply to soil placement over the GCLs:

- Equipment used for placing the soil must not be driven directly on the GCL.
- A minimum thickness of 1 foot of soil is specified between a light dozer (*i.e.*, maximum contact pressure of 5 lb/sq. inch) and the GCL.
- A minimum thickness of 3 feet of soil is specified between rubber-tired vehicles and the GCL.

Any leading edge or panels of GCL left unprotected must be covered with a heavy, waterproofing tarp that is secured and protected with sandbags or other ballast.

11.3.9 Submittals

The following will be submitted during installation:

- Daily records/logs prepared by the Installer documenting work performed, personnel involved, general working conditions, and any problems encountered or expected on the project. These records will be submitted on a weekly basis.
- Copy of subgrade acceptance forms by the Installer.
- Quality control documentation.

11.4 Post-installation

11.4.1 Final Examination

The RPR will perform a final GCL examination after portions of installation have been completed. The RPR will examine the GCL for the following:

- Tears or defects
- Proper overlaps

If any portion of the GCL requires repairs based on the above examination, it will be repaired in accordance with the procedures in Subsection 11.3.6.

11.4.2 Submittals

The following will be submitted after installation is completed:

- Installation certification prepared by the Installer certifying that the GCL was installed in substantial accordance with the specifications and the CQA Plan.
- An as-build panel layout diagram prepared by the Installer identifying the placement of panels and seams. The numbering sequence will be as agreed upon between the RPR and the Installer prior to commencing installation.
- A copy of the Warranty obtained from the Manufacturer/Installer.

12.0 Piping

12.1 General

This section includes quality assurance requirements for piping used throughout the facility. Piping will be used in the construction of the following items:

- Leachate collection system
- Leachate conveyance (or transfer) system
- Leachate head well piping
- Final cover toe drain collection and discharge piping

This section is divided into three major subheadings, which cover the quality assurance requirements for the preinstallation (includes Piping Manufacturers and Fabricators), installation, and post-installation (includes the final observation and documentation of piping installations). The terms preinstallation, installation, and post-installation are applicable only to the piping installation and do not apply to the overall construction.

Individual pipe sizes and standard dimension ratios (SDRs) to be used for each individual pipe installation are not detailed in this section; the plans and specifications will be used for the determination of correct size and wall thickness.

12.2 Preinstallation

12.2.1 Manufacturing

12.2.1.1 High-Density Polyethylene Material Specifications

High-density polyethylene (HDPE) pipe must be made from extra high molecular weight (EHMW) polyethylene (PE) resin, and the manufactured piping must be classified as at least Type III, Class C, Category 5, Grade P34 material according to ASTM D1248 and must also have a cell classification of at least 445574C as defined by ASTM D3350.

12.2.1.2 Polyvinyl Chloride Material Specifications

All polyvinyl chloride (PVC) pipe fittings must be PVC <u>molded</u> fittings. Extruded fittings may not be used unless specifically approved in writing by the CQA Officer.

12.2.1.3 Fabricator

The Piping Fabricator will be responsible for perforating the pipe delivered by the Piping Manufacturer according to the plans and specifications.

12.2.2 Delivery, Handling, and Storage of Piping

Pipe will be protected during shipment from excessive heat or cold, puncture, or other damaging or deleterious conditions. The pipe will be stored on-site in a manner suitable to protect it from long-term ultraviolet exposure prior to actual installation.

Throughout the preconstruction, construction, and post-construction periods, the RPR will be responsible for observing and documenting that the Contractor provides adequate handling equipment for moving pipe and that the equipment and handling methods do not pose any risk of damage.

The RPR will maintain a log of pipe deliveries throughout the installation. The following information, at a minimum, will be recorded on the log for each shipment received at the job site:

1. Date of receipt of delivery at job site
2. Pipe size and type

12.3 Installation

12.3.1 Connections

12.3.1.1 HDPE Pipe

Unless approved otherwise by the CQA Officer, HDPE pipe connections will be made by the butt fusion procedure. The following procedure will be used regarding butt fusion seams:

- Seams will be made at the Manufacturer's recommended temperature for fusing pipe and fittings.
- For pipe diameter sizes 4 inches (nominal) and larger, seams will be made using the hydraulic fusion machines. For pipe diameters of less than 4 inches, manual fusion equipment can be used.
- Care will be taken to make certain that adequate pressures are used for fusing pipes and that sufficient cooling periods are allowed prior to testing, bending, or backfilling of pipe sections.

12.3.1.2 PVC Pipe

Unless approved otherwise by the CQA Officer, all PVC pipe connections will be made according to the Standard Practice for Making Solvent-Cemented Joints with Polyvinyl chloride (PVC) Pipe and Fittings, ASTM D2855. Care will be taken regarding required set and cure times for solvent-cemented joints, which vary for ambient temperature conditions. Joints will not be subjected to stresses by moving or backfilling prior to the specified set times, ASTM D2855. Only original quality solvent cement may be used since expired shelf life and deteriorated cements may cause inadequate connections.

12.3.2 Placement

Pipe placement will be done in accordance with the following procedure and requirements:

- Piping will be bedded and backfilled according to the plans and specifications.
- Piping placement will not be performed in the presence of excessive moisture.
- The prepared surface underlying the piping will not show evidence of deterioration since previous acceptance and must be acceptable prior to piping placement.

- The method used to place the piping will not cause damage to the piping and will not disturb the supporting backfill.
- The pipe bedding material will be shovel-sliced or compacted to the spring line of the pipe to ensure proper bedding.
- Observations and measurements will be made to ensure that the pipes are of the specified size and dimension ratio, manufactured of the specified material, and that pipe perforations are sized and spaced as specified.
- All piping will be located as noted in the plans and specifications. Locations, grades, and size requirements are specified on the details of the plan set. Observations and surveying measurements will be made to ensure that the pipes are placed at specified locations and grades and in the specified configuration. Deviations from the plans and specifications will be brought to the attention of the CQA Officer for evaluation of the necessity of corrective action.

12.3.3 Damage

The RPR will examine each pipe after placement for damage. The RPR will advise the CQA Officer as to which pipes will be rejected, repaired, or accepted. Damaged pipes or portions of pipes that have been rejected will be marked and removed from the installation area and documented by the RPR.

12.4 Post-Installation

Leachate collection pipes will be cleaned with a water jet cleanout device with a maximum pressure of 10,000 pounds per square inch after collection pipe and leachate drainage layer installation is complete. The pipes will be cleaned by jetting from each cleanout access point to the toe of the opposite sideslope. Pipes that do not appear to be free flowing will be immediately reported to the CQA Officer, and corrective action will be taken.

A video camera inspection will be conducted on all leachate collection pipes after initial pipe cleaning activities described above. The video camera inspection will extend a minimum of 300 feet onto the base grades of each leachate collection pipe.

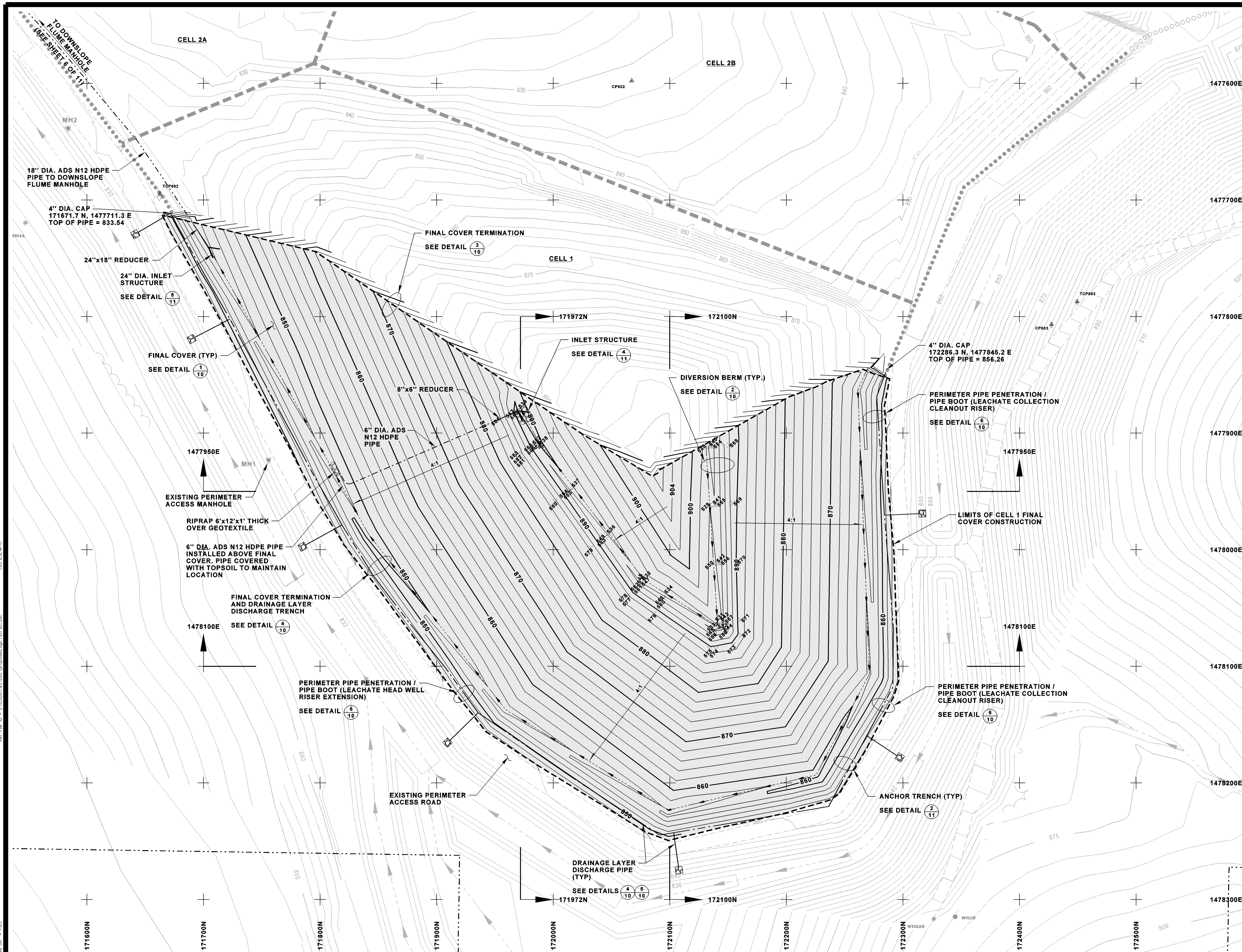
A summary report will be submitted after the pipe cleaning and video camera inspection. The report will summarize any specialty equipment used in collection pipe cleaning, blockages or difficulties in cleaning pipes, and how blockages were removed or pipe damage was repaired. Recording tape or disk of the video camera inspection will be included with the summary report.

Solid-wall pipe (single- and double-walled) outside the limits of waste will be air pressure–tested to document that the piping system is air-tight. The line will be air-pressurized to 5.0 pounds/square inch (gauge pressure). The valve on the pressurizing unit will be closed, and the system will be pressure-monitored. A system pressure of 4.5 psig or greater maintained for 30 minutes after the valve closing will be considered as acceptable. The RPR will observe and document that this operation is carried out and that the pipes are airtight.

Pipe invert elevations will be documented every 25 linear feet by survey or every 50 feet if a total station, GPS, or laser equipment is used, as well as at key points, including changes in grade, intersections, and end points.

Attachment 6

Final Cover Construction – Stormwater Drainage Piping



LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- GRID LOCATION
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING FENCE
- EXISTING BUILDING
- EXISTING 10' CONTOUR
- EXISTING 2' CONTOUR
- EXISTING SPOT ELEVATION
- EXISTING TREES AND/OR BRUSH
- EXISTING WET AREA AND WETLAND LIMITS
- EXISTING EDGE OF WATER
- DRAINAGE DITCH
- PERMITTED LIMITS OF WASTE
- CONSTRUCTED LIMITS OF WASTE
- APPROXIMATE LIMITS OF CELL 1 FINAL COVER CONSTRUCTION
- MH2 — EXISTING LEACHATE MANHOLE AND RISER PIPE
- EXISTING LEACHATE FORCEMAIN
- EXISTING LEACHATE CLEANOUT
- EXISTING HEADWELL MONITORING PORT
- 900 — 10' FINAL GRADE CONTOUR
- 904 — 2' FINAL GRADE CONTOUR
- 1/10 — DETAIL 1 ON PLAN SHEET 10
- 4:1 — SLOPE INDICATOR
- DIVERSION BERM
- TEMPORARY 6" DIA. DRAINAGE DISCHARGE PIPE
- TEMPORARY 18" DIA. DRAINAGE DISCHARGE PIPE
- DRAINAGE LAYER DISCHARGE PIPE
- 501 — COORDINATE AND ELEVATION POINT LOCATION (REFER TO TABLES 3 AND 4 OF THE REPORT)
- 1477950E — ENGINEERING CROSS SECTION LOCATION

NOTES

1. REFER TO SHEET 2 OF THIS PLAN SET FOR LEGEND, BASE MAP NOTES AND BENCHMARK LOCATIONS.
2. FULL TONE CONTOURS WITHIN THE LIMITS OF CELL 1 FINAL COVER CONSTRUCTION REPRESENT AS-CONSTRUCTED FINAL GRADES (TOP OF TOPSOIL). REFER TO DETAIL 1 ON PLAN SHEET 10.
3. FINAL GRADES (DESIGN) WERE DEVELOPED FROM THE PLAN OF OPERATION PREPARED BY RMT, INC., APPROVAL DATE: MAY 15, 2001.
4. REFER TO TABLES 3 AND 4 OF THE REPORT AND SHEET 4 OF 11 OF THIS PLAN SET FOR CONSTRUCTION COORDINATE LOCATIONS AND ELEVATIONS.
5. REFER TO PLAN SHEETS 8 AND 9 OF 11 OF THIS PLAN SET FOR ENGINEERING CROSS SECTIONS.

NOTE: THESE PLANS ARE ACCOMPANIED BY A DOCUMENTATION REPORT OF THE SAME TITLE. THESE DOCUMENTS ARE INTERRELATED AND ARE INTENDED TO BE USED TOGETHER.

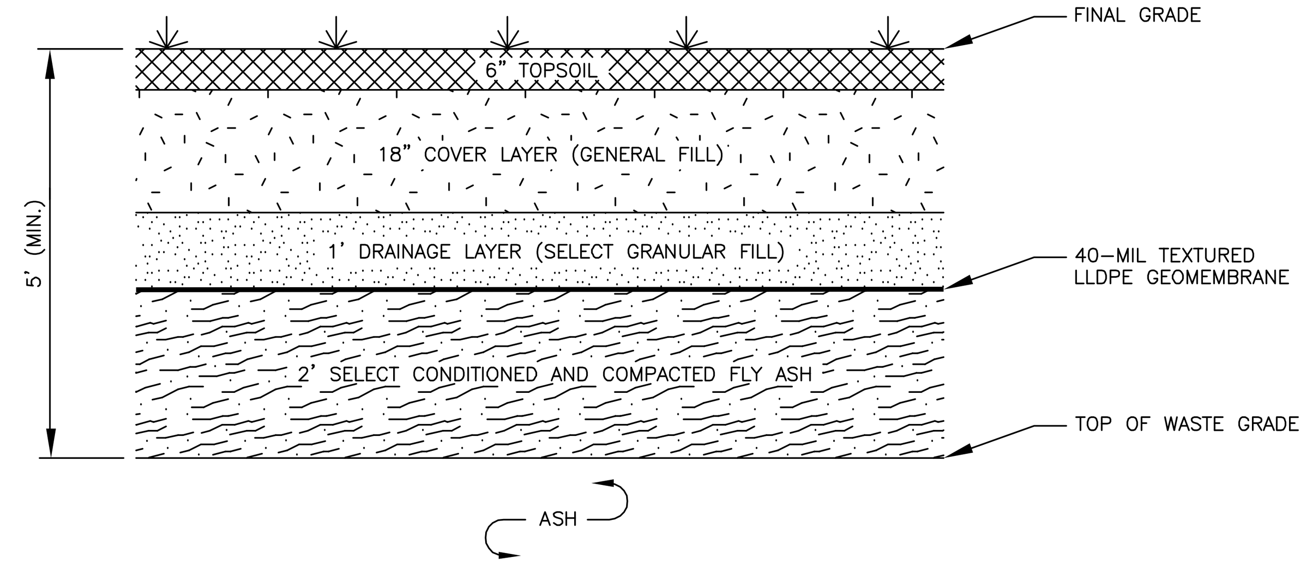
NO.	BY	DATE	REVISION	APP'D.
3.				
2.				
1.				

PROJECT: **DAIRYLAND POWER COOPERATIVE PHASE IV, CELL 1 FINAL COVER CONSTRUCTION DOCUMENTATION**

SHEET TITLE: **FINAL GRADES**

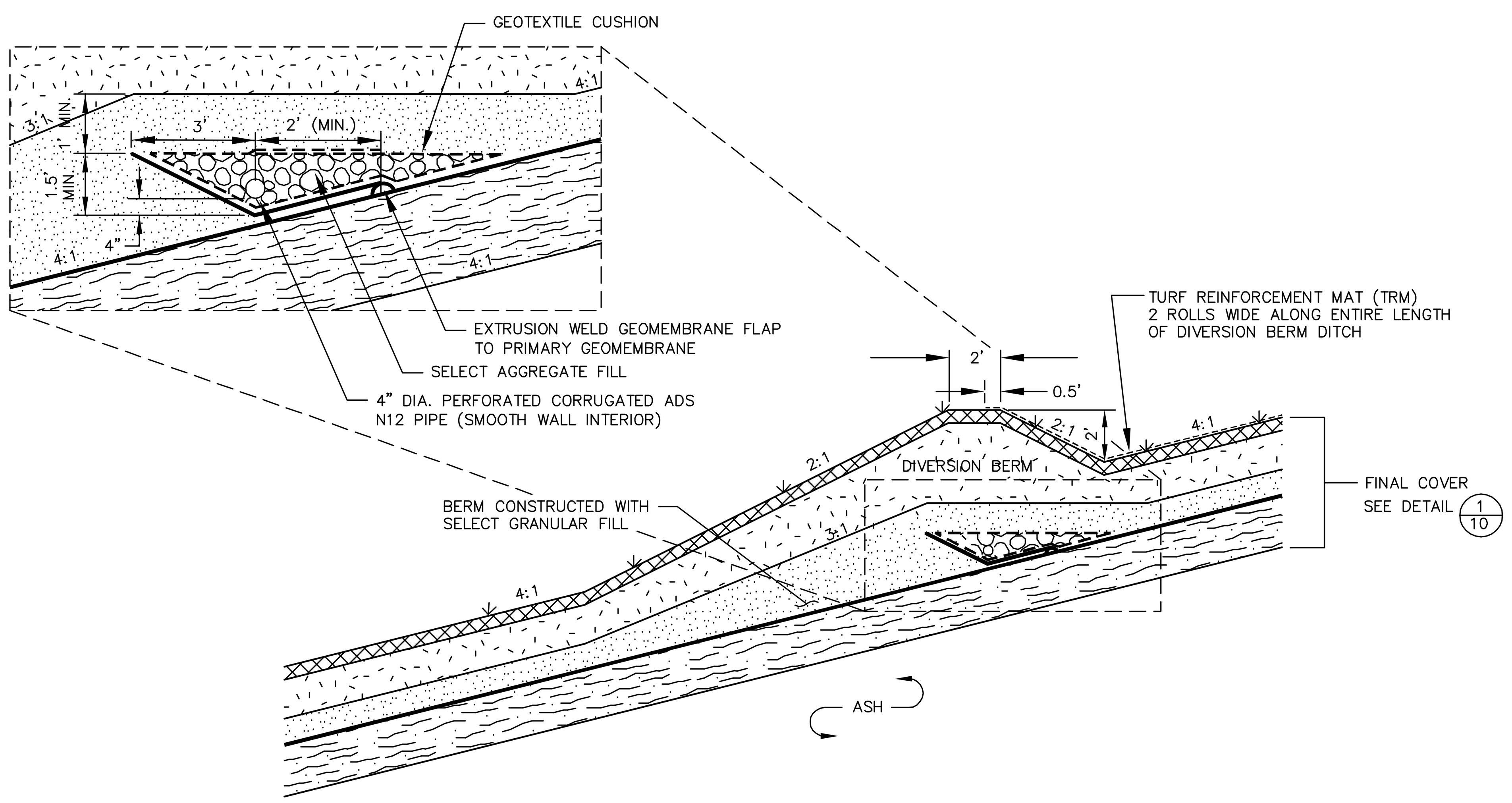
DRAWN BY: FITZGERE	SCALE: 1" = 40'	PROJ. NO. 3081.95\DOC	
CHECKED BY: TWM		FILE NO. FINALG.PLT	
APPROVED BY: CDM	DATE PRINTED:	SHEET 5 OF 11	
DATE: JANUARY 2010			

RMT
744 Heartland Trail
Madison, WI 53717-1934
P.O. Box 8923 53708-8923
Phone: 608.831.4444
Fax: 608.831.3334



1/10 FINAL COVER

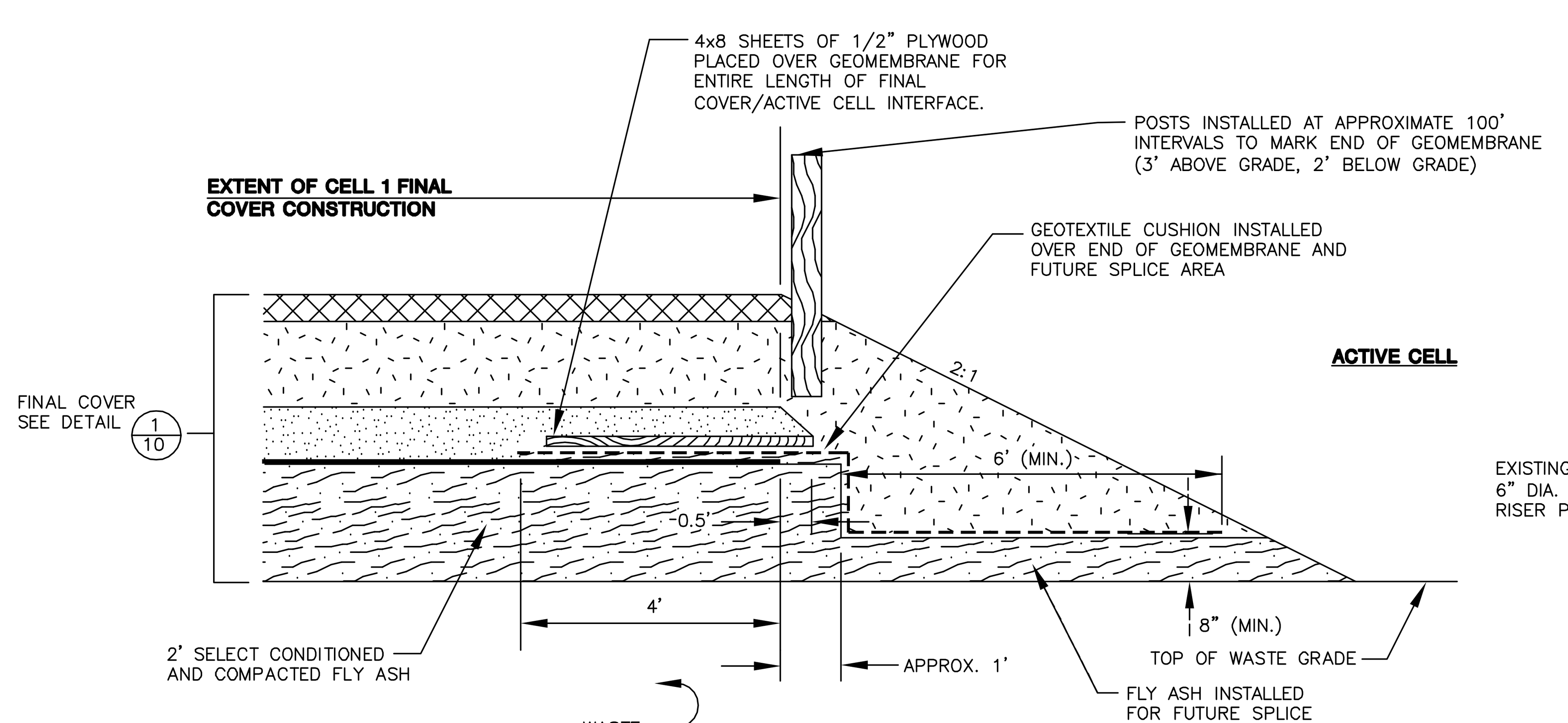
(SCALE: 1"=2')



NOTES:
1. A 4" DIA. PERFORATED CORRUGATED HDPE PIPE CONSTRUCTED IN THE UPPER DIVERSION BERM ONLY.
2. EXTENDED (DAYLIGHTED) 4" DIA. PERFORATED CORRUGATED HDPE PIPE, SELECT COARSE AGGREGATE FILL, GEOMEMBRANE FLAP, AND GEOTEXTILE TO LIMITS OF FINAL COVER; WRAPPED PIPE ENDS IN GEOTEXTILE AND COVERED WITH AGGREGATE.

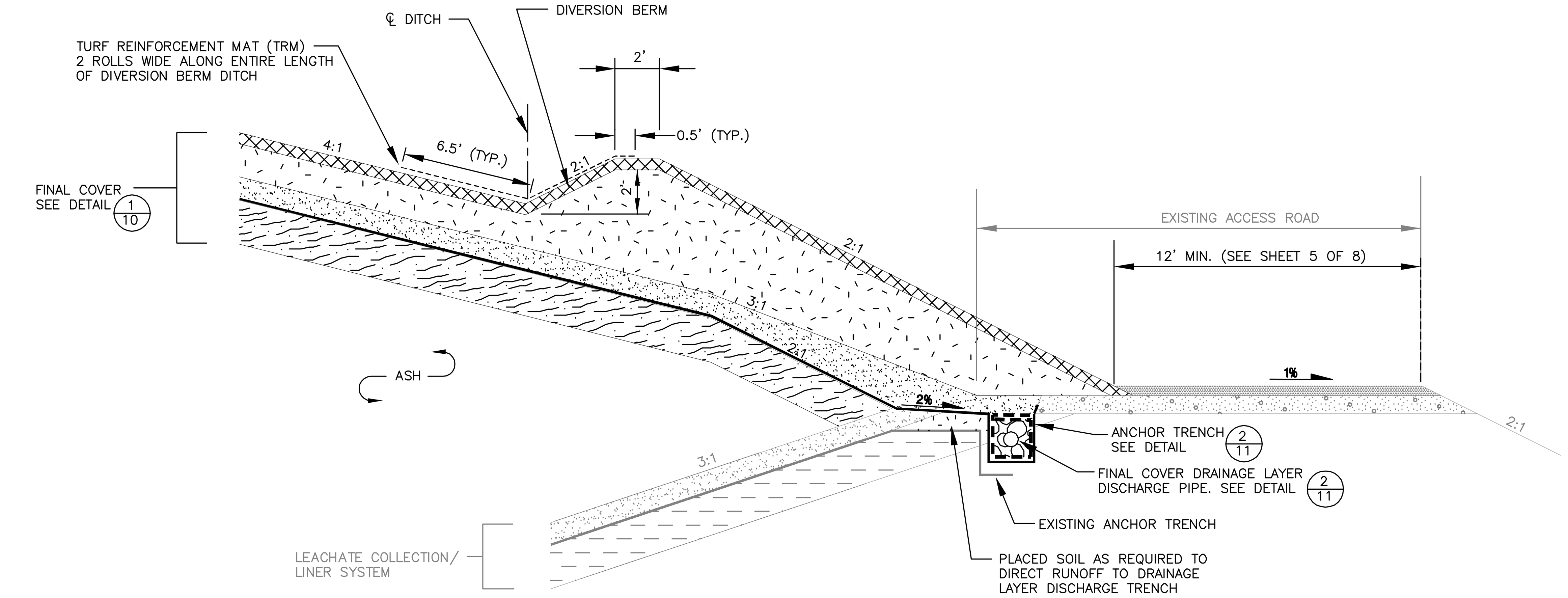
2/10 DIVERSION BERM

SCALE: 1"=5'



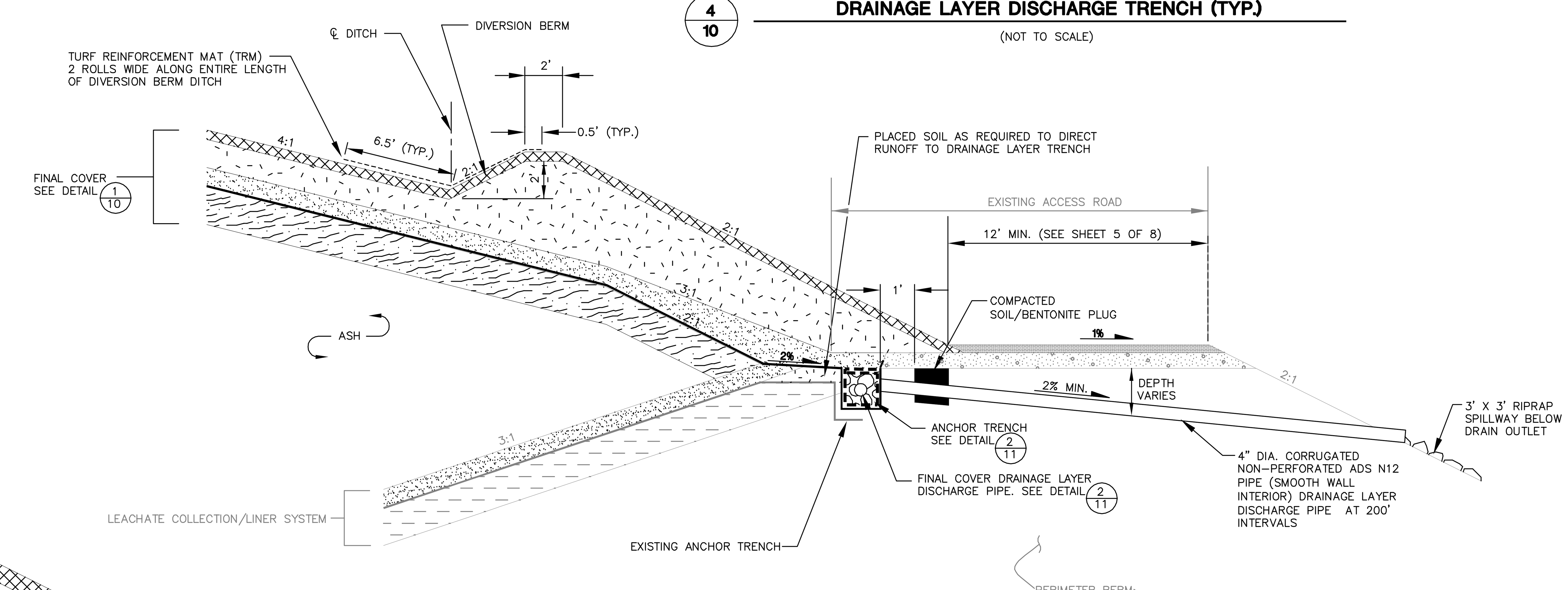
3/10 FINAL COVER TERMINATION

(NOT TO SCALE)



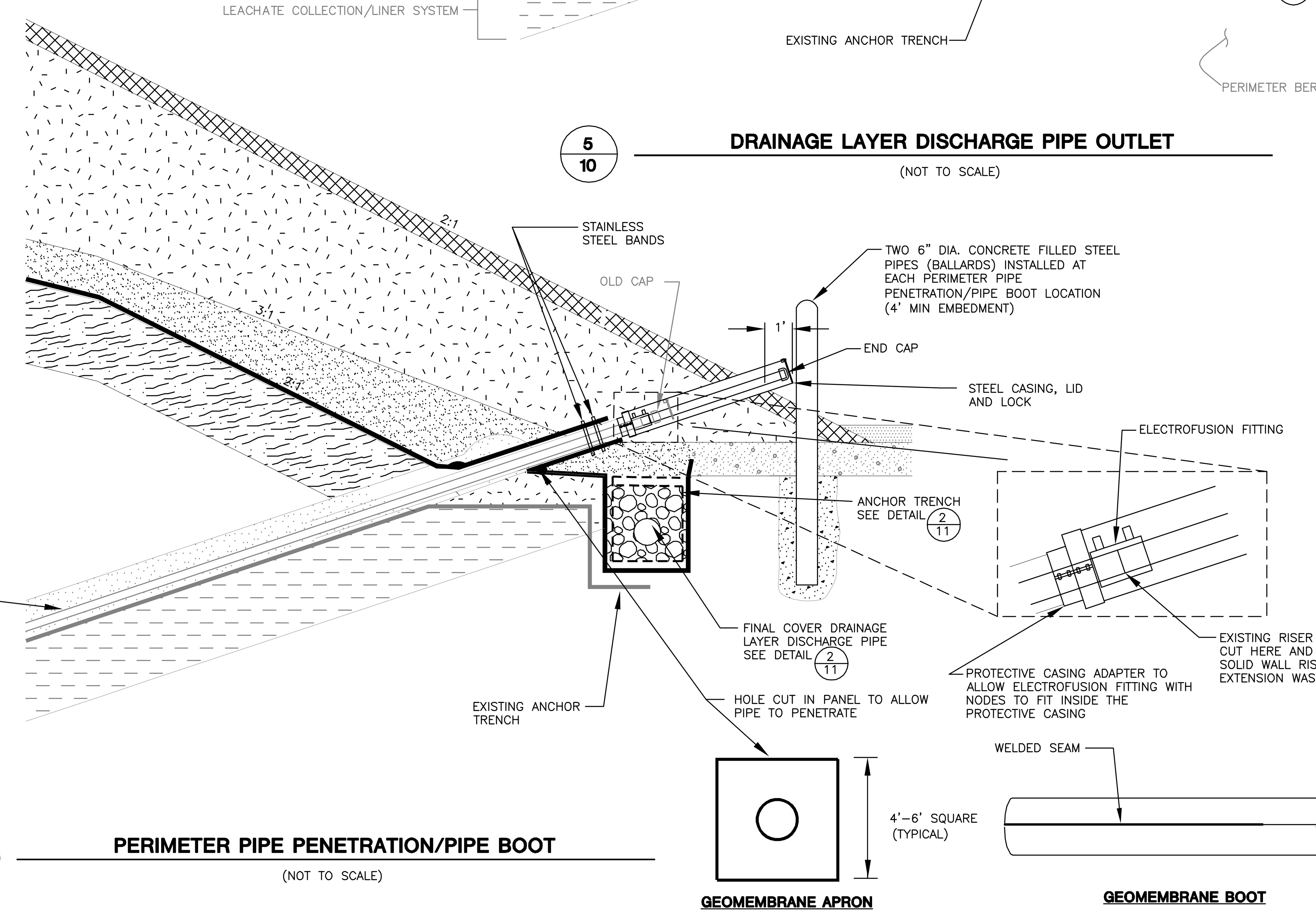
4/10 FINAL COVER TERMINATION AND DRAINAGE LAYER DISCHARGE TRENCH (TYP.)

(NOT TO SCALE)



5/10 DRAINAGE LAYER DISCHARGE PIPE OUTLET

(NOT TO SCALE)



6/10 PERIMETER PIPE PENETRATION/PIPE BOOT

(NOT TO SCALE)

LINE AND SHADING LEGEND

- - - -	GEOTEXTILE	———	GEOMEMBRANE
	TOPSOIL		NATIVE SOIL
	SELECT GRANULAR FILL DRAINAGE LAYER		FLY ASH
	CONCRETE		RIPRAP
	SELECT AGGREGATE FILL		GRAVEL
	COMPACTED SELECT LOW PERMEABILITY SOIL		GENERAL FILL

NOTE: THESE PLANS ARE ACCOMPANIED BY A DOCUMENTATION REPORT OF THE SAME TITLE. THESE DOCUMENTS ARE INTERELATED AND ARE INTENDED TO BE USED TOGETHER.

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

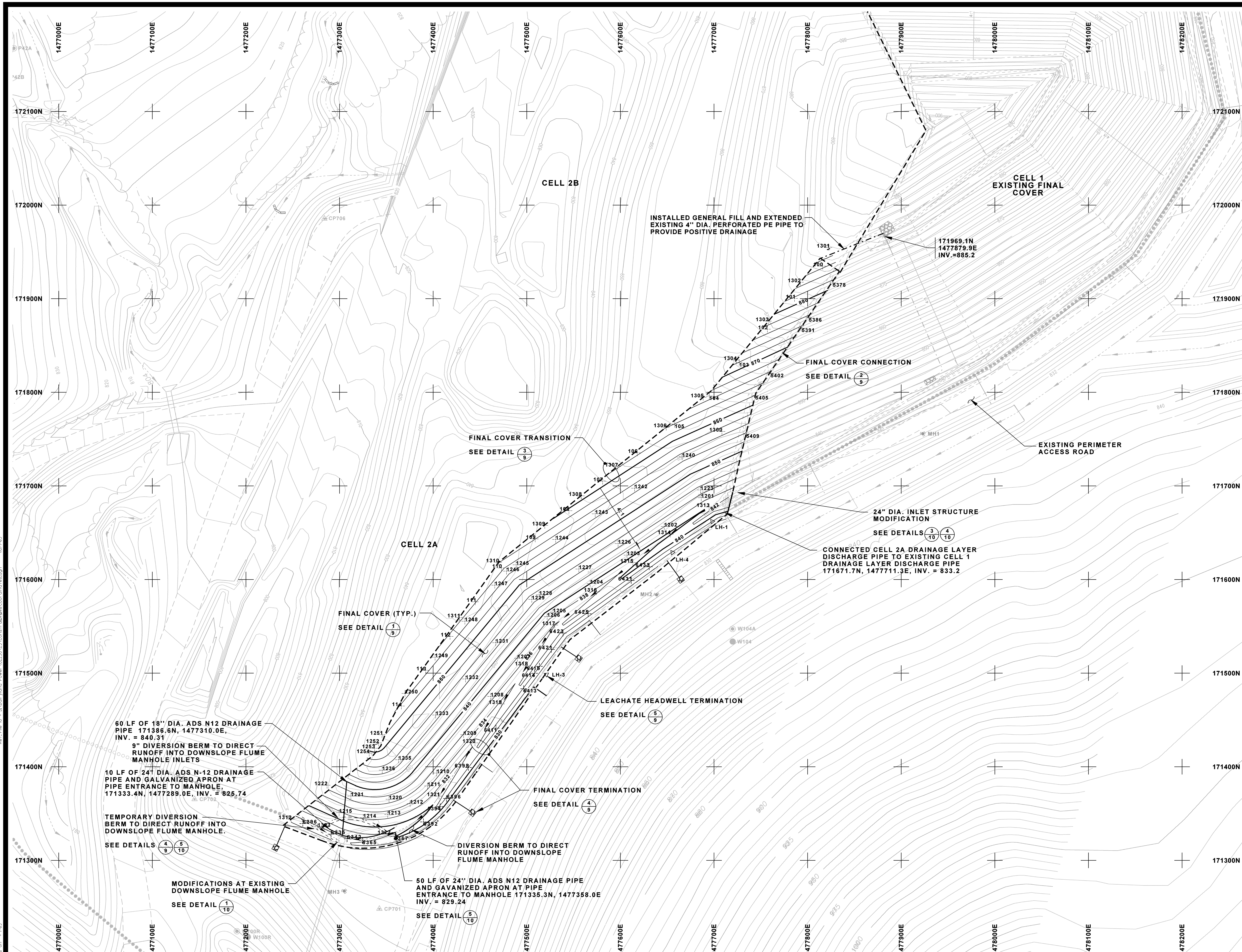
PROJECT: **DAIRYLAND POWER COOPERATIVE PHASE IV, CELL 1 FINAL COVER CONSTRUCTION DOCUMENTATION**

SHEET TITLE: **DETAILS**

DRAWN BY: FITZGERE	SCALE:	PROJ. NO.	3081.95\DOC
CHECKED BY: TWM	AS SHOWN	FILE NO.	DETAIL1.DWG
APPROVED BY: CDM	DATE PRINTED:	SHEET 10 OF 11	
DATE: JANUARY 2010			

RMT

744 Heartland Trail
Madison, WI 53717-1934
P.O. Box 8923 53708-8923
Phone: 608-831-4444
Fax: 608-831-3334



NOTES

1. REFER TO PLAN SHEET 2 OF THIS PLAN SET FOR LEGEND, BASE MAP NOTES AND BENCHMARK LOCATIONS.
2. FULL TONE CONTOURS WITHIN THE LIMITS OF CELL 2A COMPOSITE COVER REPRESENT FINAL GRADES (TOP OF TOPSOIL). REFER TO DETAIL 1 ON PLAN SHEET 9.
3. REFER TO TABLES 3 AND 4 FOR CONSTRUCTION COORDINATE LOCATIONS AND ELEVATIONS.

NOTE: THESE PLANS ARE ACCOMPANIED BY A REPORT OF THE SAME TITLE. THESE DOCUMENTS ARE INTERRELATED AND ARE INTENDED TO BE USED TOGETHER. THESE DOCUMENTS ARE INTENDED TO BE USED FOR REGULATORY PURPOSES ONLY.

NOT FOR CONSTRUCTION

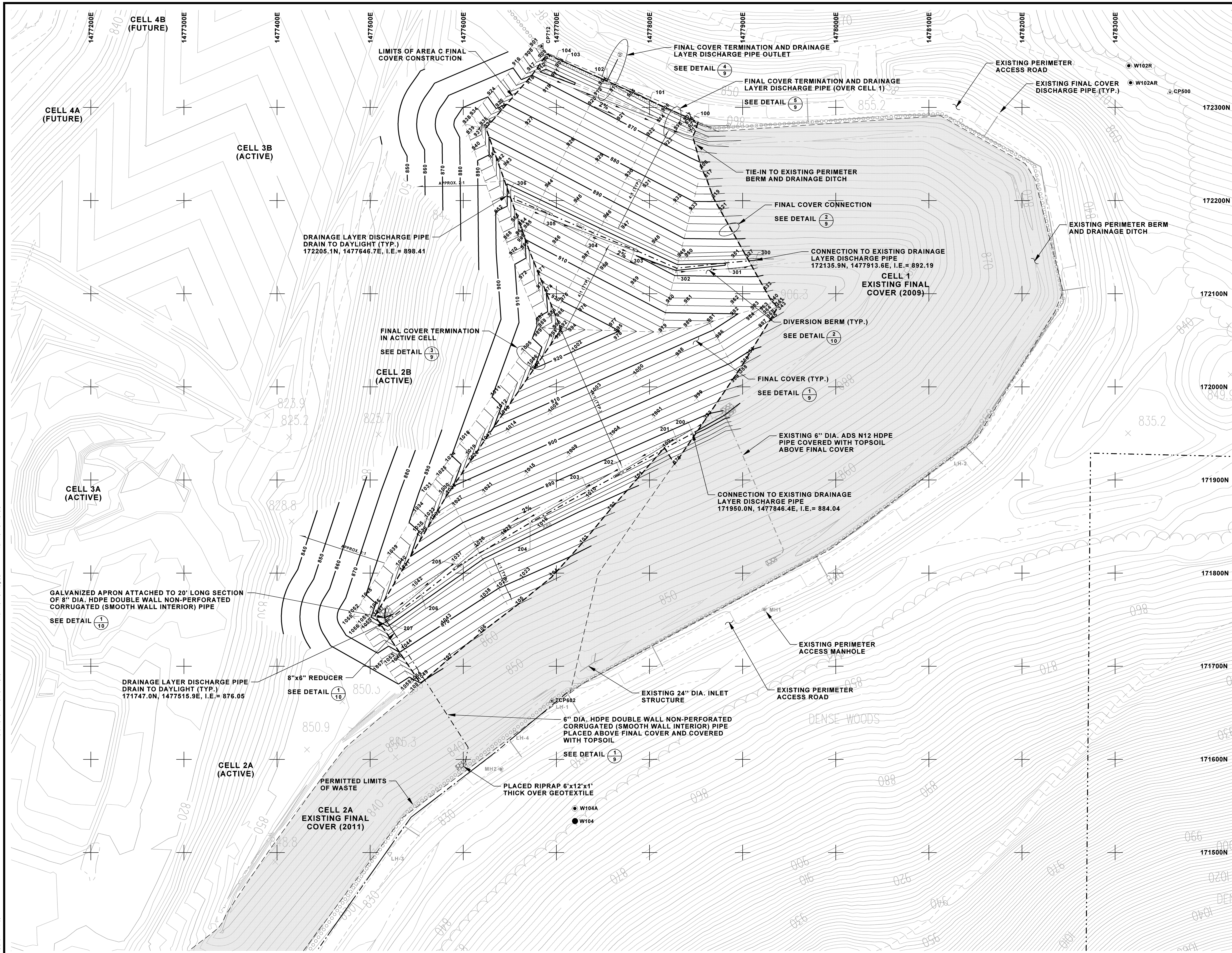
NO.	BY	DATE	REVISION	APP'D.
3.				
2.				
1.				

PROJECT: DAIRYLAND POWER COOPERATIVE
PHASE IV, CELL 2A, FINAL COVER CONSTRUCTION DOCUMENTATION
BUFFALO COUNTY, WISCONSIN

SHEET TITLE: **FINAL GRADES**

DRAWN BY: lstormer	SCALE: 1"=50'		PROJ. NO.	02250.25\DOC
CHECKED BY: TDH			FILE NO.	02250.25.C402.PLT
APPROVED BY: CDM	DATE PRINTED:		SHEET 5 OF 10	
DATE: DECEMBER 2011				

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



NOTES

1. REFER TO PLAN SHEET 2 OF THIS PLAN SET FOR LEGEND, BASE MAP NOTES AND BENCHMARK LOCATIONS.
2. FULL TONE CONTOURS WITHIN THE LIMITS OF AREA C COMPOSITE COVER REPRESENT THE FINAL GRADES (TOP OF TOPSOIL). REFER TO DETAIL 1 ON PLAN SHEET 9.
3. TOP OF FINAL COVER GRADES (DESIGN) WERE DEVELOPED FROM THE PLAN OF OPERATION PREPARED BY RMT, INC., APPROVAL DATE: MAY 15, 2001.
4. REFER TO TABLE 3 FOR CONSTRUCTION COORDINATE LOCATIONS AND ELEVATIONS.

THESE PLANS ARE ACCOMPANIED BY A DOCUMENTATION REPORT OF THE SAME TITLE. THESE DOCUMENTS ARE INTERRELATED AND NTENDED TO BE USED AND REVIEWED TOGETHER.

NO.	BY	DATE	REVISION	APP'D.

PROJECT: DAIRYLAND POWER COOPERATIVE
PHASE IV, AREA C FINAL COVER CONSTRUCTION
DOCUMENTATION REPORT
BUFFALO COUNTY, WISCONSIN

SHEET TITLE: FINAL GRADES

DRAWN BY:	Rnolden	PROJ. NO.	216851.0005
CHECKED BY:	T. MARTIN	SHEET 5 OF 10	
APPROVED BY:	D. GENTHE		
DATE:	FEBRUARY 2017		

TRC
708 Heartland Trail
Suite 3000
Madison, WI 53532
Phone: 608.826.3600

FILE NO: 216851.0005.SHT05-FC.PLT

Attachment 7

Previous GCL Conformance Testing

TRI/ENVIRONMENTAL, INC.
A Texas Research International Company

July 18, 2001

Mr. Paul Donnelly
RMT, Inc.
744 Hearland Trail
Madison, WI 53717-1934

fax: 608-8313334

Dear Mr. Donnelly:

Thank you for consulting TRI/Environmental, Inc. (TRI) for your geosynthetics testing needs. TRI is pleased to submit this final report for laboratory testing.

TRI Job Reference Number:	2159-10-07
Material(s) Tested:	8 GCL's
Test(s) Requested:	Bentonite Swell Index (ASTM D 5890) Hydraulic Conductivity (ASTM D 5887) Grab Tensile Strength (ASTM D 4632) Peel Strength (ASTM D 4632) Mass/Unit Area (ASTM D 5993)

If you have any questions or require any additional information, please call us at 1-800-880-8378.

Sincerely,

Sam R. Allen

Sam R. Allen
Vice President and Division Manager: Geosynthetics Technologies

1/10

GEOSYNTHETIC CLAY LINER TEST RESULTS

RMT, Inc.
Dairyland Power Company

Material: Cetco Bentomat ST
Roll #: 3100
TRI Log #: E2159-10-07

SRA 07.18.01
Quality Review/Date

PARAMETER	TEST REPLICATE NUMBER 1	2	3	4	5	6	7	8	9	10	MEAN	STD DEV.	COEFF. OF VAR.
Bentonite - Swell Index (ASTM D 5890)													
Slurry temperature at test intiation (22 degrees C)													
Swell index (mL/2g)	32										32		
Bentonite - Mass/Unit Area (ASTM D 5993, result @ 0% M.C.)													
Bentonite mass/unit area (lbs/ft2)	1.02	0.91	0.88	0.88	0.91						0.92	0.05	
Moisture Content (%)	26.5	26.4	24.9	23.3	24.7						25.2	1.19	
Grab Tensile Properties (ASTM D 4632)													
MD - Tensile Strength (lbs)	110	110	106	122	114	111	109	111	114	130	114	7	
TD - Tensile Strength (lbs)	133	151	183	200	209	196	181	175	208	132	177	28	
MD - Elongation @ Max. Load (%)	55	39	12	14	13	13	13	12	13	63	25	19	
TD - Elongation @ Max. Load (%)	98	82	71	95	102	98	69	83	111	72	88	14	
Peel Strength (ASTM D 4632, modified for 180 degree peel of GCL)													
MD - Peel Strength (lbs)	23	22	35	27	24	30	31	33	30	35	29	5	
TD - Peel Strength (lbs)	36	36	33	34	30	30	30	30	33	32	32	2	
Hydraulic Conductivity - ASTM D 5887 (5 psi effective stress)													
Hydraulic Conductivity (cm/sec)				1.7E-09							1.7E-09		

MD Machine Direction
TD Transverse DirectionN/A Not Available

The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.

9063 Bee Caves Road • Austin, TX 78733-6201 • (512) 263-2101 • FAX (512) 263-2558

TRI/ENVIRONMENTAL, INC.
A Texas Research International Company

GEOSYNTHETIC CLAY LINER TEST RESULTS

RMT, Inc.
Dairyland Power Company

Material: Cetco Bentomat ST
Roll #: 3052
TRI Log #: E2159-10-07

SRA 07.18.01
Quality Review/Date

PARAMETER	TEST REPLICATE NUMBER 1	2	3	4	5	6	7	8	9	10	MEAN	STD DEV.	COEFF. OF VAR.
Bentonite - Swell Index (ASTM D 5890)													
Slurry temperature at test intiation (22 degrees C)													
Swell index (mL/2g)	30										30		
Bentonite - Mass/Unit Area (ASTM D 5993, result @ 0% M.C.)													
Bentonite mass/unit area (lbs/ft2)	0.71	0.88	0.97	0.91	0.79						0.85	0.09	
Moisture Content (%)	16.2	16.5	16.7	15.4	15.0						16.0	0.65	
Grab Tensile Properties (ASTM D 4632)													
MD - Tensile Strength (lbs)	115	126	129	108	117	124	116	123	121	121	120	6	
TD - Tensile Strength (lbs)	180	210	221	204	184	217	206	243	256	206	213	22	
MD - Elongation @ Max. Load (%)	26	22	21	25	21	20	20	21	21	21	22	2	
TD - Elongation @ Max. Load (%)	112	127	132	132	123	118	123	116	119	137	124	8	
Peel Strength (ASTM D 4632, modified for 180 degree peel of GCL)													
MD - Peel Strength (lbs)	22	23	22	20	19	20	22	16	17	12	19	3	
TD - Peel Strength (lbs)	23	18	20	24	36	25	34	38	19	21	26	7	
Hydraulic Conductivity - ASTM D 5887 (5 psi effective stress)													
Hydraulic Conductivity (cm/sec)				1.5E-09							1.5E-09		

MD Machine Direction
TD Transverse DirectionN/A Not Available

The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.

9063 Bee Caves Road • Austin, TX 78733-6201 • (512) 263-2101 • FAX (512) 263-2558

TRI/ENVIRONMENTAL, INC.
A Texas Research International Company

GEOSYNTHETIC CLAY LINER TEST RESULTS

RMT, Inc.
Dairyland Power Company

Material: Cetco Bentomat ST
Roll #: 3116
TRI Log #: E2159-10-07

SRA 07·18·01
Quality Review/Date

PARAMETER	TEST REPLICATE NUMBER 1	2	3	4	5	6	7	8	9	10	MEAN	STD DEV.	COEFF. OF VAR.
Bentonite - Swell Index (ASTM D 5890)													
Slurry temperature at test intiation (22 degrees C)													
Swell index (mL/2g)	31										31		
Bentonite - Mass/Unit Area (ASTM D 5993, result @ 0% M.C.)													
Bentonite mass/unit area (lbs/ft2)	1.04	1.02	0.93	0.93	0.93						0.97	0.05	
Moisture Content (%)	21.1	19.3	19.2	17.7	16.6						18.8	1.53	
Grab Tensile Properties (ASTM D 4632)													
MD - Tensile Strength (lbs)	130	134	152	130	138	134	121	107	134	130	131	11	
TD - Tensile Strength (lbs)	229	193	169	164	174	219	187	191	175	197	190	20	
MD - Elongation @ Max. Load (%)	15	19	19	18	16	17	16	17	18	16	17	1	
TD - Elongation @ Max. Load (%)	71	75	62	67	66	75	75	103	72	109	78	15	
Peel Strength (ASTM D 4632, modified for 180 degree peel of GCL)													
MD - Peel Strength (lbs)	36	31	31	28	35	29	21	42	31	39	32	6	
TD - Peel Strength (lbs)	30	22	44	40	46	41	52	39	37	45	40	8	
Hydraulic Conductivity - ASTM D 5887 (5 psi effective stress)													
Hydraulic Conductivity (cm/sec)				1.7E-09							1.7E-09		

MD Machine Direction
TD Transverse DirectionN/A Not Available

The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.

9063 Bee Caves Road • Austin, TX 78733-6201 • (512) 263-2101 • FAX (512) 263-2558

Appendix K
GCL Conformance Testing Results

October 20, 2006

Mail To: **Bill To:**

Mr. Paul Donnelly **<= Same**
RMT, Inc.
PO Box 8923
Madison, WI 53708-8923

email: paul.donnelly@rmtinc.com
cc email: todd.martin@rmtinc.com - Todd Martin

Dear Mr. Donnelly:

Thank you for consulting TRI/Environmental, Inc. (TRI) for your geosynthetics testing needs. TRI is pleased to submit this final report for laboratory testing.

Project:	**Dairyland Power Cooperative - Alma, WI**
TRI Job Reference Number:	E2243-77-01
Material(s) Tested:	1 Bentomat ST GCL(s)
Test(s) Requested:	Mass/Unit Area (ASTM D 5993) Bentonite - Swell Index (ASTM D 5890) Peel Strength (ASTM D 4632, mod.) Index Flux (ASTM D 5887)

If you have any questions or require any additional information, please call us at 1-800-880-8378.

Sincerely,

John M. Allen

John M. Allen, E.I.T
Director of Geosynthetics Interaction Laboratory
Geosynthetic Services Division
www.GeosyntheticTesting.com

1/10

GCL TEST RESULTS

TRI Client: RMT, Inc.
Project: Dairyland Power Cooperative - Alma, WI

Material: Bentomat ST GCL
Sample Identification: 6056
TRI Log #: E2243-77-01

PARAMETER	TEST REPLICATE NUMBER 1	2	3	4	5	6	7	8	9	10	MEAN	STD. DEV.
Bentonite - Mass/Unit Area (ASTM D 5993, result @ 0% M.C.)												
Bentonite mass/unit area (lbs/ft^2)	0.78	0.72	0.77	0.75	0.73						0.75	0.03
Moisture Content (%)	32.1	31.0	31.0	32.1	31.3						31.5	0.6
Bentonite - Swell Index (ASTM D 5890)												
Water temperature at test intiation (22 degrees C)												
Swell index (mL/2g)	25										25	
Note: Bentonite sample tested is taken from finished GCL product.												
Peel Strength (ASTM D 4632, modified for 180 degree peel of GCL)												
MD - Peel Strength (lbs)	44	29	49	53	43	34	27	20	49	34	38	11
Index Flux (ASTM D 5887)												
Index Flux (m^3/m^2/sec)	2.7E-09										2.7E-09	
Hydraulic Conductivity (cm/sec)	2.2E-09										2.2E-09	

MD Machine Direction

The testing is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.

GeosyntheticTesting.com
9063 Bee Caves Road / Austin, TX 78733 / 512 263 2101 / fax: 512 263 2558

September 5, 2006

Mail To: **Bill To:**

Mr. Paul Donnelly **<= Same**
RMT, Inc.
PO Box 8923
Madison, WI 53708-8923

email: paul.donnelly@rmtinc.com
cc email: todd.martin@rmtinc.com - Todd Martin

Dear Mr. Donnelly:

Thank you for consulting TRI/Environmental, Inc. (TRI) for your geosynthetics testing needs. TRI is pleased to submit this final report for laboratory testing.

Project:	**Dairyland Power Cooperative - Alma, WI**
TRI Job Reference Number:	E2243-60-07
Material(s) Tested:	6 Bentomat ST GCL(s)
Test(s) Requested:	Mass/Unit Area (ASTM D 5993)
Updating ==>	Bentonite - Swell Index (ASTM D 5890)
	Peel Strength (ASTM D 4632, mod.)
	Index Flux (ASTM D 5887)

If you have any questions or require any additional information, please call us at 1-800-880-8378.

Sincerely,

John M. Allen

John M. Allen, E.I.T
Director of Geosynthetics Interaction Laboratory
Geosynthetic Services Division
www.GeosyntheticTesting.com

GCL TEST RESULTS

TRI Client: RMT, Inc.
Project: Dairyland Power Cooperative - Alma, WI

Material: Bentomat ST GCL
Sample Identification: 7041
TRI Log #: E2243-60-07

PARAMETER	TEST REPLICATE NUMBER 1	2	3	4	5	6	7	8	9	10	MEAN	STD. DEV.
Bentonite - Mass/Unit Area (ASTM D 5993, result @ 0% M.C.)												
Bentonite mass/unit area (lbs/ft^2)	0.91	0.91	0.97	0.89	0.84						0.90	0.05
Moisture Content (%)	30.8	31.0	24.1	24.7	15.3						25.2	6.4
Bentonite - Swell Index (ASTM D 5890)												
Water temperature at test intiation (22 degrees C)												
Swell index (mL/2g)	22										22	
Note: Bentonite sample tested is as received from manufacturer prior to production.												
Bentonite - Swell Index (ASTM D 5890)												
					RETEST							
Water temperature at test intiation (23 degrees C)												
Swell index (mL/2g)	15										15	
Note: Bentonite sample tested is as received from manufacturer prior to production.												
Peel Strength (ASTM D 4632, modified for 180 degree peel of GCL)												
MD - Peel Strength (lbs)	29	28	24	27	31	37	38	34	36	28	31	5
Index Flux (ASTM D 5887)												
Index Flux ($m^3/m^2/sec$)	3.6E-09										3.6E-09	
Hydraulic Conductivity (cm/sec)	3.4E-09										3.4E-09	

MD Machine Direction

The testing is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.

GCL TEST RESULTS

TRI Client: RMT, Inc.
Project: Dairyland Power Cooperative - Alma, WI

Material: Bentomat ST GCL
Sample Identification: 7075
TRI Log #: E2243-60-07

PARAMETER	TEST REPLICATE NUMBER 1	2	3	4	5	6	7	8	9	10	MEAN	STD. DEV.
Bentonite - Mass/Unit Area (ASTM D 5993, result @ 0% M.C.)												
Bentonite mass/unit area (lbs/ft^2)	0.88	0.91	0.97	0.87	0.81						0.89	0.06
Moisture Content (%)	29.4	29.1	28.1	31.2	30.9						29.7	1.3
Bentonite - Swell Index (ASTM D 5890)												
Water temperature at test intiation (22 degrees C)												
Swell index (mL/2g)	15										15	
Note: Bentonite sample tested is as received from manufacturer prior to production.												
Bentonite - Swell Index (ASTM D 5890)						RETEST						
Water temperature at test intiation (23 degrees C)												
Swell index (mL/2g)	18										18	
Note: Bentonite sample tested is as received from manufacturer prior to production.												
Peel Strength (ASTM D 4632, modified for 180 degree peel of GCL)												
MD - Peel Strength (lbs)	46	36	28	34	43	36	36	37	34	33	36	5
Index Flux (ASTM D 5887)												
Index Flux (m^3/m^2/sec)	3.1E-09										3.1E-09	
Hydraulic Conductivity (cm/sec)	2.4E-09										2.4E-09	

MD Machine Direction

GCL TEST RESULTS

TRI Client: RMT, Inc.
Project: Dairyland Power Cooperative - Alma, WI

Material: Bentomat ST GCL
Sample Identification: 7109
TRI Log #: E2243-60-07

PARAMETER	TEST REPLICATE NUMBER 1	2	3	4	5	6	7	8	9	10	MEAN	STD. DEV.
Bentonite - Mass/Unit Area (ASTM D 5993, result @ 0% M.C.)												
Bentonite mass/unit area (lbs/ft^2)	0.83	0.93	0.97	0.92	0.69						0.87	0.11
Moisture Content (%)	29.4	27.6	27.5	27.0	26.6						27.6	1.1
Bentonite - Swell Index (ASTM D 5890)												
Water temperature at test intiation (22 degrees C)												
Swell index (mL/2g)	22										22	
Note: Bentonite sample tested is as received from manufacturer prior to production.												
Bentonite - Swell Index (ASTM D 5890)						RETEST						
Water temperature at test intiation (23 degrees C)												
Swell index (mL/2g)	18										18	
Note: Bentonite sample tested is as received from manufacturer prior to production.												
Peel Strength (ASTM D 4632, modified for 180 degree peel of GCL)												
MD - Peel Strength (lbs)	39	28	33	31	39	32	43	33	33	28	34	5
Index Flux (ASTM D 5887)												
Index Flux ($m^3/m^2/sec$)	3.2E-09										3.2E-09	
Hydraulic Conductivity (cm/sec)	2.0E-09										2.0E-09	

MD Machine Direction

Appendix K
GCL Conformance Testing Results

August 3, 2012

Mail To:	**Bill To:**
Terrence Halena	**Accounts Payable**
TRC Environmental Corporation	TRC Companies, Inc.
744 Heartland Trail	21 Griffin Road North
Madison, WI 53717	Windsor, CT 06095
email: thalena@trcsolutions.com	PO: 46408
fax:608-662-5451	email: apinvoiceapproval@trcsolutions.com

Dear Mr. Halena:

Thank you for consulting TRI/Environmental, Inc. (TRI) for your geosynthetics testing needs. TRI is pleased to submit this final report for laboratory testing.

Project:	**DPC - Alma Off Site Cell 3A**
TRI Job Reference Number:	E2365-60-03
Material(s) Tested:	2, Bentoliner NSL GCL(s)
Test(s) Requested:	Index Flux (ASTM D 5887)

If you have any questions or require any additional information, please call us at 1-800-880-8378.

Sincerely,

John M. Allen

John M. Allen, P.E.
Division Director

www.GeosyntheticTesting.com

GCL TEST RESULTS

TRI Client: TRC Environmental Corporation
Project: DPC - Alma Off Site Cell 3A

Material: Bentoliner NSL
TRI Log #: E2365-60-03

PARAMETER	TEST REPLICATE NUMBER 1	2	3	4	5	6	7	8	9	10	MEAN	STD. DEV.
Index Flux (ASTM D 5887) **Sample Identification: 502207460**												
Index Flux ($m^3/m^2/sec$)	3.2E-09										3.2E-09	
Hydraulic Conductivity (cm/sec)	2.7E-09										2.7E-09	
Index Flux (ASTM D 5887) **Sample Identification: 502207517**												
Index Flux ($m^3/m^2/sec$)	3.4E-09										3.4E-09	
Hydraulic Conductivity (cm/sec)	3.3E-09										3.3E-09	

MD Machine Direction TD Transverse Direction NA Not Available

GeosyntheticTesting.com
9063 Bee Caves Road / Austin, TX 78733 / 512 263 2101 / fax: 512 263 2558

October 9, 2012

Mail To:

Terrence Halena
TRC Environmental Corporation
744 Heartland Trail
Madison, WI 53717

email: thalena@trcsolutions.com
fax:608-662-5451

Bill To:

Accounts Payable
TRC Companies, Inc.
21 Griffin Road North
Windsor, CT 06095

PO: 46408
email: apinvoiceapproval@trcsolutions.com

Dear Mr. Halena:

Thank you for consulting TRI/Environmental, Inc. (TRI) for your geosynthetics testing needs. TRI is pleased to submit this final report for laboratory testing.

Project:	**DPC - Alma Off Site Cell 3A**
TRI Job Reference Number:	E2365-92-06
Material(s) Tested:	1, BentoLiner NSL GCL(s)
Test(s) Requested:	Index Flux (ASTM D 5887)

If you have any questions or require any additional information, please call us at 1-800-880-8378.

Sincerely,

John M. Allen, P.E.
Division Director

www.GeosyntheticTesting.com

GCL TEST RESULTS

TRI Client: TRC Environmental Corporation
Project: DPC - Alma Off Site Cell 3A

Material: Bentoliner NSL
TRI Log #: E2365-92-06

PARAMETER	TEST REPLICATE NUMBER										MEAN	STD. DEV.
	1	2	3	4	5	6	7	8	9	10		
Index Flux (ASTM D 5887) **Sample Identification: 502215787**												
Index Flux ($m^3/m^2/sec$)	2.1E-09										$\boxed{\text{2.1E-09}}$	
Hydraulic Conductivity (cm/sec)	1.4E-09										$\boxed{\text{1.4E-09}}$	

MD Machine Direction TD Transverse Direction NA Not Available

The testing is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.

GeosyntheticTesting.com
9063 Bee Caves Road / Austin, TX 78733 / 512 263 2101 / fax: 512 263 2558

GCL Conformance Testing

July 29, 2015

Mail To:

Terrence Halena
TRC Environmental Corporation
708 Heartland Trail, Suite 3000
Madison, WI 53717

email: thalena@trcsolutions.com
cc email: twmartin@trcsolutions.com

Bill To:

<= Same

Dear Mr. Halena:

Thank you for consulting TRI/Environmental, Inc. (TRI) for your geosynthetics testing needs. TRI is pleased to submit this final report for laboratory testing.

Project:	**DPC Alma Off-Site Ash Disposal Facility Cell 3B**
TRI Job Reference Number:	E2392-71-05
Material(s) Tested:	Four GSE BentoLiner NSL GCL(s)
Test(s) Requested:	Mass/Unit Area (ASTM D5993) Index Flux (ASTM D5887)

If you have any questions or require any additional information, please call us at 1-800-880-8378.

Sincerely,

John M. Allen

John M. Allen, P.E.
Division Director
Geosynthetic Services Division
www.GeosyntheticTesting.com

GCL TEST RESULTS
TRI Client: TRC Environmental Corporation
Project: DPC Alma Off-Site Ash Disposal Facility Cell 3B

Material: GSE BentoLiner NSL GCL
Sample Identification: 502256840
TRI Log #: E2392-71-05

PARAMETER	TEST REPLICATE NUMBER 1	2	3	4	5	6	7	8	9	10	MEAN	STD. DEV.
Bentonite - Mass/Unit Area (ASTM D5993, result @ 0% M.C.)												
Bentonite mass/unit area (lbs/ft^2)	0.79	0.80	0.92	0.88	0.80						0.84	0.06
Moisture Content (%)	9.8	9.9	9.8	9.7	9.7						9.8	0.1
Index Flux (ASTM D5887)												
Index Flux ($m^3/m^2/sec$)		3.3E-09									3.3E-09	
Hydraulic Conductivity (cm/sec)		2.8E-09									2.8E-09	

MD Machine Direction TD Transverse Direction NA Not Available

TRI ENVIRONMENTAL, INC.
9063 BEE CAVES RD. – AUSTIN, TX 78733 – USA | PH: 800.880.TEST OR 512.263.2101

GCL TEST RESULTS
TRI Client: TRC Environmental Corporation
Project: DPC Alma Off-Site Ash Disposal Facility Cell 3B

Material: GSE BentoLiner NSL GCL
Sample Identification: 502256860
TRI Log #: E2392-71-05

PARAMETER	TEST REPLICATE NUMBER 1	2	3	4	5	6	7	8	9	10	MEAN	STD. DEV.
Bentonite - Mass/Unit Area (ASTM D5993, result @ 0% M.C.)												
Bentonite mass/unit area (lbs/ft^2)	0.83	0.76	0.81	0.90	0.74						0.81	0.06
Moisture Content (%)	10.3	10.5	10.6	10.8	10.6						10.6	0.2
Index Flux (ASTM D5887)												
Index Flux ($m^3/m^2/sec$)	3.6E-09										3.6E-09	
Hydraulic Conductivity (cm/sec)	2.8E-09										2.8E-09	

MD Machine Direction TD Transverse Direction NA Not Available

TRI ENVIRONMENTAL, INC.
9063 BEE CAVES RD. – AUSTIN, TX 78733 – USA | PH: 800.880.TEST OR 512.263.2101

July 29, 2015
September 23, 2015 Reissued to add roll number

Mail To: **Bill To:**

Terrence D. Halena **<= Same**
TRC Environmental Corporation
708 Heartland Trail, Suite 3000
Madison, WI 53717

email: thalena@trcsolutions.com
cc email: twmartin@trcsolutions.com
cc email: ssellner@trcsolutions.com

Dear Mr. Halena:

Thank you for consulting TRI/Environmental, Inc. (TRI) for your geosynthetics testing needs. TRI is pleased to submit this final report of the laboratory testing for the sample listed below.

Project:	**DPC Cell 3 B Construction**
TRI Job Reference Number:	E2392-74-03
Material Tested:	One GCL
Test Requested:	Index Flux (ASTM D5887)

If you have any questions or require any additional information, please call us at 1-800-880-8378.

Sincerely,

Richard S. Lacey, P.E.
Senior Engineer
Geosynthetic Services Division
www.GeosyntheticTesting.com

GCL TEST RESULTS
TRI Client: TRC Environmental Corporation
Project: DPC Cell 3 B Construction

Material: GCL
Sample Identification: 502252239
TRI Log #: E2392-74-03

PARAMETER	TEST REPLICATE NUMBER										MEAN	STD. DEV.
	1	2	3	4	5	6	7	8	9	10		
Index Flux (ASTM D5887)												
Index Flux ($m^3/m^2/sec$)		2.9E-09									2.9E-09	
Hydraulic Conductivity (cm/sec)		2.3E-09									2.3E-09	

MD Machine Direction TD Transverse Direction NA Not Available

TRI ENVIRONMENTAL, INC.
9063 BEE CAVES RD. – AUSTIN, TX 78733 – USA | PH: 800.880.TEST OR 512.263.2101

Report Date
8/4/2015

Quality Assurance Laboratory Test Results

Project: CAAWS/Fargo Landfill Cell 15 Ph 1
Sales Order: 76072
Product: BLI-089-06N-03S-D-00 BentoLiner NS

Required Testing: ASTM D5887 - Standard Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter

Frequency: 1/Week

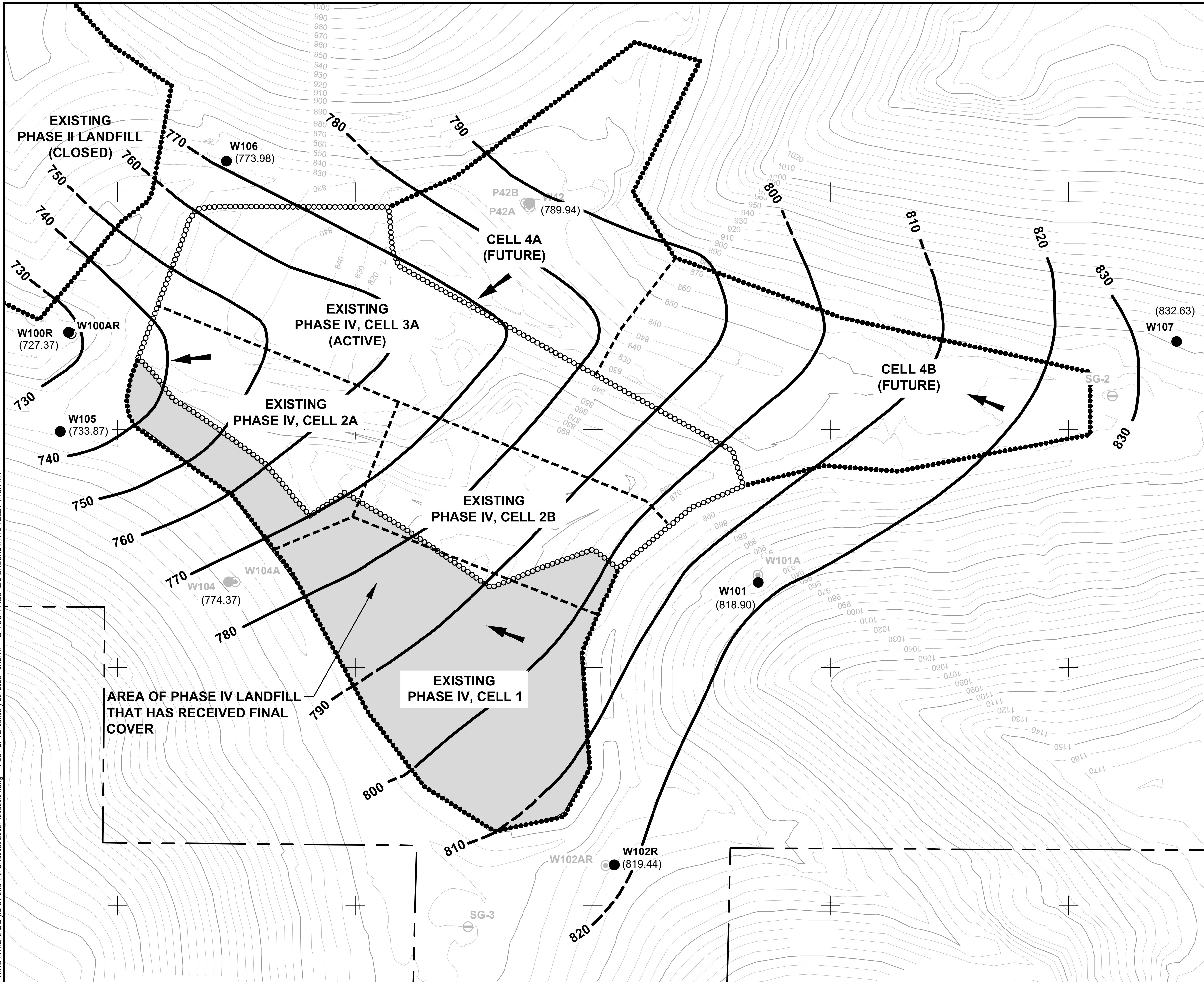
Effective Stress: 5 psi

Daily Lot	Roll Number	Production Date	Index Flux ($m^3/m^2/sec$)	Hydraulic Conductivity (cm/sec)
25051102	502252163	5/11/2015	3.50E-09	1.23E-09

Approved By: Michael Ellendorf
Date Approved: August 4, 2015

Attachment 8

Water Table Map



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
- (787.22) — GROUNDWATER ELEVATION
- GROUNDWATER FLOW DIRECTION
- 800 — GROUNDWATER EQUIPOTENTIAL LINE

NOTES

1. THE BASE MAP WAS COMPILED FROM THE CELL 3B LINER CONSTRUCTION DOCUMENTATION REPORT (OCTOBER, 2016) AND THE NOVEMBER 2, 2016 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.
4. GROUNDWATER ELEVATIONS BASED ON MEASUREMENTS TAKEN SEPTEMBER 20-21, 2022. GROUNDWATER ELEVATIONS ARE BASED ON MEAN SEA LEVEL DATUM.

N

0 200 400

SCALE IN FEET

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

TITLE: **GROUNDWATER ELEVATION MAP**

DRAWN BY:	T. FIEBRANZ	PROJ NO.:	469888
CHECKED BY:	S.EDWARDS	FIGURE 2	
APPROVED BY:	S.SELLWOOD		
DATE:	JANUARY 2023		

TRC
999 Fourier Drive
Suite 101
Madison, WI 53717
Phone: 608.826.3600

FILE NO.: 469888.01.dwg

DRAWING NAME: J:\Dairyland Power\Alma\469888\0000\469888.01.dwg --- PLOT DATE: January 25, 2023 - 5:12AM --- LAYOUT: FIGURE 2 GROUNDWATER ELEVATION MAP

Version: 2017-03-03

Attachment 9

Baseline Groundwater Monitoring Data

Alma Off-site Groundwater Data CCR Wells

Site	Sample Date	Location	Comment	Lab ID	Elevation ft	pH SU	Temperature degrees C	Conductance micromhos/cm	Alkalinity mg/L	Total Hardness mg/L as CaCO3	Total Copper ug/L	Total Manganese ug/L	Total Silver ug/L	Total Zinc ug/L	Nitrate + Nitrite mg/L as N
Alma Offsite	26-Oct-22	W100AR		40253880001	717.13	7.07	10.4	600	313	346	<1.9	<1.2	<0.13	<10.3	1.9
Alma Offsite	28-Nov-22	W100AR		40255290001	717.36	7.18	9.4	602	312	322	<1.9	<1.2	<0.13	<10.3	2.0
Alma Offsite	28-Mar-23	W100AR		40260038001	716.93	7.14	9.1	595	311	347	<1.9	<1.2	<0.13	<10.3	1.9
Alma Offsite	03-May-23	W100AR		40261759001	717.67	7.17	10.1	577	310	303	<1.9	<1.2	<0.13	<10.3	1.9
Alma Offsite	06-Jun-23	W100AR		40263312001	717.31	7.23	11.5	582	311	344	<1.9	<1.2	<0.13	<10.3	2.2
Alma Offsite	12-Jul-23	W100AR		40265136001	715.97	7.19	10.0	585	307	367	<1.9	<1.2	<0.13	<10.3	2.0
Alma Offsite	15-Aug-23	W100AR		40266836001	718.34	7.23	11.5	594	304	346	<1.9	<1.2	<0.13	<10.3	2.0
Alma Offsite	19-Sep-23	W100AR		40268395001	718.04	7.30	10.8	587	305	312	<1.9	<1.2	<0.13	<10.3	2.2
Alma Offsite	26-Oct-22	W100R		40253880002	727.27	7.27	10.2	578	296	341	<1.9	<1.2	<0.13	<10.3	2.1
Alma Offsite	28-Nov-22	W100R		40255290002	727.24	7.17	9.6	578	299	307	<1.9	<1.2	<0.13	<10.3	2.1
Alma Offsite	28-Mar-23	W100R		40260038002	727.29	7.21	10.4	564	299	337	<1.9	<1.2	<0.13	<10.3	2.1
Alma Offsite	03-May-23	W100R		40261759002	727.47	7.16	10.1	574	305	300	<1.9	<1.2	<0.13	<10.3	2.3
Alma Offsite	06-Jun-23	W100R		40263312002	727.38	7.25	11.0	573	301	335	<1.9	<1.2	<0.13	<10.3	2.3
Alma Offsite	12-Jul-23	W100R		40265136002	727.24	7.19	10.4	572	300	324	<1.9	<1.2	<0.13	<10.3	2.2
Alma Offsite	15-Aug-23	W100R		40266836002	727.14	7.28	11.2	583	296	333	<1.9	<1.2	<0.13	<10.3	2.2
Alma Offsite	19-Sep-23	W100R		40268395002	727.10	7.08	11.0	572	299	301	<1.9	<1.2	<0.13	<10.3	2.3
Alma Offsite	26-Oct-22	W101		40253880004	818.68	7.29	9.7	578	285	317	<1.9	<1.2	<0.13	<10.3	2.8
Alma Offsite	28-Nov-22	W101		40255290004	818.61	7.40	8.7	582	291	318	<1.9	1.6	<0.13	<10.3	2.9
Alma Offsite	27-Mar-23	W101		40260038004	817.97	7.43	10.3	582	293	353	<1.9	1.3	<0.13	<10.3	3.0
Alma Offsite	03-May-23	W101		40261759004	818.83	7.49	8.7	561	288	285	<1.9	<1.2	<0.13	<10.3	2.8
Alma Offsite	06-Jun-23	W101		40263312004	818.76	7.50	10.9	570	291	343	5.6	<1.2	<0.13	<10.3	3.3
Alma Offsite	12-Jul-23	W101		40265136004	818.23	7.33	10.5	575	293	346	<1.9	<1.2	<0.13	<10.3	3.0
Alma Offsite	15-Aug-23	W101		40266836004	817.83	7.39	11.3	598	294	334	<1.9	<1.2	<0.13	<10.3	3.3
Alma Offsite	18-Sep-23	W101		40268395004	817.55	7.43	10.1	590	294	321	<1.9	1.2	<0.13	<10.3	3.4
Alma Offsite	26-Oct-22	W102R		40253880003	819.20	7.25	9.1	535	278	308	<1.9	<1.2	<0.13	<10.3	1.7
Alma Offsite	28-Nov-22	W102R		40255290003	819.15	7.38	8.7	537	277	307	<1.9	<1.2	<0.13	<10.3	1.7
Alma Offsite	27-Mar-23	W102R		40260038003	818.57	7.38	8.8	528	275	315	<1.9	<1.2	<0.13	<10.3	1.6
Alma Offsite	03-May-23	W102R		40261759003	819.40	7.44	9.0	517	276	264	<1.9	<1.2	<0.13	<10.3	1.6
Alma Offsite	06-Jun-23	W102R		40263312003	819.29	7.40	10.0	522	279	310	<1.9	<1.2	<0.13	<10.3	1.9
Alma Offsite	12-Jul-23	W102R		40265136003	818.80	7.16	9.8	525	280	301	<1.9	<1.2	<0.13	<10.3	1.8
Alma Offsite	15-Aug-23	W102R		40266836003	818.42	7.26	10.6	539	274	304	<1.9	<1.2	<0.13	<10.3	1.8
Alma Offsite	18-Sep-23	W102R		40268395003	818.16	7.40	9.9	526	277	291	<1.9	3.6	<0.13	<10.3	1.8
Alma Offsite	26-Oct-22	W105		40253880005	733.82	7.25	8.8	549	284	322	<1.9	<1.2	<0.13	<10.3	2.0
Alma Offsite	28-Nov-22	W105		40255290005	733.81	7.37	8.1	553	286	299	<1.9	<1.2	<0.13	<10.3	2.1
Alma Offsite	28-Mar-23	W105		40260038005	733.65	7.33	7.4	548	283	321	<1.9	<1.2	<0.13	<10.3	2.0
Alma Offsite	03-May-23	W105		40261759005	733.79	7.37	8.8	535	285	281	<1.9	<1.2	<0.13	<10.3	2.1
Alma Offsite	06-Jun-23	W105		40263312005	733.82	7.37	11.7	544	286	310	<1.9	<1.2	<0.13	<10.3	2.3
Alma Offsite	12-Jul-23	W105		40265136005	733.74	7.18	10.6	543	286	324	3.5	<1.2	<0.13	<10.3	2.2
Alma Offsite	15-Aug-23	W105		40266836005	733.69	7.38	9.7	560	282	333	<1.9	<1.2	<0.13	<10.3	2.2
Alma Offsite	18-Sep-23	W105		40268395005	733.63	7.31	12.4	550	280	303	<1.9	<1.2	<0.13	<10.3	2.3
Alma Offsite	26-Oct-22	W106		40253880006	773.92	7.26	9.2	601	293	354	<1.9	<1.2	<0.13	<10.3	3.6
Alma Offsite	28-Nov-22	W106		40255290006	773.95	7.40	8.3	602	293	328	<1.9	<1.2	<0.13	<10.3	3.7
Alma Offsite	28-Mar-23	W106		40260038006	773.77	7.41	7.7	598	290	350	<1.9	<1.2	<0.13	<10.3	3.6
Alma Offsite	03-May-23	W106		40261759006	773.89	7.44	10.1	583	294	306	<1.9	<1.2	<0.13	<10.3	3.6
Alma Offsite	06-Jun-23	W106		40263312006	773.91	7.44	12.6	592	293	366	<1.9	1.4	<0.13	<10.3	4.6
Alma Offsite	12-Jul-23	W106		40265136006	773.75	7.36	10.9	593	293	348	4.1	1.3	<0.13	<10.3	3.8
Alma Offsite	15-Aug-23	W106		40266836006	773.79	7.46	13.6	610	292	339	<1.9	<1.2	<0.13	<10.3	4.0
Alma Offsite	18-Sep-23	W106		40268395006	773.74	7.45	13.4	600	292	311	<1.9	<1.2	<0.13	12.50	4.1
Alma Offsite	26-Oct-22	W107		40253880007	832.59	7.16	9.5	669	307	373	<1.9	<1.2	<0.13	<10.3	6.0
Alma Offsite	28-Nov-22	W107		40255290007	832.58	7.32	8.9	673	312	358	<1.9	<1.2	<0.13	<10.3	6.0
Alma Offsite	27-Mar-23	W107		40260038007	832.39	7.38	7.9	661	305	394	<1.9	2.5	<0.13	<10.3	5.7
Alma Offsite	03-May-23	W107		40261759007	832.47	7.40	10.6	643	307	345	<1.9	<1.2	<0.13	<10.3	5.7
Alma Offsite	06-Jun-23	W107		40263312007	832.48	7.32	10.7	651	311	383	<1.9	<1.2	<0.13	<10.3	6.4
Alma Offsite	12-Jul-23	W107		40265136007	832.44	7.24	9.7	655	310	385	<1.9	<1.2	<0.13	<10.3	6.0
Alma Offsite	15-Aug-23	W107		40266836007	832.38	7.22	10.7	678	308	384	<1.9	2.1	<0.13	<10.3	6.2
Alma Offsite	18-Sep-23	W107		40268395007	832.53	7.11	10.0	661	307	362	<1.9	<1.2	<0.13	<10.3	6.3
Parameter #					04189	00400	00010	00094	00410	00900	01042	01055	01077	01092	00630
LOD									5.0	0.32	1.9	1.2	0.13	10.3	0.059
LOQ									10.0	1.7	6.4	4.0	0.50	34.4	0.25
Method #									SM 2320 B	6020B	6020B	6020B	6020B	6020B	353.2
Lab Cert. No									405132750	405132750	405132750	405132750	405132750	405132750	405132750

Attachment 10

Revised Environmental Sampling and Analysis Plan

Environmental Sampling and Analysis Plan

Alma Offsite Disposal Facility
Phase IV Landfill
Alma, Wisconsin

January 2023
Revised January 2024

Prepared For:

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

Prepared By:

TRC
999 Fourier Drive, Suite 101
Madison, Wisconsin 53717

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TABLES

FIGURES

ATTACHMENTS

Introduction

This Environmental Sampling and Analysis Plan (ESAP) describes the methods for monitoring site conditions and for sampling the monitoring devices at the Dairyland Power Cooperative (DPC) Phase IV disposal area. This ESAP has been prepared in accordance with the requirements of ss. NR 514.06(7)(a), NR 507.16, and NR 140.16. Samples will be collected and analyzed in accordance with this ESAP and with NR 507.17. A certified laboratory (NR 149) will perform chemical analyses following the approved methods listed in this ESAP. Figure 1 presents an 11 inch by 17-inch map showing monitoring locations. Attachment 1 includes a Well Information Form.

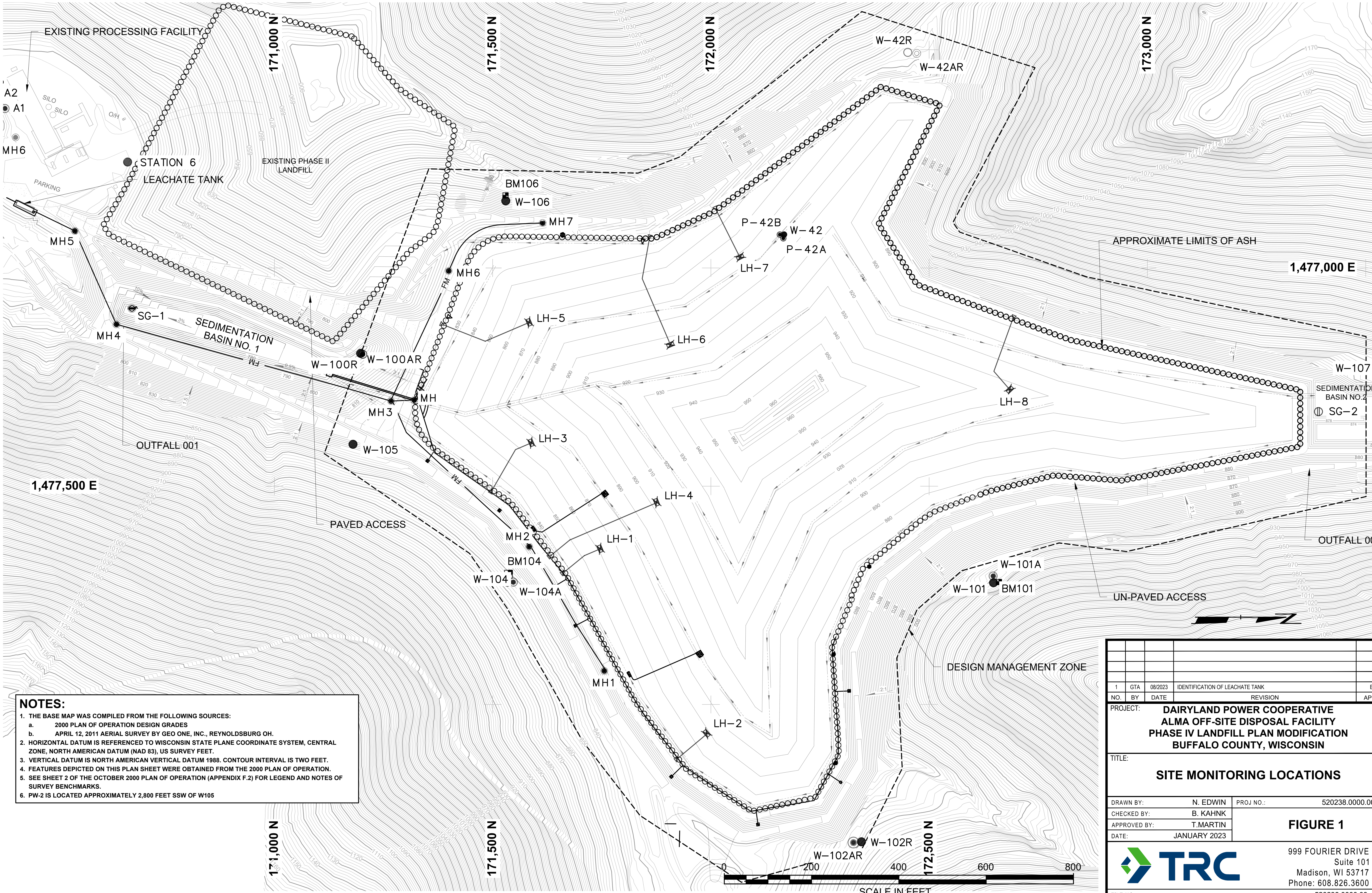
Three basic types of data will be collected during implementation of the ESAP as follows:

- Chemical data derived from samples collected from the various media
- Fluid levels
- Fluid extraction volumes

The environmental media to be monitored are as follows:

- Groundwater
- Surface water/Sedimentation basin outfalls
- Leachate

DPC sampling personnel will keep and use this ESAP as an independent document (separate from the Plan of Operation or its subsequent modifications). The sampling plan will be followed unless the Wisconsin Department of Natural Resources (WDNR) is notified of, and concurs with, modifications. Written documentation of the approved changes will be submitted to the WDNR.



NOTES:

1. THE BASE MAP WAS COMPILED FROM THE FOLLOWING SOURCES:
   a. 2000 PLAN OF OPERATION DESIGN GRADES
   b. APRIL 12, 2011 AERIAL SURVEY BY GEO ONE, INC., REYNOLDSBURG OH.
2. HORIZONTAL DATUM IS REFERENCED TO WISCONSIN STATE PLANE COORDINATE SYSTEM, CENTRAL ZONE, NORTH AMERICAN DATUM (NAD 83), US SURVEY FEET.
3. VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988. CONTOUR INTERVAL IS TWO FEET.
4. FEATURES DEPICTED ON THIS PLAN SHEET WERE OBTAINED FROM THE 2000 PLAN OF OPERATION.
5. SEE SHEET 2 OF THE OCTOBER 2000 PLAN OF OPERATION (APPENDIX F.2) FOR LEGEND AND NOTES OF SURVEY BENCHMARKS.
6. PW-2 IS LOCATED APPROXIMATELY 2,800 FEET SSW OF W105

NO.	BY	DATE	REVISION	APP'D.
1	GTA	08/2023	IDENTIFICATION OF LEACHATE TANK	BK

PROJECT: DAIRYLAND POWER COOPERATIVE
ALMA OFF-SITE DISPOSAL FACILITY
PHASE IV LANDFILL PLAN MODIFICATION
BUFFALO COUNTY, WISCONSIN

TITLE: SITE MONITORING LOCATIONS

DRAWN BY:	N. EDWIN	PROJ NO.:	520238.0000.0000
CHECKED BY:	B. KAHNK	FIGURE 1	
APPROVED BY:	T.MARTIN		
DATE:	JANUARY 2023		

TRC
999 FOURIER DRIVE
Suite 101
Madison, WI 53717
Phone: 608.826.3600

FILE NO.: 520238.0000.09.dwg

DRAWING NAME: \\madison-vfp\CADD\CADD\PJT\000\Dairyland Power\Alma\520238 - 2022 Annual Airspace\0000\520238.0000.09.dwg --- PLOT DATE: October 18, 2023 - 3:15PM --- LAYOUT: PLAN SHEET 2

Version: 2017-10-21

1.0 Landfill Monitoring Systems

The design of the DPC Phase IV disposal facility incorporates several different monitoring systems in accordance with ch. NR 507. The landfill monitoring systems are discussed in the following subsections. Specific procedures for purging, sampling, and quality assurance/quality control (QA/QC) are provided in other sections of this ESAP. The monitoring program is summarized in Table 1.

1.1 Detection Groundwater Monitoring

Detection groundwater monitoring will be conducted at the DPC Phase IV ash disposal facility in accordance with s. NR 507.19. Figure 1 shows the monitoring wells included in the detection groundwater monitoring program. The wells designated with no “A” or “B” suffix are water table wells. The monitoring wells with the “A” or “B” suffix are piezometers. Monitoring wells with an “R” suffix are replacement wells.

Groundwater beneath the site flows to the south. Therefore, monitoring wells completed to the northwest, north, and northeast of the Phase IV facility (W-42, P-42A, P-42B, W-107, W-101, W-101A, W-102R, and W-102AR) will function as upgradient monitoring points. Wells W-104, W-104A, W-105, W-100R, W-100AR, and W-106 are downgradient monitoring points. Seven of these wells (W-100AR, W-100R, W-101, W-102R, W-105, W-106, and W-107) are designated for the coal combustion residual (CCR) monitoring program under NR 507.15(3). The detection monitoring program includes wells completed in both the unconsolidated sand and silty sand and within the sandstone bedrock. A detailed description of geologic units can be found in the Feasibility Report (RMT, 1997).

Non-CCR wells will be sampled on a semiannual basis (in March and September) for the parameters listed in NR 507, Appendix I, Table 2 for solid waste landfills accepting fly or bottom ash. The CCR wells will be sampled on a semiannual basis (in March and September) for the parameters listed in ch. NR 507, Appendix I, Table 1A for CCR wells at CCR Landfills. Wells and parameters for detection monitoring are summarized in Table 1. Results will be reported in accordance with ch. NR 507 including submittal of sampling results and water elevation data within 60 days of the end of the sampling period per s. NR 507.26, and preparation of an annual groundwater monitoring and corrective action report for CCR wells in accordance with s. NR 507.15(3)(m).

1.2 Leachate Monitoring

Leachate collected at the leachate tank will be monitored on a semiannual (March/September) basis for the parameters listed in Table 1, which is consistent with ch. NR 507, Appendix I, Table 4 for landfills accepting fly ash or bottom ash. The leachate tank will be sampled annually for semivolatile organic compounds (ch. NR 507, Appendix IV).

DPC will maintain records of leachate pumped. Leachate analytical results, volumes, and elevations will be reported to the WDNR on a semiannual basis. Results will be reported in accordance with ch. NR 507.

Table 1: Environmental Monitoring Program
Dairyland Power Cooperative
Phase IV Ash Disposal Area

Sample Points	Frequency	Parameters
Groundwater		
Non-CCR Wells: W-42, P-42A, P-42B, W-101A, W-102AR, W-104, W-104A, PW-2	Semiannually (March, September)	NR 507, Appendix I, Table 2: Groundwater elevation, field temperature, field conductivity (at 25°C), field pH, alkalinity, dissolved boron, hardness, sulfate; plus dissolved selenium
CCR Wells: W-100R, W-100AR, W-101, W-102R, W-105, W-106, and W-107	Semiannually (March, September)	NR 507, Appendix I, Table 1A: Groundwater elevation, field temperature, field conductivity (at 25°C), field pH, alkalinity, total boron, calcium, chloride, fluoride, hardness, total dissolved solids (TDS), sulfate; plus dissolved selenium
Leachate		
Leachate tank	Semiannually (March, September)	BOD_5, field conductivity at 25°C, field pH, alkalinity, boron, cadmium, chloride, hardness, iron, lead, manganese, mercury, selenium, sulfate, total suspended solids, antimony, beryllium, cobalt, fluoride, lithium, molybdenum, Ra226 and Ra228 combined, thallium
	Annually	Semivolatile organic compounds (NR 507, Appendix IV)
Leachate collection tank	Monthly	Monthly volume records shall be maintained (reported semiannually)
Leachate head wells: LH-1, LH-2, LH-3, LH-4, LH-5, LH-6, LH-7, LH-8	Monthly	Leachate level elevation during operation (reported semiannually)
Surface Water		
Staff gauges: SG-1, SG-2	Semiannually (March, September)	Surface water elevation
Outfall 001, Outfall 002	Semiannually (March, September), if water is present	Visual turbidity, field temperature, field conductivity at 25°C, alkalinity, boron, field pH, hardness, selenium, sulfate

Prepared by: COB, 7/00
Checked by: CCS, 9/19/00
Updated by: S. Sellwood, 12/21/2022

1.3 Surface Water Monitoring

Two sedimentation basins are proposed to be constructed at the Phase IV facility, with Sedimentation Basin 1 currently constructed as of January 2023. Surface water in the sedimentation basins will be sampled in accordance with the requirements set forth in s. NR 507.23 and s. 507.26(3) and analyzed for the parameters listed in Table 1 when water is present at the outfall during a scheduled semiannual sampling event. Surface water monitoring procedures are discussed in Subsection 3.2. Results will be reported in accordance with ch. NR 507.

1.4 Settlement Monitoring

Because fly ash and bottom ash, which are disposed after adding moisture, do not experience significant settlement following placement, no settlement monitoring is planned for the Phase IV disposal area. Annual airspace surveys are conducted.

2.0 Baseline Groundwater Sampling

Baseline groundwater quality was established for monitoring wells at the Phase IV facility and presented in the Plan of Operation (RMT, 2000). Preventive action limits (PALs) and alternative concentration limits (ACLs) were subsequently proposed for replacement monitoring wells in May 2006 (RMT, 2006). PALs for indicator parameters and ACLs were included in the Conditional Plan of Operation Approval (WDNR, 2001) and a WDNR approval letter dated September 22, 2006 (WDNR, 2006).

Additional baseline groundwater monitoring for the seven CCR monitoring wells was conducted between September 2015 and June 2017. Baseline monitoring in 2015 through 2017 included parameters listed in ch. NR 507 Appendix I, Tables 1A and 3, except for alkalinity, hardness, nitrate+nitrite-N, copper, manganese, silver, zinc, field conductivity, and field temperature. Baseline groundwater monitoring for alkalinity, hardness, nitrate+nitrite-N, copper, manganese, silver, zinc, field conductivity, and field temperature in the CCR wells was completed from October 2022 to September 2023. ACLs and PALs calculated using baseline groundwater data have been submitted to the WDNR for review. Metals concentrations in CCR wells are measured as total recoverable metals (i.e., samples for metals are not field-filtered).

Baseline groundwater quality will be established at new or replacement wells in accordance with ss. NR 507.18(4) and (5), unless the requirement for baseline groundwater quality is waived by the WDNR.

3.0 Sample Collection

This section presents specific written procedures for collecting groundwater, surface water, and leachate samples. It includes details on taking field measurements, purging monitoring wells, and obtaining samples in accordance with ss. NR 507.16(1)(c)(d) and (e). Samples will be collected during the months of March and September. The wells will generally be sampled from upgradient to downgradient. If wells are determined to be impacted by regulated or other activities, impacted wells shall be sampled after unimpacted wells have been sampled. If more than one well is determined to have detections of a given substance, the order of sampling of impacted wells will be from the well with the lowest concentration of contaminant to the well with the highest concentration of contaminant.

3.1 Field Procedures for Groundwater Sampling

Figure 1 shows groundwater sample locations, sampling frequencies, and parameters.

3.1.1 Groundwater Monitoring Well Maintenance

In order to assess problems and possible damage to the monitoring wells, field technicians will visually inspect wells at the time of sampling. Wells will be inspected for the following items:

- Protective casing condition
- Protective casing cap condition
- Casing lock condition
- Well cap condition
- Concrete seal condition
- Visual damage to well

DPC field technicians will provide a written inspection report if repair action is needed.

3.1.2 Static Water Level Measurement

Static water levels will be measured in each well prior to purging each time groundwater is sampled. All groundwater level measurements will be made using a reference point established on the well casing. The reference point will be the highest point of the PVC well casing. A battery-operated water level indicator will be the primary device for water level measurements. The indicator is a self-contained transistorized instrument equipped with a cable and sensor that activates a buzzer and a light when it contacts the water. The depth to water is read from permanent 0.01-foot increment markings on the cable.

In case of instrument failure, depth to groundwater will be measured by a plopper tape that is a bell- or cup-shaped weight attached to a nylon-coated stainless-steel measuring tape. When lowered into the well, a “plopping” or “popping” sound is made when the weight strikes the surface of the water. An accurate reading can be determined by lifting and lowering the weight in short strokes, and reading the tape when the weight just strikes the water. Depth to water will be recorded to the nearest 0.01 foot.

In order to prevent cross-contamination between wells, the water level measuring device will be decontaminated between each well by rinsing first with a soapy water solution and then with distilled water.

In accordance with s. NR 507.15(3)(h), groundwater elevations in wells that monitor the same CCR landfill will be measured within a timeframe short enough to avoid temporal variations in groundwater flow that could preclude accurate determination of groundwater flow rate and direction.

3.1.3 Purging of Wells

The monitoring wells will be purged by removing stagnant water so that the samples collected are fresh formation water. Purging will be accomplished using a QED® MicroPurge pump and controller or similar submersible pump and a YSI® Pro DSS or equivalent multiparameter meter equipped with a flow-through cell. Wells will be purged at a rate of less than a half-liter per minute. Purging will continue until stable conditions are reached, as shown by three consecutive readings taken 2 minutes apart, for the following parameters:

- Dissolved oxygen (± 0.2 mg/L)
- pH (± 0.1 pH unit)
- Conductivity (± 10 percent)
- Temperature (± 0.1°C)

Purging and sampling data will be recorded on a groundwater sampling form (Attachment 2). In accordance with s. NR 507.26, DPC will inform the department of any CCR well that purges dry, is damaged or obstructed, or in any way is rendered such that a sample is unable to be collected from the well during a scheduled sampling event. In such case, DPC will propose actions to correct the problem prior to the next sampling event.

3.1.4 Sampling and Data Collection at Each Well

Samples will be collected immediately after purging. If the well is purged dry, then the sample will be collected when the well has sufficiently recovered (approximately 4 hours). The flow rate during sampling will be the same or less than the flow rate used while purging. Purging and sampling flow rates should be one half-liter per minute or less. The procedure for sampling the monitoring wells is as follows:

- Prepare bottles by labeling with the well number, the date, the name of the sampler, and the time of day at which the sample is collected.
- Collect samples using the QED® MicroPurge pump and controller or equivalent.
- Collect samples for field measurements.
- Fill unfiltered bottles first.
- After filling unfiltered bottles, collect samples to be filtered, if any, using the filtering device.

A log of meter calibrations and checks will be maintained during each sampling event. The volume of sample water required will be based on the sample bottles provided by the lab (i.e., fill the bottles provided), and is anticipated to be approximately one-half liter per well.

3.1.5 Field-filtering

Samples from the CCR wells collected to meet the requirements of the CCR program will not be field-filtered. If field-filtering is required for samples from non-CCR wells or non-CCR parameters at CCR wells, it will be performed using a 0.45 micron in-line filter attached to the sampling pump discharge.

3.1.6 Equipment Cleaning Procedure Between Sampling Events

All equipment used for sampling that is not dedicated or discarded after use (meters, flow cell, and water level measuring devices, etc.) is decontaminated after the sampling event using the following methods:

- Prepare a soapy water bath using laboratory-grade detergent (Alconox).
- Unwind water level measuring devices, soak in soapy water, and wipe clean with a cloth.
- Rinse all equipment with deionized water (ASTM Type II).
- Dry equipment.
- Seal dry equipment in polypropylene plastic to prevent contamination.

3.1.7 Equipment Cleaning Procedure Between Monitoring Wells

The procedure to be followed for cleaning water level indicators and nylon-clad steel tapes in the field between wells is as follows:

- Rinse equipment with soapy water.
- Rinse equipment with deionized water (ASTM Type II).

If non-dedicated purging equipment is used during a sampling event, the non-dedicated purging equipment will be cleaned between wells as described above.

3.1.8 Sample Preservation Methods

The preservation methods for the parameters to be analyzed are listed in Table 2 below. Each of the bottles will contain a premeasured volume of preservative, as needed.

Samples will be analyzed at a laboratory certified in Wisconsin in accordance with ch. NR 149.

3.1.9 Chain-of-Custody Guidelines

A Chain-of-Custody Record provides a written record of sample bottle possession and transference. The guidelines for the Chain-of-Custody Record to be used by sampling and laboratory personnel to ensure proper tracking are outlined below. An example of a typical Chain-of-Custody Record is included as Attachment 3.

Table 2: Sample Preservation and Analysis Methods

Parameter	Bottle Material	Preservative	Holding Time	Laboratory Methods
Groundwater, Surface Water, and Leachate				
Alkalinity	Polyethylene	None	14 days	SM 2320B
Chloride, fluoride, and sulfate	Polyethylene	None	28 days	EPA 300.0
Boron and calcium	Polyethylene	Nitric acid	6 months	6020B/6010D
Hardness	Polyethylene	Nitric acid	6 months	6020B/6010D/ SM 2340B
Selenium	Polyethylene	Nitric acid	6 months	6020B
Total dissolved solids (TDS)	Polyethylene	None	7 days	SM 2540C
Leachate Only				
BOD5	Polyethylene	None	48 hours	SM 5210B
Total suspended solids (TSS)	Polyethylene	None	7 days	SM 2540D
Cadmium, antimony, and thallium	Polyethylene	Nitric acid	6 months	6020B
Iron, lead, manganese, beryllium, cobalt, lithium, and molybdenum	Polyethylene	Nitric acid	6 months	6020B/6010D
Mercury	Polyethylene	Nitric acid	28 days	7470/1631E
Radium226 + Radium228	Polyethylene	None/Nitric acid	5 days/ 6 months	903.1, 904.0
Semivolatile organic compounds	Glass	None	7 days	EPA 8270E

3.1.10 Sample Shipment Methods

3.1.10.1 Time Period

At the completion of the sampling event, DPC personnel will ship samples to the laboratory via commercial shipping service or courier. Sample shipping will be coordinated to ensure that holding times (Table 2) of the analyses are met.

3.1.10.2 Handling

1. Samples will be iced to 4°C and contained in coolers for transport to the laboratory as soon as possible.
2. Transport will be by commercial shipping service or courier service.
3. Samples will be transported in coolers.
4. Sample packaging will include the following:
   - Fill the cooler with ice.
   - Tape the drain on the cooler shut, and wrap the cooler completely with tape in two locations.
   - Place address labels on the cooler.

3.1.10.3 Sample Bottle Labels

Each sample bottle will be labeled so that the analytical laboratory has the following information:

- Collector's name or initials
- Sample date and time
- Sample source/identification
- Sample preservatives
- Whether or not the sample was field-filtered

All labels are color-coded to indicate the type of preservative in the bottle (e.g., red - nitric acid, yellow - sulfuric acid, white - no preservative).

3.1.10.4 Transport Container Labels

Labels for the transport containers will be addressed to the selected laboratory.

3.2 Surface Water Sampling Field Procedures

3.2.1 Static Water Level Measurement

Static water levels will be measured at each sampling point by reading the staff gauge to the nearest 0.05 foot. Surface water sampling points are shown on Figure 1.

3.2.2 Sampling and Data Collection

Surface water samples will be collected with a clean, stainless-steel ladle near the outlet of the sedimentation basins with the opening facing upstream (flowing condition). All bottles will be filled prior to taking a sample for performing field measurements. Field measurements will be performed with the YSI® Pro DSS or equivalent measuring equipment. Surface water samples will not be filtered.

3.2.3 Sample Preservation

The preservation methods for the parameters to be analyzed are identical to those for groundwater samples (see Table 2).

3.2.4 Chain-of-Custody Guidelines

The chain-of-custody procedures are identical to those for groundwater samples (see Subsection 3.1.9).

3.2.5 Sample Shipment Method

The sample shipment method for surface water samples is identical to that described for groundwater samples (see Subsection 3.1.10).

3.3 Leachate Monitoring

Leachate levels will be measured monthly at the leachate head wells, and leachate samples will be collected semiannually at the leachate tank. Leachate head will be measured in the leachate head wells using a water level indicator tape. Leachate head measurements will be referenced to mean sea level. Leachate samples will be obtained from the leachate tank using a dedicated bailer or from the leachate tanker truck outflow. The leachate tank will not be purged prior to obtaining samples. The samples will be handled and analyzed as described for groundwater samples. Leachate samples will not be filtered. Collected leachate volumes will be recorded monthly using flow meters. The volume of leachate that is used for dust control will be recorded separately.

3.4 Air Monitoring

In accordance with communication with the WDNR, no air monitoring is required for this site (see Subsection 3.15 of the October 2000 POO).

4.0 Quality Assurance/Quality Control Procedures (QA/QC)

Field QA/QC samples are used to evaluate two primary areas of quality control. Sample contamination that may occur in the field and/or during shipping is monitored in the trip blank(s) and the equipment or rinsate blank(s). Field duplicate samples and matrix spike/matrix spike duplicate samples are used to evaluate precision and bias of the sampling and analytical procedures. A general description of each of these follows.

4.1 Trip Blanks

Trip blank samples are prepared in the laboratory by filling the appropriate clean sample container(s) with reagent-grade water and adding any applicable chemical preservative. The containers are labeled “Trip Blank.” Trip blanks are shipped from the laboratory in the cooler to the field and back to the laboratory along with the other samples for that parameter for a given sampling event. The trip blanks are analyzed to identify contamination that may occur from the containers, coolers, cleaning procedures, or chemical preservatives used. Trip blanks are used and analyzed at a frequency of at least one for each sampling event that includes analysis of samples for VOCs. Because VOCs are not part of the analytical program, trip blanks will not be analyzed.

4.2 Equipment (Rinsate) Blank

Equipment or rinsate blanks are prepared in the field immediately following decontamination of nondedicated field equipment used for purging or sampling. Following decontamination, reagent-grade water is passed through the equipment using the same procedures followed in collecting a groundwater sample. The equipment blank water is then collected into laboratory supplied sample bottles and analyzed for the same parameters as the groundwater samples. The equipment blank confirms proper field decontamination procedures. Therefore, one equipment blank will be collected in association with each surface water sampling event, and one equipment blank will be collected in association with each groundwater sampling event if non-dedicated and/or non-disposal field sampling equipment is used. Sampling typically utilizes dedicated and disposable equipment; therefore, equipment blanks will not typically be collected.

4.3 Field Duplicate

Field duplicate samples are an extra set of samples collected at a routine monitoring point and labeled as “Duplicate.” These are two separate samples collected from the same source, stored in separate containers, and analyzed independently. The samples shall be collected in proper alternating order for the sample point and field duplicate for each parameter (e.g., first collect metals sample, then duplicate metals sample, and so on). Field duplicates document the precision of the sampling and analytical process. Field duplicates may be collected, and analyzed semiannually if data discrepancies or QA/QC issues are occurring.

4.4 Matrix Spike / Matrix Spike Duplicate

Matrix spike and matrix spike duplicate (MS/MSD) samples are used to evaluate the precision and bias of a method in a given sample matrix. To conduct a matrix spike analysis, a known amount of a target analyte is added to a sample at the laboratory prior to sample preparation and analysis. The matrix spike is then split to create duplicate samples spiked with identical concentrations of target analytes. The laboratory performs MS/MSD analysis for batches of analyzed samples. Site-specific MS/MSD samples will not be collected unless requested by the laboratory.

5.0 Record Keeping

5.1 Field Logs

Field notes must be completely and accurately prepared to become a part of the final report for a monitoring event. Field information will be recorded on groundwater sampling forms (Attachment 2) or equivalent. Field logs will be available to the WDNR upon request.

5.2 Chain-of-Custody Procedures

Proper chain-of-custody procedures are necessary to document the integrity of the samples and the condition of the samples upon receipt at the laboratory. The sample collector will fill in all applicable sections of the Chain-of-Custody Record and forward the original, along with the respective sample(s), to the laboratory. Upon receipt at the laboratory, the DPC sampling coordinator will complete the Chain-of-Custody Record, make a copy for his/her records, and make the original form a part of the final analytical report.

5.3 Labeling

Sample containers will be labeled to prevent misidentification. The following will be recorded on an adhesive label on each sample container. Data will be recorded using a waterproof pen:

- Collector's name or initials
- Sample date and time
- Sample source/identification
- Sample preservatives
- Whether or not the sample was field-filtered

6.0 Sampling, Analysis, and Laboratory Requirements

Samples will be obtained and analyzed in accordance with the approved sampling plan and with the requirements of NR 507.17. Sampling methods are further described in Section 3. All chemical analyses will be conducted by a laboratory certified under s. 144.95, Stats., and NR 149 for that test category, in accordance with NR 507.17(5). Samples will be analyzed for the parameters listed in Table 1.

7.0 Reporting

The results of environmental monitoring will be submitted to the WDNR within 60 days of the end of the sampling period, in accordance with NR 507. Sampling data will be submitted in an electronic format, and will include the information required by NR 507.26(3)(b). The WDNR will be notified of values that have attained or exceeded the groundwater standards, in accordance with NR 507.30. The owner or operator of the CCR landfill shall determine the rate and direction of groundwater flow each time groundwater is sampled and include the results in the report to the WDNR within 60 days of the end of the sampling period.

In addition, an annual groundwater monitoring and corrective action report in accordance with NR 507.15(3)(m) will be prepared and submitted by January 31 of the year following the calendar year in which the groundwater monitoring system is approved by the department, and annually thereafter. The annual groundwater monitoring and corrective action report will be placed in the written operating record and posted on a publicly accessible internet site in accordance with NR 506.17 (2) and (3). In accordance with NR 507.15(3)(m) the annual groundwater monitoring and corrective action report will document the status of the groundwater monitoring and any corrective action implemented at the CCR landfill, summarize key actions completed, describe any problems encountered, discuss actions to resolve the problems, and project key activities for the upcoming year. The report will include, at a minimum, the information specified in NR 507.15(3)(m)1. through 5.

8.0 Groundwater Standards

8.1 Calculation of Groundwater Standards

The site-specific Preventive Action Limits (PALs) and Alternative Concentration Limits (ACLs) have been calculated or will be calculated following completion of remaining baseline sampling. PALs and ACLs were computed in accordance with NR 507.27. PALs and ACLs for any replacement wells will be established following the first eight rounds of detection monitoring after installation.

8.2 Evaluation of Groundwater Standard Exceedances

Exceedances of PALs and ACLs will be determined in accordance with NR 507.28. If a false reading is suspected, the WDNR will be notified of the intent to either begin assessment monitoring or determine that a false exceedance has occurred. The statement of intent will be submitted with the notification required in NR 507.30(1). The written demonstration of false exceedance will be included with the next monitoring round.

8.3 Exemptions to Groundwater Standards

Any groundwater exemption requests will be made in accordance with NR 507.29, NR 140.28, and NR 500.08(4). Exemption requests will be made in writing to the WDNR. Requests will include a list of the specific wells and parameters for which an exemption is being requested, proposed ACLs, calculations in accordance with NR 507.27, and a discussion of how the criteria listed in NR 140.28(2), (3), or (4) are met.

8.4 Notification and Response to Attainment or Exceedance of Standards

In accordance with NR 507.30, the WDNR will be notified in writing if any groundwater monitoring well value exceeds or attains a groundwater standard. Per NR 507.15(3)(L)(4), the horizontal distance for the design management zone for a CCR landfill is zero feet from the waste boundary and may not be expanded by the department. The waste boundary includes the horizontal space taken up by any liner, dike, or barrier designed to contain CCR waste. Therefore, the point of standards application to determine if a value exceeds or attains a standard is any point where groundwater is monitored.

The notification will specify the parameters for which standards have been attained or exceeded and the well(s) at which the standard was attained or exceeded. The written notification will provide a preliminary analysis of the cause and significance of each concentration in accordance with NR 140.24(1)(a) or NR 140.26(1)(a). The sampling results and two copies of the notification will be submitted to the WDNR within 60 days from the end of the sampling period.

Responses to groundwater exceedances will be in accordance with NR 508, including establishment of an assessment monitoring program in accordance with NR 508.06 unless the exceedance is determined by the WDNR to be from a source other than the CCR landfill, the result of a sampling error, or natural variation.

9.0 References

RMT, Inc. 1997. Feasibility Report – Dairyland Power Cooperative Phase IV Disposal Area Alma Off-Site Ash Disposal Facility. September 1997.

RMT, Inc. 2000. Plan of Operation – Dairyland Power Cooperative, Phase IV Disposal Area, Alma Off-Site Ash Disposal Facility. October 2000.

RMT, Inc. 2006. Proposed PALs and ACL Values for wells W100AR, W100R, W102AR and W102R, Dairyland Power Cooperative, Phase IV Disposal Area, Alma Off-Site Ash Disposal Facility. May 2006.

WDNR. 2001. Conditional Plan of Operation Approval for Dairyland Power Cooperative Phase IV Disposal Area, Alma Off-Site Ash Disposal Facility, Town of Belvidere, Buffalo County, License #4126. May 2001.

WDNR. 2006. WDNR Approval of proposed PAL/ACL calculations for the Dairyland Power Cooperative Phase IV Ash Disposal Facility, Town of Belvidere, Buffalo County Wisconsin, License No. 4126. September 2006.

Attachment 1: Well Information Form

State of Wisconsin
Department of Natural Resources

GROUNDWATER WELL INFORMATION FORM
Chapter 281 and 289, Wis. Stats.
Form 4400-89 Rev. 7-98

Facility Name	Facility ID Number	License, Permit or Monitoring No.	Date	Completed By (Name and Firm)
Dairyland Power Cooperative	606009360	4126	21-Aug-00	Craig Bartholomew, 8/00; QC'd by Rob Hafemeister, 8/00; updated by Mike Dickey 6/13/01

WI Unique Well	Well Name	DNR Well ID Numbe	Well Location	Dir. N/E	Dir. S/W	Date Establishe	Well Casing Diam.	Well Casing Type	Elevation Top of Well Casing	Elevation Ground Surface	Reference MSL (√)	Reference Site Datum (√)	Depths Screen Top (bgs)	Depths Initial Groundwater (btoc)	Depths Well Depth (bgs)	Screen Length	Well Type	Well Status	Enf. Stds.	Grad-ient	Distance to Waste
	Station 1	001	171440	X		8/24/81	4	PVC	837.22	835.7	X		34	31.6	44	10	OW	Aband	Y	U	Within[1]
			1508460	X																	
	Station 2	002	170730	X		9/18/81	4	PVC	827.12	825.6	X		37	34.1	47	10	OW	Aband	Y	U	Within[1]
			1508940	X																	
	W42	017	172168.72	X		10/19/94	2	PVC	837.93	836.0	X		46.5	51.5	56.5	10	OW		Y	S	Within[1]
			1476924.64	X																	
	P42A	018	172166.81	X		9/10/79	2	PVC	838.90	835.3	X		64.9	51.4	69.9	5	PZ		Y	S	Within[1]
			1476933.9	X																	
	P42B	019	172159.42	X		9/11/79	2	PVC	838.30	835.1	X		81.8	51.4	84.8	3	PZ		Y	S	Within[1]
			1476925.25	X																	
	W43	020	171828.38	X		8/29/79	2	PVC	817.70	814.7	X		54	42.8	64	10	OW	Aband	Y	D	Within[1]
			1477672.25	X																	
	W100	021	171345.3	X		10/25/94	2	PVC	794.52	792.2	X		60.5	65.3	70.5	10	OW	Aband	Y	D	20' S
			1477166.2	X																	
	W101	023	172654.5	X		11/2/94	2	PVC	925.83	923.2	X		107	112.5	122	15	OW		Y	U	200' NE
			1477721	X																	
	W101A	024	172652	X		10/27/95	2	PVC	925.53	923.1	X		146	112.5	151.0	5	PZ		Y	U	190' NE
			1477729	X																	
	W102	025	172046.6	X		10/18/94	2	PVC	838.02	836.1	X		25	30.2	35	10	OW	Aband	Y	S	Within[1]
			1478190.2	X																	
	W102A	026	172041.8	X		10/18/96	2	PVC	837.45	835.7	X		50	30.4	55	5	PZ	Aband	Y	S	Within[1]
			1478191.2	X																	

Location Coordinates Are:
- ☑ State Plane Coordinate
  - ☑ Northern
  - ☐ Central
  - ☐ Southern
- ☐ Local Grid System

Grid Origin Location: (Check if estimated: __)
Lat. ____ ° _____' ________" Long. ____ ° _____' ____ __" or
St. Plane ____________ ft. N. ___________ ft. E. S/C/N Zone

Remarks:
bgs = below ground surface; btoc = below top of casing.
(1) To be abandoned during landfill construction - spring 2000.

State of Wisconsin
Department of Natural Resources

GROUNDWATER WELL INFORMATION FORM
Chapter 281 and 289, Wis. Stats.
Form 4400-89 Rev. 7-98

Facility Name	Facility ID Number	License, Permit or Monitoring No.	Date	Completed By (Name and Firm)
Dairyland Power Cooperative	606009360	4126	21-Aug-00	Dan Reid - RMT, Inc.; updated by Craig Bartholomew, 8/00; QC'd by Rob Hafemeister, 8/00

WI Unique Well No.	Well Name	DNR Well ID Number	Well Location	Dir. N E	Dir. S W	Date Established	Well Casing Diam.	Well Casing Type	Elevation Top of Well Casing	Elevation Ground Surface	Reference MSL (√)	Reference Site Datum (√)	Depths Screen Top (bgs)	Depths Initial Groundwater (btoc)	Depths Well Depth (bgs)	Screen Length	Well Type	Well Status	Enf. Stds.	Grad-ient	Distance to Waste
	W100A	022	171357	X		10/27/95	2	PVC	795.31	792.9	X		95	82.9	100	5	PZ	Aband	Y	D	18' S
			1477172	X																	
	W104	027	171542	X		11/14/95	2	PVC	845.79	843.3	X		75	87.2	90	15	OW		Y	S/U	120' SE
			1477713	X																	
	W104A	028	171546	X		11/13/95	2	PVC	845.14	843.1	X		109	100.25	114	5	PZ		Y	S/U	110' SE
			1477718	X																	
	W105	029	171180	X		11/3/95	2	PVC	821.21	818.3	X		79	88.45	94	15	OW		Y	S/U	127' SE
			1477404	X																	
	W106	030	171530	X		11/7/95	2	PVC	850.84	848.3	X		72	79.5	82	10	OW		Y	S/U	80' W
			1476837	X																	
	W107	031	173527.44	X		5/1/97	2	PVC	908.29	906.2	X		69	77.4	84	15	OW		Y	U	190' N
			1477214.99	X																	
	PW01	032	170430	X		8/24/81	10	STL						67	410	NA	Water Supply	Aband	Y	D	260' SE
			1477100	X																	
JQ894	W100R	40	171197.15	X		5/17/01	2	PVC	784.38	781.4	X				75	15	OW		Y	D	135' NE
			1477195.77	X																	
JQ893	W100AR	42	171202.48	X		5/17/01	2	PVC	784.79	781.4	X				92	10	PZ		Y	D	135' NE
			1477198.28	X																	
SQ892	W102R	44	172319.04	X		5/17/01	2	PVC	876.1	873.1	X				78	5	OW		Y	U	90' W
			1478318.01	X																	
SQ891	W102AR	46	172320.77	X		5/17/01	2	PVC	876.1	873.1	X				98	10	PZ		Y	U	90' W
			1478313.97	X																	

Location Coordinates Are:

☑ State Plane Coordinate ☐ Local Grid System

☑ Northern
☐ Central
☐ Southern

Grid Origin Location: (Check if estimated: __)

Lat. ____ ° _____' ________" Long. ____ ° _____' ____ __" or

St. Plane _____________ ft. N. ____________ ft. E. S/C/N Zone

Remarks:

bgs = below ground surface; btoc = below top of casing.

Completion of this form is mandatory under s. NR 507.14 and NR 110.25 Wis. Adm. Code. Failure to file this form may result in forfeiture of not less than $10 nor more than $5,000 for each day of violation. Personally identifiable information provided is intended to be used by the Department for the purposes related to the waste management program.

Attachment 2: Example Groundwater Sampling Form

LOW-FLOW GROUNDWATER SAMPLING RECORD

Well Name W106
Page 1 of

PROJECT : DAIRYLAND POWER COOPERATIVE	DNR WELL ID No: 30	DATE:
LOCATION: Alma Offsite 04126	WUWN:	WEATHER:
FIELD MONITOR DEVICE: YSI ProDSS	PUMP DEVICE: Dedicated Pump	TEMPERATURE:
WELL I.D. (in.): 2-inch	SCREEN LENGTH: 10	FIELD REPS:
WATER LEVEL:	MEASURING POINT: Top of PVC Casing	PUMP INTAKE DEPTH: 62
WELL DEPTH (Log): 64.7		Duplicate: W106

TIME (24 HR)	DEPTH (ft)	TEMP (°c)	*DO (mg/L)	COND. (µS/cm)	pH	ORP (mV)	**TURB (NTU)	DRAW DOWN (ft)	FLOW RATE	REMARKS
Stabilized within >		N/A	[+/- 10%]	[+/- 3%]	[+/- 0.1]	[+/- 10]	[+/- 10%]	[+/- 0.3]	<700mL/min	(Color, odor, comments)
			[if > .5 mg/l]				[if > 5 NTU]			

NOTES:

2/43 200 Historical Ranges: pH: 7.15 - 7.65 Cond: 560 - 570

* If three DO readings are < 0.5 mg/l, consider value stabilzed ** If three turbidity values are less than 5 NTU, consider values as stablized

[well volume = 3.14 (PI) * radius^2 * height of water column] → 2 in well = 0.163 gal/ft 4 in = 0.653 gal/ft 6 in = 1.469 gal/ft 1 ft^3 = 7.48 gal 1 gal = 3.785 L 1L = 0.264 gal 0.5L/min = 0.132 gal/min

Attachment 3: Example Chain of Custody Record

CHAIN-OF-CUSTODY Analytical Request Document

Pace Analytical®

Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard-terms.pdf

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevant fields

LAB USE ONLY- Affix Workorder/Login Label Here or List Pace Workorder Number or MTJL Log-in Number Here

ALL BOLD OUTLINED AREAS are for LAB USE ONLY

Company: Dairyland Power Cooperative

Billing Information: APInvoices@DairylandPower.com

Address: 3251 East Ave. South, LaCrosse, WI 54601

Report To: Tad.Schwartzhoff@DairylandPower.com

Email To:

Copy To:

Site Collection Info/Address: Alma Off Site

Customer Project Name: ALMA OFF-SITE GROUNDWATER

State: WI

County/City: /

Time Zone Collected: [ ]PT [ ]MT [X]CT [ ]ET

Phone: 608-787-1441

Email:

Site/Facility ID #: Alma Off-Site

Compliance Monitoring? [X] Yes [ ] No

Collected By (print): Tad Schwartzhoff/Brian Kalvelage

Purchase Order # :

Quote #:

DW PWS ID #:

DW Location Code:

Collected By (signature):

Turnaround Date Required: Standard

Immediately Packed on Ice: [X] Yes [ ] No

Sample Disposal:
[X] Dispose as appropriate
[ ] Return
[ ] Archive: ______________
[ ] Hold: ________________

Rush: (Expedite Charges Apply)
[ ] Same Day [ ] Next Day
[ ] 2 Day [ ] 3 Day
[ ] 4 Day [ ] 5 Day

Field Filtered (if applicable): [ ] Yes **[X] No**

Analysis: All

Container Preservative Type **

U	2	1	1	1	1	1			

Lab Project Manager:

** Preservative Types: (1) nitric acid, (2) sulfuric acid, (3) hydrochloric acid, (4) sodium hydroxide, (5) zinc acetate, (6) methanol, (7) sodium bisulfate, (8) sodium thiosulfate, (9) hexane, (A) ascorbic acid, (B) ammonium sulfate, (C) ammonium hydroxide, (D) TSP, (U) Unpreserved, (O) Other ______________

Analyses

Lab Profile/Line:

Lab Sample Receipt Checklist:
Custody Seals Present/Intact Y N NA
Custody Signatures Present Y N NA
Collector Signature Present Y N NA
Bottles Intact Y N NA
Correct Bottles Y N NA
Sufficient Volume Y N NA
Samples Received on Ice Y N NA
VOA - Headspace Acceptable Y N NA
USDA Regulated Soils Y N NA
Samples in Holding Time Y N NA
Residual Chlorine Present Y N NA
Cl Strips: ___________________
Sample pH Acceptable Y N NA
pH Strips: ___________________
Sulfide Present Y N NA
Lead Acetate Strips: __________

LAB USE ONLY:
Lab Sample # / Comments:

* Matrix Codes (Insert in Matrix box below): Drinking Water (DW), Ground Water (GW), Wastewater (WW), Product (P), Soil/Solid (SL), Oil (OL), Wipe (WP), Air (AR), Tissue (TS), Bioassay (B), Vapor (V), Other (OT)

Customer Sample ID	Matrix *	Comp / Grab	Collected (or Composite Start) Date	Collected (or Composite Start) Time	Composite End Date	Composite End Time	Res Cl	# of Ctns	Container Type: Plastic (P) or Glass (G)
	GW	Grab							
	GW	Grab							
	GW	Grab							
	GW	Grab							
	GW	Grab							
	GW	Grab							
	GW	Grab							
	GW	Grab							

Customer Remarks / Special Conditions / Possible Hazards:

Type of Ice Used: Wet Blue Dry None

SHORT HOLDS PRESENT (<72 hours) : Y N N/A

Packing Material Used:

Lab Tracking #:

Radchem sample(s) screened (<500 cpm): Y N NA

Samples received via: FEDEX UPS Client Courier Pace Courier

LAB Sample Temperature Info:
Temp Blank Received: Y N NA
Therm ID#: ___________
Cooler 1 Temp Upon Receipt: __oC
Cooler 1 Therm Corr. Factor:___oC
Cooler 1 Corrected Temp: _____oC
Comments:

Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:

MTJL LAB USE ONLY
Table #:
Acctnum:
Template:
Prelogin:
PM:
PB:

Trip Blank Received: Y N NA
HCL MeOH TSP Other

Non Conformance(s): YES / NO

Page: 1 of: 1

Attachment 11

Additional Information for s. NR 514.045(c) Demonstration

Appendix E
Soil Boring Logs and Monitoring Well Information and Photographs of Abandonments

New Boring Logs

State of Wisconsin
Department of Natural Resources

Route To:
☒ Solid Waste
☐ Emergency Response
☐ Wastewater
☐ Haz. Waste
☐ Underground Tanks
☐ Water Resources
☐ Other

Soil Boring Log Information
Form 4400-122 7-91

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Dairyland Power 3081.23	2927	B60

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Boart Longyear, Crew Chief: Eric Shoenberg	10/31/95	10/31/95	4 1/4" HSA

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			Feet MSL	854.4 Feet MSL	8.0 Inches

Boring Location
State Plane 172243.00 N, 1478204.00 E
NE 1/4 of NE 1/4 of Section 19 T 21 N,R 12W
Lat ° ' "
Long ° ' "
Local Grid Location (If applicable)
Feet ☐ N ☐ S Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
Buffalo County	06	Belvidere

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			0–1	TOPSOIL.										
			1–5	SILT (ML), 10-20% fine sand, non-plastic, 10YR 5/6 yellowish brown, loose, (fluvial/lacustrine), with reddish mottles. qu=.25						M				
1	24	4	5		ML									SS
2	24	11	10	As above. qu=~.25										SS
3	24	8	15	As above. qu=~.25										SS
4	22	9	20	As above.										SS
			24	POORLY GRADED SAND WITH						M				

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

Signature	Firm
Daniel O. Reid	RMT 744 Heartland Trail, Madison Wisconsin Tel: 608-831-4444, Fax: 608-831-3334

Boring Number **B60** Use only as an attachment to Form 4400-122.

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
5	20	10	26–29	**GRAVEL (SP)**, fine to coarse, 10-15% silt, 10YR 6/6 yellowish brown, loose.	SP									SS
6	18	100/.4'	30–34	As above, but with 4" silt lense from ~ 31.0 to 31.3 feet.						M	NP	NP	26.4	SS KH= 3.2X10-4 cm/sec
7	15	11	35–39	As above.						M				SS
8	24	14	40–42	As above, but with 6" silt lense from ~40.2 to 40.8 feet.						M				SS
			42–44	**SILTY SAND (SM)**, 80% fine sand, 20% silt, 10YR 6/6 yellowish brown, loose.										
9	24	13	45–47		SM					W				SS
			47	End of boring at 47.0 feet.										

6

State of Wisconsin
Department of Natural Resources

Route To:
☒ Solid Waste
☐ Emergency Response
☐ Wastewater
☐ Haz. Waste
☐ Underground Tanks
☐ Water Resources
☐ Other

Soil Boring Log Information

Form 4400-122 7-91

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Dairyland Power 3081.23	2927	B61

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Boart Longyear, Crew Chief: Eric Shoenberg	11/2/95	11/6/95	4 1/4" HSA

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			Feet MSL	894.4 Feet MSL	8.0 Inches

Boring Location
State Plane 172170.00 N, 1477763.00 E
NE 1/4 of NE 1/4 of Section 19 T 21 N,R 12W
Lat ° ' "
Long ° ' "
Local Grid Location (If applicable)
Feet ☐ N ☐ S Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
Buffalo County	06	Belvidere

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			0–20	**POORLY GRADED SAND WITH GRAVEL (SP)**, fine to coarse, 10% silt, 5-10% cobbles, 10YR 6/6 yellowish brown, dense, (Fill).						M				
1	16	17	20–25	As above.	SP									SS

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

Signature	Firm
Craig O Bartholomew	RMT 744 Heartland Trail, Madison Wisconsin Tel: 608-831-4444, Fax: 608-831-3334

This form is authorized by Chapters 144, 147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 144.99 and 162.06, Wis. Stats.

Boring Number **B61** Use only as an attachment to Form 4400-122.

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
2	12	15	26–29	As above.										SS
3	14	27	30–34	As above.										SS
4	4	23	35–39	As above.										SS
5	14	20	40–43	As above.						M				SS
6	24	12	44–49	SILT (ML), 15% fine to coarse sand, 10% fine gravel, 10YR 3/2, very dark grayish brown, stiff, very slightly plastic, (Fill).	ML									SS
7	14	23	50–54	As above, but with rust colored mottles, (Native), (Loess/fluvial).										SS
8	18	22	55–59	As above.						M	28	22	86.4	SS
9	24	15	60–64	As above.						M				SS
10	16	16	65–66											SS

Boring Number **B61** Use only as an attachment to Form 4400-122.

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			67	As above.						M				
11	24	17	70											SS
			71							M				
			72	As above.										
12	6	51	75	As above, with Dolomite gravel from 75.0 to 75.2 feet, 10YR 5/3 brown.						M-W				SS
13	18	50	80	As above.										SS
			82							VW				
14	14		85	As above.										SS
			88							W				
			89	**WEATHERED SANDSTONE**, with silt zones, medium grained, brown and rust.										
15	4	100/4"	90											SS
			91	**SANDSTONE GRAVEL**, with some silt, brown, angular.										
			92							W				
16	16	87	93											SS
			94	As above.										
			95	End of boring at 95.0 feet.										

State of Wisconsin Department of Natural Resources	Route To: ☒ Solid Waste ☐ Emergency Response ☐ Wastewater	☐ Haz. Waste ☐ Underground Tanks ☐ Water Resources ☐ Other	Soil Boring Log Information Form 4400-122 7-91

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Dairyland Power 3081.23	2927	B62

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Boart Longyear, Crew Chief: Eric Shoenberg	11/1/95	11/1/95	4 1/4" HSA

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			Feet MSL	818.2 Feet MSL	8.0 Inches

Boring Location		Local Grid Location (If applicable)
State Plane 172192.00 N, 1477253.00 E	Lat ° ' "	☐ N ☐ E
NE 1/4 of NE 1/4 of Section 19 T 21 N,R 12W	Long ° ' "	Feet ☐ S Feet ☐ W

County	DNR County Code	Civil Town/City/ or Village
Buffalo County	06	Belvidere

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			0–2	TOPSOIL, (silt).										
			2	SILT (ML), 5-10% fine sand, 5% clay, 10YR 5/6 dark yellowish brown, medium stiff, slight plasticity, (Lacustrine).						M				
1	20	7	5		ML									SS
2	24	9	10	As above.						M	19	17	98.5	SS
3	24	8	15							M				SS
			16	POORLY GRADED SAND WITH GRAVEL (SP), fine to coarse 10-30% silt, 10YR 6/6 yellowish brown, medium dense, (fluvial).										
4	24	8	20	As above, but with 6" silt lense from 21.0 to 21.5 feet.	SP									SS
			25											

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

Signature	Firm
Daniel D. [illegible]	RMT 744 Heartland Trail, Madison Wisconsin Tel: 608-831-4444, Fax: 608-831-3334

Boring Number **B62** Use only as an attachment to Form 4400-122.

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
5	24	15	26–29	As above.										SS
6	12	17	30–34	As above.										SS
7	10	10	35–39	As above.										SS
8	6	50/2"	40–42	As above, but dense.										SS
				End of boring at 42.0 feet.										

State of Wisconsin
Department of Natural Resources

Route To:
☒ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☐ Other

Soil Boring Log Information
Form 4400-122 7-91

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Dairyland Power 3081.23		B63

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Boart Longyear, Crew Chief: Paul Dickinson	10/31/95	10/31/95	4 1/4" HSA

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			Feet MSL	817.3 Feet MSL	8.0 Inches

Boring Location
State Plane 171976.00 N, 1477115.00 E
NE 1/4 of NE 1/4 of Section 19 T 21 N,R 12W
Lat ° ' "
Long ° ' "
Local Grid Location (If applicable)
Feet ☐ N ☐ S Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
Buffalo County	06	Belvidere

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			0–1.5	TOPSOIL, (silt).										
			1.5	SILT (ML), 10% fine sand, non-plastic, 10YR 4/6 dark yellowish brown, medium stiff, (Loess, fluvial/lacustrine).						M				
1	20	11	5		ML									SS
ST-1			8	As above.						M	23	20	61.7	ST KV= 2.4X10-5
2	2	27	10											SS
			12	As above, (rock in spoon).						M				
			13.5	POORLY GRADED SAND WITH GRAVEL (SP), fine to coarse, 10% silt, 10YR 6/6 dark yellowish brown, very dense, (fluvial).										
3	8	100/.9'	15		SP									SS
4	8	100/.5'	20											SS
			21	As above.										

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

Signature: Craig O'Bartholomew

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

This form is authorized by Chapters 144, 147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 144.99 and 162.06, Wis. Stats.

Boring Number **B63** Use only as an attachment to Form 4400-122.

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
5	10	100/8"	26–29	As above.										SS
6	8	100/6"	30–34	As above.										SS
7	12	50	35–39	As above.						W				SS
8	24	52	40–43											SS
			43	**WEATHERED SANDSTONE,** 10-20% silt, 10-15% fine to coarse gravel, 5Y 4/3 olive, dense, (weathered sandstone), (glauconitic).						W				
9	18	52	44–49		SS									SS
10	4	100/6"	50–54	As above, but becomes denser.										SS
11	12	100/6"	55–59	As above.										SS
12	18	100/8"	60–64	As above.										SS
13	18	100/8"	65–66											SS

Boring Number **B63** Use only as an attachment to Form 4400-122.

Sample Number	Sample Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			67	As above.										
			68											
			69											
14		100/6"	70											SS
			71	As above.										
			72											
			73											
			74											
15		100/6"	75											SS
			76	As above.										
			77	End of boring at 77.0 feet.										

State of Wisconsin
Department of Natural Resources

Route To:
☒ Solid Waste
☐ Emergency Response
☐ Wastewater
☐ Haz. Waste
☐ Underground Tanks
☐ Water Resources
☐ Other

Soil Boring Log Information

Form 4400-122 7-91

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Dairyland Power 3081.23	2927	B64

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Boart Longyear, Crew Chief: Paul Dickinson	10/31/95	10/31/95	4 1/4" HSA

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			Feet MSL	822.1 Feet MSL	8.0 Inches

Boring Location
State Plane 172012.00 N, 1477483.00 E
NE 1/4 of NE 1/4 of Section 19 T 21 N,R 12W
Lat ° ' "
Long ° ' "

Local Grid Location (If applicable)
Feet ☐ N ☐ S Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
Buffalo County	06	Belvidere

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
1	18	16	5	SILT (ML), 10% fine sand, non-plastic, 10YR 4/6 dark yellowish brown, medium stiff, (Loess, fluvial/lacustrine).	ML									SS
2	NR	13	10	Rock in spoon.										SS
3	22	21	15	As above.						M	29	22	97.0	SS
4	12	35	20											SS
			22	POORLY GRADED SAND WITH GRAVEL (SP), fine to coarse, 10% silt, 10YR 6/6 yellowish brown, dense, (fluvial),						M				

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

Signature	Firm
Daniel A. Card	RMT 744 Heartland Trail, Madison Wisconsin Tel: 608-831-4444, Fax: 608-831-3334

Boring Number **B64** Use only as an attachment to Form 4400-122.

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
5	12	100/12	25–26	(lacustrine). As above, but with 10-15% silt.	SP									SS
6	16	45	30–31	As above, but with ~6" silt lense from ~32.0 to 32.5 feet.										SS
7	12	43	35–36	As above.										SS
8	20	43	40–41	As above.										SS
9	18	56	45–46	As above, but with 4" silt lense from ~46.4 to 46.7 feet.						W				SS
10	24	24	50–51	As above.										SS
11	24	31	55–57	As above.										SS
			57	End of boring at 57.0 feet.										

State of Wisconsin
Department of Natural Resources

Route To:
☒ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☐ Other

Soil Boring Log Information

Form 4400-122 7-91

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Dairyland Power 3081.23	2927	B65

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Boart Longyear, Crew Chief: Eric Shoenberg	11/9/95	11/10/95	4 1/4 HSA

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			Feet MSL	801.8 Feet MSL	8.0 Inches

Boring Location
State Plane 171704.00 N, 1477174.00 E
NE 1/4 of NE 1/4 of Section 19 T 21 N,R 12W

Lat ° ' "
Long ° ' "

Local Grid Location (If applicable)
Feet ☐ N ☐ S Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
Buffalo County	06	Belvidere

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
1	18	11	5	SILTY SAND (SM), 55% very fine sand, 45% fines, 10YR 4/4 dark yellowish brown, loose, (Fluvial).	SM					M				SS
2	8	26 100/5	10	POORLY GRADED GRAVEL (GP), 90% fine angular Dolomite gravel, 10% fine to coarse sand, 2.5Y 5/3 light olive brown, very dense.	GP									SS
3	2	50/2"	15	As above, (fluvial).										SS
4	14	78	20	SILTY SAND WITH GRAVEL (SM), 60-80% fine to coarse sand, mostly fine, 20% silt, 10-20% gravel, 10YR 4/4 dark yellowish brown, very dense, (fluvial).										SS
			24	POORLY GRADED GRAVEL										

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

Signature	Firm
Daniel B. [illegible]	RMT 744 Heartland Trail, Madison Wisconsin Tel: 608-831-4444, Fax: 608-831-3334

Boring Number **B65** Use only as an attachment to Form 4400-122.

Sample Number	Sample Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
5	9	13 50/5	26 27 28 29	**(GP)**, 90% fine angular gravel, 10% fine to coarse sand, 2.5Y 5/3 olive brown, dense.	GP									SS
6	5	50/5"	30 31 32 33 34	As above, auger refusal at 31.0 feet, (fluvial).										SS
7	0	50/1"	35 36 37											SS
			38 39	**SILT (ML)**, 95% silt, 5% clay, 10YR 4/4 dark yellowish brown, stiff to very stiff, (Loess, fluvial).										
8	14	31	40 41 42 43 44		ML									SS
9	13	17	45 46 47 48 49	**SILT (ML)**, as above, with 60-70% silt, 30-40% clay, 5% sandstone gravel, 10YR 4/4 dark yellowish brown, stiff, (fluvial).	ML					M				SS
10	9.5	45	50 51 52	As above.										SS
			53 54	**POORLY GRADED GRAVEL (GP)**, 95% fine angular gravel, 5% fine to coarse sand, 10YR 4/4 dark yellowish brown, medium dense to very dense, (fluvial).						W				
11	4	16 55/5	55 56 57 58 59		GP									SS
12	14	78	60 61 62 63 64	**SILTY SAND (SM)**, 80% fine to medium sand, 20% silt, 10YR 5/6 yellowish brown, dense to very dense. Lost circulation at 63.0 feet.	SM					M				SS
13	3	50/4"	65 66	As above (weathered sandstone).										SS

Boring Number **B65** Use only as an attachment to Form 4400-122.

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			67											
			68											
			69											
14	2	50/2"	70	As above, some gravel zones.										SS
			71											
			72	End of boring at 72.0 feet.										

State of Wisconsin
Department of Natural Resources

Route To:
☒ Solid Waste
☐ Emergency Response
☐ Wastewater
☐ Haz. Waste
☐ Underground Tanks
☐ Water Resources
☐ Other

Soil Boring Log Information

Form 4400-122 7-91

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Dairyland Power 3081.23	2927	B66

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Boart Longyear, Crew Chief: Eric Shoenberg	10/31/95	10/31/95	4 1/4" HSA

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			Feet MSL	791.0 Feet MSL	8.0 Inches

Boring Location
State Plane 171532.00 N, 1477014.00 E
NE 1/4 of NE 1/4 of Section 19 T 21 N,R 12W

Lat ° ' "
Long ° ' "

Local Grid Location (If applicable)
Feet ☐ N ☐ S Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
Buffalo County	06	Belvidere

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			0–1	TOPSOIL, (silt).										
			1.5	POORLY GRADED SAND (SP), fine to medium, 5% fine gravel, 10% silt, 10YR 6/8 brownish yellow, medium dense, (fluvial).						M				
1	24	14	5		SP									SS
2	1	30	10	As above, but ~ 15% gravel.										SS
3	6	20 50/4"	15	As above.										SS
			18.5	POORLY GRADED SAND (SP), fine to medium, 5% fine gravel, 10% silt, 5Y 6/8 reddish yellow, medium dense, (fluvial).										
4	22	19	20		SP					M				SS
			25											

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

Signature: Daniel O. Erd

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

Boring Number **B66** Use only as an attachment to Form 4400-122.

Sample Number	Sample Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
5	12	25	26, 27, 28, 29	As above.										SS
6	20	27	30, 31, 32, 33, 34	As above.										SS
7	18	28	35, 36, 37, 38, 39	**WEATHERED SANDSTONE**, fine to medium, 25% silt, 5Y 4/3 olive, medium dense, (weathered sandstone).	SS					W				SS
8	20	34	40, 41, 42	As above.										SS
				End of boring at 42.0 feet.										

State of Wisconsin
Department of Natural Resources

Route To:
☒ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☐ Other

Soil Boring Log Information

Form 4400-122 7-91

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Dairyland Power 3081.23	2927	B67

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Boart Longyear, Crew Chief: Eric Shoenberg	10/31/95	10/31/95	4 1/4" HSA

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			Feet MSL	807.5 Feet MSL	8.0 Inches

Boring Location
State Plane 171768.00 N, 1477518.00 E
NE 1/4 of NE 1/4 of Section 19 T 21 N,R 12W
Lat ° ' "
Long ° ' "
Local Grid Location (If applicable)
Feet ☐ N ☐ S Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
Buffalo County	06	Belvidere

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			0–2	**TOPSOIL**, (silt).										
			2–8	**SILTY SAND (SM)**, 20-30% silt, 7.5YR brown, loose, (fluvial), (Lacustrine).						M				
1	16	16	5		SM									SS
			8	**POORLY GRADED SAND WITH GRAVEL (SP)**, 10% silt, 10YR 6/6 yellowish brown, medium dense, (fluvial).						M				
2	14	26	10		SP									SS
3	NR	26	15	**NO RECOVERY**, rock in spoon.										SS
4	6	25 50/2"	20	As above.										SS

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

Signature: Daniel D. Reid

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

Boring Number **B67** Use only as an attachment to Form 4400-122.

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
5	2	100/2"		As above.										SS
6	8	40 50/3"	30	As above.						M	NP	NP	28.2	SS KV= 6.1X10-4
7	6	50/4"	35	As above.										SS
8	8	50/6"	40	As above.										SS
9		50/6"	45	As above.										SS
10	2.4	100/5"	50											SS
			52	End of boring at 52.0 feet.										

State of Wisconsin
Department of Natural Resources

Route To:
☒ Solid Waste
☐ Emergency Response
☐ Wastewater
☐ Haz. Waste
☐ Underground Tanks
☐ Water Resources
☐ Other

Soil Boring Log Information
Form 4400-122 7-91

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Dairyland Power 3081.23	2927	B68

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Boart Longyear, Crew Chief: Paul Dickinson	10/30/95	10/30/95	4 1/4" HSA

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			Feet MSL	800.1 Feet MSL	8.0 Inches

Boring Location
State Plane 171572.00 N, 1477353.00 E
NE 1/4 of NE 1/4 of Section 19 T 21 N,R 12W
Lat ° ' "
Long ° ' "

Local Grid Location (If applicable)
Feet ☐ N ☐ S Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
Buffalo County	06	Belvidere

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			0–3	**POORLY GRADED SAND WITH GRAVEL (SP)**, fine to medium, 25% fine gravel, 7.5YR 4/3 brown, (Fill).	SP					M				
1	24	7	3–8	**SILT (ML)**, 5% fine sand, non-plastic, 7.5YR 4/2 brown, with rust colored mottles, loose, (Loess, fluvial). qu=.50	ML									SS
T-1										M	24	22	96.7	ST KV= 1.1X10-4
2	6	100/4"	8–25	**POORLY GRADED SAND WITH GRAVEL (SP)**, fine to medium, 10% silt, 10YR 6/6 yellowish brown, very dense, (fluvial).	SP									SS
3	6	100/6"	15	As above.										SS
4	6	100/8"	20	As above.										SS

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

Signature: David D. Leid

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

Boring Number **B68** Use only as an attachment to Form 4400-122.

Sample Number	Sample Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plastic Limit	Soil Properties: P 200	Comments
5	8	100/6"	26, 27, 28, 29	As above.										SS
6	6	100/6"	30, 31, 32, 33, 34	As above, but 10-15% silt.										SS
7	8	100/6"	35, 36, 37, 38, 39	As above.										SS
8	12	100/1'	40, 41, 42, 43, 44	As above.										SS
9	8	100/6"	45, 46, 47, 48, 49	As above.										SS
10	10	100/12"	50, 51, 52											SS
11	12	100/12"	53, 54, 55, 56, 57, 58, 59	As above.										SS
12	10	100/8"	60, 61, 62	As above.										SS
				End of boring at 62.0 feet.										

State of Wisconsin
Department of Natural Resources

Route To:
☒ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☐ Other

Soil Boring Log Information

Form 4400-122 7-91

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Dairyland Power 3081.23	2927	B103

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Environmental & Foundation Drilling, Crew Chief: Frank Badula	10/21/94	10/21/94	HSA 2 1/4"

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			Feet MSL	810.4 Feet MSL	6 1/4 Inches

Boring Location
State Plane 171852.00 N, 1477317.00 E
NE 1/4 of NE 1/4 of Section 19 T 21 N,R 12W
Lat ° ' "
Long ° ' "
Local Grid Location (If applicable)
Feet ☐ N ☐ S Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
Buffalo County	06	Belvidere

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
1	10	25	1–3	**FILL, SILTY SAND WITH GRAVEL (SM)**, fine to coarse, 20% fine gravel, brown 7.5YR 5/2, medium to very dense.						M				SS
2	4	100/12	4											SS
			5	Cobble in spoon.						M				
3	4	100/6	6											SS
			8	Easier drilling at ~7.5'.						M				
4	20	17	9											SS
			10	**TOPSOIL** 12" layer, black.						M				
			11	**SILTY SAND WITH GRAVEL (SM)**, fine to coarse, 20% fine to coarse gravel, 30% silt, brown 7.5YR 5/2, medium dense, Fluvial.	SM									
5	16	29	15		SM					M				SS
6	4	100/14	20							M				SS
			25											

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

Signature	Firm
Daniel D. Seel	RMT 744 Heartland Trail, Madison Wisconsin Tel: 608-831-4444, Fax: 608-831-3334

This form is authorized by Chapters 144, 147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 144.99 and 162.06, Wis. Stats.

Boring Number **B103** Use only as an attachment to Form 4400-122.

Sample Number	Sample Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
7	4	100/8	26 27 28 29							M				SS
8	4	100/8	30 31 32 33 34							M				SS
9	3	100/6	35 36 37 38 39							M				SS
10	10	9	40 41 42 43 44	**SILT (ML)**, 5% fine to medium sand, nonplastic, brown 10YR 4/3, loose, (Loess).	ML					M				SS
11	6	100/12	45 46 47 48 49	**SILTY SAND WITH GRAVEL (SM)**, fine to coarse, 20% fine to coarse gravel, 30-35% silt, brown 7.5YR 5/2, very dense, Fluvial.	SM					M				SS
12	6	100/8	50 51 52 53 54							M				SS
13	6	100/15	55 56 57 58 59							M				SS
14	10	100/8	60 61 62 63 64	Glauconitic.						W				SS
15	24	100/6	65 66	Drilling becomes more difficult.	SM					W				SS

Boring Number **B103** Use only as an attachment to Form 4400-122.

Sample: Number	Sample: Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plastic Limit	Soil Properties: P 200	Comments
			67	Sandstone bedrock at ~67.0 feet.										
				End of Boring at 67.0 feet.										

State of Wisconsin
Department of Natural Resources

Route To:
☒ Solid Waste
☐ Emergency Response
☐ Wastewater
☐ Haz. Waste
☐ Underground Tanks
☐ Water Resources
☐ Other

Soil Boring Log Information
Form 4400-122 7-91

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Dairyland Power 3081.23	2927	W42	
Boring Drilled By (Firm name and name of crew chief)	**Date Drilling Started**	**Date Drilling Completed**	**Drilling Method**
Environmental & Foundation Drilling, Crew Chief: Frank Badula	10/19/94	10/19/94	HSA 6 1/4"

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			787.2 Feet MSL	836.0 Feet MSL	10 1/4 Inches

Boring Location
State Plane 172169.00 N, 1476925.00 E
NE 1/4 of NE 1/4 of Section 19 T 21 N,R 12W
Lat ° ' "
Long ° ' "

Local Grid Location (If applicable)
Feet ☐ N ☐ S Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
Buffalo County	06	Belvidere

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			0–1	**TOPSOIL.**										
1	8	4	1–9	**SILT (ML)**, 3-10% fine sand, 5% fine gravel, 10-15% lean clay, black mottles, nonplastic, brown 7.5YR 4/2, soft, (Loess, fluvial/lacustrine).	ML					M				SS
2	18	4								M				SS
3	24	7								M				SS
4	16	100/12	9–	**SILTY SAND WITH GRAVEL (SM)**, 25% gravel, fine to medium, 10-25% silt, brownish yellow 10YR 6/6, very dense, Fluvial.	SM					M				SS
5	12	39			SM					M				SS
6	12	100/12	20	Cobbles (5-10%).						M				SS

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

Signature: Daniel R. Reid

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

Boring Number **W42** Use only as an attachment to Form 4400-122.

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
7	8	100/8	26–29							M				SS
8	16	14	30–34	4" silt lens at 31.3'.						M				SS
9	24	19	35–39	**POORLY GRADED SAND (SP),** fine to coarse, glauconitic, 5-10% silt, 5% clay, 5% fine gravel, olive 5Y 4/4, medium dense, Fluvial.	SP					M				SS
10	24	23	40–44							M				SS
11	24	45	45–48	**SILTY SAND WITH GRAVEL (SM),** fine to coarse, 5% clay, reddish yellow 7.5YR, at ~46.7', Fluvial.	SM					M				SS
12	14	100/12	49–56	**SILTY SAND (SM),** fine to medium, 5% fine gravel, olive 5Y 4/4, very dense, wet at ~51.0', (Sandstone Fragments).	SM					W				SS KH= 1.7X10 cm/sec
				End of Boring at 56 Ft.										

State of Wisconsin
Department of Natural Resources

Route To:
☒ Solid Waste
☐ Emergency Response
☐ Wastewater
☐ Haz. Waste
☐ Underground Tanks
☐ Water Resources
☐ Other

Soil Boring Log Information
Form 4400-122 7-91

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Dairyland Power 3081.23	2927	W100

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Environmental & Foundation Drilling, Crew Chief: Frank Badula	10/24/94	10/24/94	HSA 4 1/4"

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			729.1 Feet MSL	792.2 Feet MSL	8.0 Inches

Boring Location
State Plane 171345.00 N, 1477166.00 E
NE 1/4 of NE 1/4 of Section 19 T 21 N,R 12W
Lat ° ' "
Long ° ' "
Local Grid Location (If applicable)
Feet ☐ N ☐ S Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
Buffalo County	06	Belvidere

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			0–1	**TOPSOIL**, silt.										
1	12	17	1–7	**FILL, SILT (ML)**, 5-10% fine to coarse sand, 3% fine gravel, nonplastic, brown 7.5YR 4/2, medium stiff. **FILL**, as above but 10% clay, wood fragments, bricks within matrix.						D				SS
2	18	9								D				SS
3	6	16								M				SS
			7	**SILTY SAND WITH GRAVEL (SM)**, 20% fine to coarse gravel, 20% silt, brownish yellow 10YR 6/6, medium dense-very dense, Fluvial/Lacustrine.	SM									
4	4	100/14								M				SS
5	4	100/12			SM					M				SS
6	4	100/14								M				SS

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

Signature: David D. Leid

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

Boring Number **W100** Use only as an attachment to Form 4400-122.

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
7	4	100/6	26	5% cobbles.						M				SS
8	10	100/8	30							M				SS
			33	Cobble layer from ~31'-35'.										
9	12	100/10	35							M				SS
10	6	100/10	40		SM					M				SS
11	10	100/12	45							M				SS
			47	Drilling becomes much easier at 47.0' - 49.5'.										
12	4	100/10	50	Less sand.						M				SS
13	6	100/5	55							M				SS
14	8	100/12	60							M				SS
			64	**SILTY SAND (SM)**, fine to medium, 10% clay, olive 5Y 4/4, very dense, wet (Glauconitic), two 1" thick silt lenses at 66.5'	SM					W				
15	14	100/12	65		SM					W	20	18	18.5	SS

Boring Number **W100** Use only as an attachment to Form 4400-122.

Sample Number	Sample Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			67, 68, 69, 70	and 66.3', (Weathered Sandstone).										KH= 1X10 cm/sec
				End of Boring at 70 Ft.										

State of Wisconsin
Department of Natural Resources

Route To:
☒ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☐ Other

Soil Boring Log Information
Form 4400-122 7-91

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Dairyland Power 3081.23	2927	W100A

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Boart Longyear, Crew Chief: Randy Radke	10/23/95	10/27/95	4 1/4" HSA/MR

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			712.5 Feet MSL	792.9 Feet MSL	8.0 Inches

Boring Location
State Plane 171357.00 N, 1477172.00 E
NE 1/4 of NE 1/4 of Section 19 T 21 N,R 12W

Lat ° ' "
Long ° ' "

Local Grid Location (If applicable)
Feet ☐ N ☐ S Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
Buffalo County	06	Belvidere

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
1	3	50/.1	70–72	Blind drilled to 70.0 feet. See log of W100 for sample descriptions.	SM-ML									SS
			72–75	**SILTY SAND TO SANDY SILT (SM-ML)**, fine sand, 10% clay, 5Y 4/4 olive, very dense, (glauconitic), (weathered sandstone).										
2	6	50/5"	81	As above.										SS
3	18	100/17"	91	As above.										SS

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

Signature
Daniel A. Lid

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

Boring Number **W100A** Use only as an attachment to Form 4400-122.

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
4	12	100/10"	101	As above.										KH= 2.5X10-5 cm/sec
			104	-----										
			106	**SANDSTONE**, fine grained glauconitic with interbedded silt lenses, soft, friable, and poorly cemented.										
		100/4"	110											
		100/3"	120											
			121	End of boring at 121.0 feet.										

State of Wisconsin
Department of Natural Resources

Route To:
☒ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☐ Other

Soil Boring Log Information
Form 4400-122 7-91

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Dairyland Power 3081.23	2927	W101

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Environmental & Foundation Drilling, Crew Chief: Frank Badula	10/25/94	10/25/94	HSA 6 1/4"-6"

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			813.1 Feet MSL	923.2 Feet MSL	6-10 1/4 Inches

Boring Location
State Plane 172655.00 N, 1477721.00 E
NE 1/4 of NE 1/4 of Section 19 T 21 N,R 12W
Lat ° ' "
Long ° ' "
Local Grid Location (If applicable)
Feet ☐ N ☐ S Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
Buffalo County	06	Belvidere

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
1	12	20	1–3	**POORLY GRADED SAND (SP)** fine, brownish yellow 10YR 6/6 medium to very dense, (with sandstone fragments), Fluvial.	SP					M				SS
2	14	8	4–5	Grades to yellow 10YR 7/6.						M				SS
3	16	11	6–8	Rust colored mottles. Sand is interbedded with pale yellow and brownish yellow lenses.						M				SS
4	10	100/12"	9–14							M				SS
										M				
5	18	24	15–19		SP					M				SS
6		100/14"	20–25	Very fine silty sand at ~21.0'.						M				SS

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

Signature: Daniel O. [illegible]

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

State of Wisconsin
Department of Natural Resources

Soil Boring Log Information Supplement

Form 4400-122A 7-91

Boring Number **W101** Use only as an attachment to Form 4400-122.

Sample Number	Sample Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
7	8	100/6"	26	More cemented, yellow 10YR 7.8 very dense, 20% silt.						M				SS
			27											
8	4	100/4"	28											SS
			29	**DOLOMITE**, bedrock, highly weathered and fractured, brown 7.5YR 5/2, fractures/voids filled with silt and sand.										
9			30											Grab
			31											
10			32											Grab
			33											
			34											
			35											
			36											
11			37											Grab
			38											
			39											
			40											
			41											
			42											
12	6	100/6"	43											SS
			44											
13			45	Rock becomes more competent at ~46'.										Grab
			46											
			47											
14			48											Grab
			49											
			50	Fracture zone at ~48.0' - 50.0' (loose air circulation).										
			51											
			52											
			53											Grab
			54											
			55											
			56											
			57											
15		100/2"	58											SS
			59											
			60											
			61											
			62											
16			63											Grab
			64											
17			65											Grab
			66											

Boring Number **W101** Use only as an attachment to Form 4400-122.

Sample Number	Sample Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			67–69											
18			69–74	**SANDSTONE**, fine grained glauconitic, friable poorly-cemented, olive.										Grab
19			75	**DOLOMITE**, weathered fractured interbedded with glauconitic sandstone (or glauconitic silty sand in fractures).										Grab
20			80											Grab
			81	**SANDSTONE**, fine grained, very friable, poorly cemented, olive weathered.										
21			85											Grab
22			90	Color change to rust brown at ~91.0', color change to olive at ~93'.						D				Grab
23			95	Color changes from rust brown to olive.						D				Grab
24			100											Grab
			103							D				
25			105–108											Grab

Boring Number **W101** Use only as an attachment to Form 4400-122.

Sample Number	Sample Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
26			109–115	Attempt to core from 108 to 118 feet below ground surface but got no recovery.						W				0
27			118–122							W				KH= 1X10 cm/sec Grab
			122	**End of Boring at 122 Ft.**										

State of Wisconsin
Department of Natural Resources

Route To:
☒ Solid Waste
☐ Emergency Response
☐ Wastewater
☐ Haz. Waste
☐ Underground Tanks
☐ Water Resources
☐ Other

Soil Boring Log Information
Form 4400-122 7-91

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Dairyland Power 3081.23	2927	W101A	
Boring Drilled By (Firm name and name of crew chief)	**Date Drilling Started**	**Date Drilling Completed**	**Drilling Method**
Boart Longyear, Crew Chief: Eric Shoenberg	10/23/95	10/30/95	Air

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			813.0 Feet MSL	923.1 Feet MSL	6.0 Inches

Boring Location
State Plane 172652.00 N, 1477729.00 E
NE 1/4 of NE 1/4 of Section 19 T 21 N,R 12W
Lat ° ' "
Long ° ' "

Local Grid Location (If applicable)
Feet ☐ N ☐ S Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
Buffalo County	06	Belvidere

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			30–31	Blind drilled to 30.0 feet. See log of W101 for sample descriptions.										
			32–34	**DOLOMITE/LIMESTONE**, hard, fractured, highly weathered, fractures filled with silt/sand.										
			52–54	As above.										

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

Signature: Daniel Q. Reid

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

This form is authorized by Chapters 144, 147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 144.99 and 162.06, Wis. Stats.

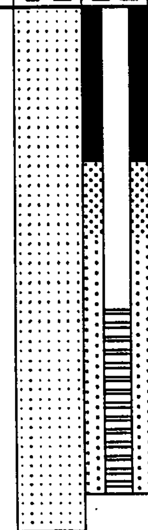
Boring Number **W101A** Use only as an attachment to Form 4400-122.

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			55–73											
			73–77	**SANDSTONE**, olive green, glauconitic, soft, fissile, friable, fine to medium grained.										
			77–79	**DOLOMITE/LIMESTONE**, hard, dense, highly weathered.										
			79–81	**SANDSTONE**, olive green, glauconitic, interbedded with dark brown-black sandstone and white lenses, fine grained, fissile, medium friable, recovery=94%, RQD=50%, FF=3.										
1			81											RC
2			91	Recovery=99%, RQD=55%, FF=6.										RC
			93–96	As above, but also contains tan sandstone, very fine with lenses of shaley consistency, bottom 3.5 feet well cemented.										

Boring Number **W101A** Use only as an attachment to Form 4400-122.

Sample Number	Sample Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
3			97–104	Recovery=40%, RQD=0%. Core barrel locks up at 104.0 feet.										RC
			110	▽			▼							
			125–137	As above, SANDSTONE, olive green, glauconitic, interbedded with dark brown to black sandstone and white calcareous shaley lenses, fine-grained, fissile, medium friable.										

Boring Number **W101A** Use only as an attachment to Form 4400-122.

Sample Number	Sample Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plastic Limit	Soil Properties: P 200	Comments
			138–152											KH = 1X10-2 cm/sec
			152	End of boring at 152.0 feet.										

State of Wisconsin
Department of Natural Resources

Route To:
☒ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☐ Other

Soil Boring Log Information

Form 4400-122 7-91

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Dairyland Power 3081.23	2927	W102

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Environmental & Foundation Drilling, Crew Chief: Frank Badula	10/18/94	10/18/94	HSA 6 1/4"

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			807.6 Feet MSL	836.1 Feet MSL	10 1/4 Inches

Boring Location	Lat / Long	Local Grid Location (If applicable)
State Plane 172047.00 N, 1478190.00 E	Lat ° ' "	☐ N ☐ E
NE 1/4 of NE 1/4 of Section 19 T 21 N,R 12W	Long ° ' "	Feet ☐ S Feet ☐ W

County	DNR County Code	Civil Town/City/ or Village
Buffalo County	06	Belvidere

Sample Number	Sample Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			0–5	Not sampled, see Log of W102A for sample descriptions.										
1	24	NA	5–7	**LEAN CLAY WITH SAND** (CL/L), 40% silt, Lacustrine.	CL						31	19	80.7	Kv 4.8E-8 ST
			7–25	Not sampled, see Log of W102A for sample descriptions.										

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

Signature	Firm
Daniel R. Reid	RMT 744 Heartland Trail, Madison Wisconsin Tel: 608-831-4444, Fax: 608-831-3334

Boring Number **W102** Use only as an attachment to Form 4400-122.

Sample Number	Sample Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			26											
			27											
			28											
			29											
			30											
			31											KH=
			32											3.5/10
			33											cm/sec
			34											
			35											
				End of Boring at 35.5 Ft.										

State of Wisconsin
Department of Natural Resources

Route To:
☒ Solid Waste
☐ Emergency Response
☐ Wastewater
☐ Haz. Waste
☐ Underground Tanks
☐ Water Resources
☐ Other

Soil Boring Log Information

Form 4400-122 7-91

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Dairyland Power 3081.23	2927	W102A

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Environmental & Foundation Drilling, Crew Chief: Frank Badula	10/18/94	10/18/94	HSA 6 1/4"

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			808.9 Feet MSL	835.7 Feet MSL	10 1/4 Inches

Boring Location
State Plane 172042.00 N, 1478191.00 E
NE 1/4 of NE 1/4 of Section 19 T 21 N,R 12W

Lat ° ' "
Long ° ' "

Local Grid Location (If applicable)
Feet ☐ N ☐ S Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
Buffalo County	06	Belvidere

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
1	24	4	0-2	TOPSOIL.										SS
			1-5	SILT (ML), 10% fine to coarse sand, 5% fine gravel, nonplastic, brown 7.5YR 4/2, loose, Fluvial/Lacustrine.	ML					M				
2	24	4	3-5											SS
			5-10	LEAN CLAY (CL), 20-30% silt, 5% fine to medium sand and gravel, slightly plastic, brown 7.5YR 4/3, with black mottles, soft, (Loess/lacustrine).	CL					M				
3	24	4	5.5-7.5											SS
4	24	5	8-10											SS
			10-25	SILTY SAND WITH GRAVEL (SM-SP), fine to coarse, 25-30% silt, 10-15% fine gravel, brownish yellow 10YR 6/6, very dense, Fluvial.	SM-SP					M				SS
5	18	100/18	15-17							M				SS
6	12	100/12	20-22		SM-SP					M				SS

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

Signature	Firm
Daniel Q. Reid	RMT 744 Heartland Trail, Madison Wisconsin Tel: 608-831-4444, Fax: 608-831-3334

Boring Number **W102A** Use only as an attachment to Form 4400-122.

Sample Number	Sample Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
7	12	36	26, 27, 28, 29							M				SS
8	6	38	30, 31, 32, 33, 34							W				SS
9	10	31	35, 36, 37, 38, 39		SM					W	NP	NP	14.7	SS
10	4	14	40, 41, 42, 43, 44	More fine to medium, dense gravel.						W				SS
11	16	30	45, 46, 47, 48, 49	Less gravel.						W				SS
12	12	18	50, 51, 52, 53, 54, 55	**SANDY SILT (ML)**, 30% fine to medium sand, 15% clay (glauconitic), olive 5Y 4/4, medium dense, (Weathered Sandstone). Becomes harder at ~53'.	ML					W	18	17	64.6	SS KH= 2.8X10 cm/sec
				End of Boring at 55 Ft.										

State of Wisconsin
Department of Natural Resources

Route To:
☒ Solid Waste
☐ Emergency Response
☐ Wastewater
☐ Haz. Waste
☐ Underground Tanks
☐ Water Resources
☐ Other

Soil Boring Log Information
Form 4400-122 7-91

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Dairyland Power 3081.23	2927	W104

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Boart Longyear, Crew Chief: Todd Schmalfeldt	11/14/95	11/14/95	HSA/MR

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			757.4 Feet MSL	843.3 Feet MSL	6.0 Inches

Boring Location
State Plane 171542.00 N, 1477713.00 E
NE 1/4 of NE 1/4 of Section 19 T 21 N,R 12W
Lat ° ' "
Long ° ' "

Local Grid Location (If applicable)
Feet ☐ N ☐ S Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
Buffalo County	06	Belvidere

Sample Number	Sample Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			1–25	Blind drilled to 93.0 feet. See log for W104A for sample descriptions.										

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

Signature	Firm
Craig O'Bartholomew	RMT 744 Heartland Trail, Madison Wisconsin Tel: 608-831-4444, Fax: 608-831-3334

This form is authorized by Chapters 144, 147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 144.99 and 162.06, Wis. Stats.

Boring Number **W104** Use only as an attachment to Form 4400-122.

Sample: Number	Sample: Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			26											
			27											
			28											
			29											
			30											
			31											
			32											
			33											
			34											
			35											
			36											
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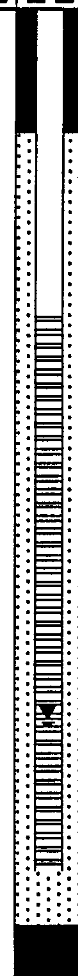
			57											
			58											
			59											
			60											
			61											
			62											
			63											
			64											
			65											
			66											

Boring Number **W104** Use only as an attachment to Form 4400-122.

Sample: Number	Sample: Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			67											
			68											
			69											
			70											
			71											
			72											
			73											
			74											
			75											
			76											
			77											
			78											
			79											
			80											
			81											
			82											
			83											
			84											
			85											
			86											
			87											
			88											
			89											
			90											
			91											
			92											
			93											
				End of boring at 93.0 feet.										



State of Wisconsin
Department of Natural Resources

Route To:
☒ Solid Waste
☐ Emergency Response
☐ Wastewater
☐ Haz. Waste
☐ Underground Tanks
☐ Water Resources
☐ Other

Soil Boring Log Information
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Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Dairyland Power 3081.23	2927	W104A

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Boart Lonyear, Crew Chief: Paul Dickinson	11/9/95	11/13/95	HSA/AIR/MR

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			744.8 Feet MSL	843.1 Feet MSL	6.0 Inches

Boring Location
State Plane 171546.00 N, 1477718.00 E
NE 1/4 of NE 1/4 of Section 19 T 21 N,R 12W
Lat ° ' "
Long ° ' "

Local Grid Location (If applicable)
Feet ☐ N ☐ S Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
Buffalo County	06	Belvidere

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
1	24	NA	5	SILT (ML), 95% silt, 5% clay, 10YR 5/4 yellowish brown, non-plastic, (Loess, fluvial/lacustrine).	ML					M				ST
2	16	8	10	As above.										SS
3	0	16	15	Rock in shoe, sandstone.										SS
			17	Very hard drilling at 17.0 feet, (fluvial).										
4	20	79	20	SILTY SAND (SM), 55-60% fine to coarse angular sand, 30-40% silt, 5% gravel, 10YR 5/4 yellowish brown, dense, sandstone in shoe.	SM									SS

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

Signature: Craig O Bartholo

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

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Boring Number **W104A** Use only as an attachment to Form 4400-122.

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
5	11	21	26	As above, with 70% fine sand, gravel zone at ~ 25.5 to 25.7 feet, (weathered sandstone).										SS
6	23	26	30	Weathered sandstone, fine grained, glauconitic, gray, tan, and olive, (came out as SM-50% gravel).										SS
7	23	55	35	As above, 85% fine sand, 10% silt, 5% gravel.										SS
			37	As above.										
8	13	48	40	As above.										SS
			42	**WEATHERED SANDSTONE,** green, glauconitic, fine grained, silty.						M				
			45											GRAB
			50	As above.										GRAB
			55	As above.										GRAB
			60	As above.										GRAB
			65	As above.										GRAB

State of Wisconsin
Department of Natural Resources

Soil Boring Log Information Supplement
Form 4400-122A 7-91

Boring Number **W104A** Use only as an attachment to Form 4400-122.

Sample: Number	Sample: Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plastic Limit	Soil Properties: P 200	Comments
			70	As above.										GRAB
			75	As above.										GRAB
			79							M				
			80	As above, with steam from hole - moisture.										GRAB
			85											GRAB
			87	No return from 87.0 to 117.0 feet.										
			98	∇										
			102–103	**SANDSTONE**, as above, green, glauconitic, fine-grained, silty.										

Boring Number **W104A** Use only as an attachment to Form 4400-122.

Sample: Number	Sample: Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plastic Limit	Soil Properties: P 200	Comments
			109											
			110											
			111											KH=
			112											4.4X10-4
			113											cm/sec
			114											
			115											
			116											
			117	Liquid coming from hole - very small drops. End of boring at 117.0 feet.										

State of Wisconsin
Department of Natural Resources

Route To:
☒ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☐ Other

Soil Boring Log Information
Form 4400-122 7-91

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Dairyland Power 3081.23	2927	W105

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Boart Longyear, Crew Chief: Eric Shoenberg	11/7/95	11/9/95	HSA

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			732.9 Feet MSL	818.3 Feet MSL	8 1/4 Inches

Boring Location
State Plane 171180.00 N, 1477404.00 E
NE 1/4 of NE 1/4 of Section 19 T 21 N,R 12W

Lat ° ' "
Long ° ' "

Local Grid Location (If applicable)
Feet ☐ N ☐ S Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
Buffalo County	06	Belvidere

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			0–5	Not sampled.										
1	15	14	5	SILT (ML), 98% silt, 2.5Y 5/4 light olive brown, (almost fine sand size just in visual spectrum), (Loess, fluvial/lacustrine).	ML					D				SS
2	17	25	10	As above.										SS
3	15	103	15	Attempted shelby - only went 4". POORLY GRADED GRAVEL WITH SAND (GP), 55-60% fine angular dolomite gravel, 40-45% fine to coarse sand, 10YR 5/6 yellowish brown, very dense.	GP									SS
4	18	130	20	POORLY GRADED SAND WITH GRAVEL (SP), 10YR 5/6 yellowish brown, very dense. Very hard drilling to ~24.0 feet,										SS

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

Signature: Craig O Bartholas

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

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State of Wisconsin
Department of Natural Resources

Soil Boring Log Information Supplement
Form 4400-122A 7-91

Boring Number **W105** Use only as an attachment to Form 4400-122.

Sample Number	Sample Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plastic Limit	Soil Properties: P 200	Comments
				dolomite boulder, (fluvial).										
			26	No sample, (weathered rock).										
5	12	86	30	**WEATHERED SANDSTONE**, ~50-60% very fine sand, 40-50% fines, 2% gravel, yellowish brown and green.						M				SS
6	5	100/5"	35	Weathered glauconitic **SANDSTONE**, fine grained, olive brown.										SS
7			40	As above.										GRAB
8			45	As above.										GRAB
9			50	As above.										GRAB
10			55	As above.										GRAB
11			60	As above.										GRAB
12			65	As above.										GRAB

State of Wisconsin
Department of Natural Resources

Soil Boring Log Information Supplement
Form 4400-122A 7-91

Boring Number **W105** Use only as an attachment to Form 4400-122.

Sample: Number	Sample: Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plastic Limit	Soil Properties: P 200	Comments
			67											
			68											
			69											
13			70	As above.										GRAB
			71											
			72											
			73											
			74											
14			75	As above.										GRAB
			76											
			77											
			78											
			79											
15			80	No sample taken.										GRAB
			81											
			82											
			83											
			84											
16			85	As above.										KH= 3X10-3 cm/sec GRAB
			86											
			87	No return from 87.0 to 90.0 feet.										
			88											
			89											
17			90											GRAB
			91											
			92											
			93											
			94											
			95	End of boring at 95.0 feet.										

State of Wisconsin
Department of Natural Resources

Route To:
☒ Solid Waste
☐ Emergency Response
☐ Wastewater
☐ Haz. Waste
☐ Underground Tanks
☐ Water Resources
☐ Other

Soil Boring Log Information
Form 4400-122 7-91

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Dairyland Power 3081.23	2927	W106

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Boart Longyear, Crew Chief: Paul Dickinson	11/2/95	11/7/95	8"MUD ROTARY

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			773.6 Feet MSL	848.3 Feet MSL	8.0 Inches

Boring Location
State Plane 171530.00 N, 1476837.00 E
NE 1/4 of NE 1/4 of Section 19 T 21 N,R 12W

Lat ° ' "
Long ° ' "

Local Grid Location (If applicable)
Feet ☐ N ☐ S Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
Buffalo County	06	Belvidere

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			1–4	**SILTY SAND WITH GRAVEL (SM)**, fine to coarse, 15-30% silt, 10YR 6/6 yellowish brown, medium dense, (Fill).						M				
1	20	12	5		SM									SS
2	18	19	10	As above.										SS
3	14	38	15	As above.										SS
4	14	20	20	As above.										SS
			24–25											

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

Signature: Craig [signature]

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

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Boring Number **W106** Use only as an attachment to Form 4400-122.

Sample Number	Sample Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
5	18	100/.5'	26–27	As above, but native soil.										SS
			28–29	**SILTY SAND (SM)**, fine to medium, 10% clay, 5Y 4/4 olive, very dense, (glauconitic), (weathered sandstone).						M				
6	20	46	30–34		SM									SS
7	10	12	35–39											SS
8	12	100/14"	40–44	As above, but interbedded with silt and fines.										SS
9	8	100/10"	45–49	As above, but very dense.										SS
10	6	100/8"	50–54	As above.										SS
11	6	100/6"	55–59	As above.										SS
12	3	100/3"	60–63	As above.										SS
			64–66	**SANDSTONE**, tan to greenish tan, weathered, some fracturing, only 2 pieces longer than 4".										

Boring Number **W106** Use only as an attachment to Form 4400-122.

Sample Number	Sample Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
13		NA	67	Recovery=32%, RQD=5%.										RC
14		NA	74							W				RC
			77	Recovery=25%, RQD=4%.										
			84	End of boring at 84.0 feet.										

67

State of Wisconsin
Department of Natural Resources

Route To:
☒ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☐ Other

Soil Boring Log Information

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Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Dairyland Power 3081.30	2927	W107	
Boring Drilled By (Firm name and name of crew chief)	**Date Drilling Started**	**Date Drilling Completed**	**Drilling Method**
Boart Longyear, Crew Chief: T. Schmalfeldt	4/29/97	5/1/97	6 1/4 HSA

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			Feet MSL	906.2 Feet MSL	6.0 Inches

Boring Location
State Plane 173527.44 N, 1477214.99 E
NE 1/4 of NE 1/4 of Section 19 T 21 N,R 12W
Lat ° ' "
Long ° ' "

Local Grid Location (If applicable)
Feet ☐ N ☐ S Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
Buffalo County	06	Belvidere

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			0-3	SILT (ML), 5% fine to coarse sand, 5% fine gravel, 10-15% clay, slightly plastic, stiff, 7.5YR 4/4 brown.						M				
			3	POORLY GRADED SAND WITH GRAVEL (SP) to SILTY SAND WITH GRAVEL (SM), fine to coarse, 10-20% silt, 15-20% fine to coarse gravel, 5% cobbles, 10YR 6/6 brownish yellow, medium dense.						M				
1	8	26	5		SP									SS
2	24	56	10	As above.										SS
3	15	36	15	As above, but with boulder at ~12.0-13.5 feet.										SS
			18	POORLY GRADED SAND WITH SILT (SP/SM), 10% silt, 10% fine to medium gravel (angular fragments), 10YR 6/6 brownish yellow, medium dense.						M				
4	18	26	20		SP/SM									SS

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

Signature: David D. Leid

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

State of Wisconsin
Department of Natural Resources

Soil Boring Log Information Supplement
Form 4400-122A 7-91

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

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
5	14	44	26–30	As above, except ~20% silt.										SS
6	15	100/5	30–31	**WEATHERED DOLOMITE BEDROCK**, becomes competent at ~31.0 feet.										SS
RC1	24	NA	32–37											RQD=0 FF=0 Rec=40%
7			37–40											GRAB
8			40–45	Alternating layers (1-2 feet thick) of light brown dolomite and olive brown to olive green silty sandstone.										GRAB
9			45–48											GRAB
			48–50	Olive brown to olive green SILTY SANDSTONE, glauconitic, fine to medium grained.										
10			50–54	Driller notes large fractures at ~53.0 feet, loose air circulation.										GRAB
			54–61	**DOLOMITE**, light brown to gray, highly weathered with alternating layers of olive brown to olive green silty sandstone. Air circulation returns at ~60.0 feet.										
			61–66	Olive brown to olive green Glauconitic SANDSTONE, fine-grained with many silty lenses.										

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

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
			67–86	Olive green glauconitic SANDSTONE, fine grained with many silty lenses.										
				Water at 74.5 feet while drilling.										
RC2	18	NA	76											RQD=0 FF=0 Rec=38%
			86	End of boring at 86.0 feet.										

State of Wisconsin
Department of Natural Resources

Route To:
☒ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☐ Other

Soil Boring Log Information

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Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Dairyland Power 3081.23		STATION6

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
Environmental & Foundation Drilling, Crew Chief: Frank Badula	10/20/94	10/20/94	HSA 6 1/4"

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			717.9 Feet MSL	766.4 Feet MSL	10 1/4 Inches

Boring Location
State Plane 170664.00 N, 1476758.00 E
NE 1/4 of NE 1/4 of Section 19 T 21 N,R 12W
Lat ° ' "
Long ° ' "
Local Grid Location (If applicable)
Feet ☐ N ☐ S Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
Buffalo County	06	Belvidere

Sample Number	Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
				ASPHALT, 3".										
1	4	100/7	1–2	**FILL, SILTY SAND (SM)**, fine to coarse, 25% silt, 15% fine to medium gravel, brownish yellow 10YR 6/6, very dense.						M				SS
2	2	100/2	4	Boulder.						M				SS
3	8	36	6–7	**POORLY GRADED SAND (SP)**, fine to coarse, 0-10% fine gravel, (sandstone fragments), brownish yellow 10YR 6/8, dense, Fluvial.	SP					M				SS
4	14	20	9–10	2" silt lens at ~9.5' and ~10.0'.						M				SS
5	24	32	15–16	6" silt lens at 15.2'.	SP					M				SS
6	26	100/9	20–21							M				SS
			25											

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

Signature	Firm
David O. Reid	RMT 744 Heartland Trail, Madison Wisconsin Tel: 608-831-4444, Fax: 608-831-3334

State of Wisconsin
Department of Natural Resources

Soil Boring Log Information Supplement
Form 4400-122A 7-91

Boring Number **STATION6** Use only as an attachment to Form 4400-122.

Sample Number	Sample Length (In) Recovered	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	Comments
7	10	100/14	26, 27							M				SS
			28, 29	Cobble zone from ~27' to 30'.						M				
8	16	25	30, 31											SS
			32, 33, 34	Mostly fine to coarse sand.						M				
9	24	12	35											SS
			36, 37, 38, 39	12" silt lens at 35.5' - 36.5'.						M				
10	16	100/18	40, 41, 42, 43	**SILTY SAND WITH GRAVEL (SM)**, fine to medium, 20% silt, 10-20% gravel, brownish yellow 10YR 6/8, very dense, Fluvial.	SM					M				SS
11	4	2	44, 45, 46, 47	**SILT (ML)**, 10% clay, 20% fine to coarse sand, and fine gravel, nonplastic, dark brown 7.5YR 5/4, very loose, (Fluvial).	ML					W				SS
12	12	27	48, 49, 50, 51, 52, 53, 54, 55	**SILTY GRAVEL WITH SAND (GM)**, 33% fine to coarse sand, 15% silt, clay, dark brown 7.5YR 5/4, medium dense, Fluvial.	GM					W	NP	NP	18.5	SS KH= 1.6X10 cm/sec
				End of Boring at 55 Ft.										

Attachment 12

Revised Run-On and Run-Off Systems Plan

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
999 Fourier Drive, Suite 101
Madison, Wisconsin 53717

BreAnne Kahnk

BreAnne Kahnk, P.E.
Senior Project Engineer

Todd W. Martin

Todd Martin
Principal Project Manager

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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

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

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

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	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).

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 By:	Date:	CHECKED By:	Date:	PROJECT/PROPOSAL NO.
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-

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

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.

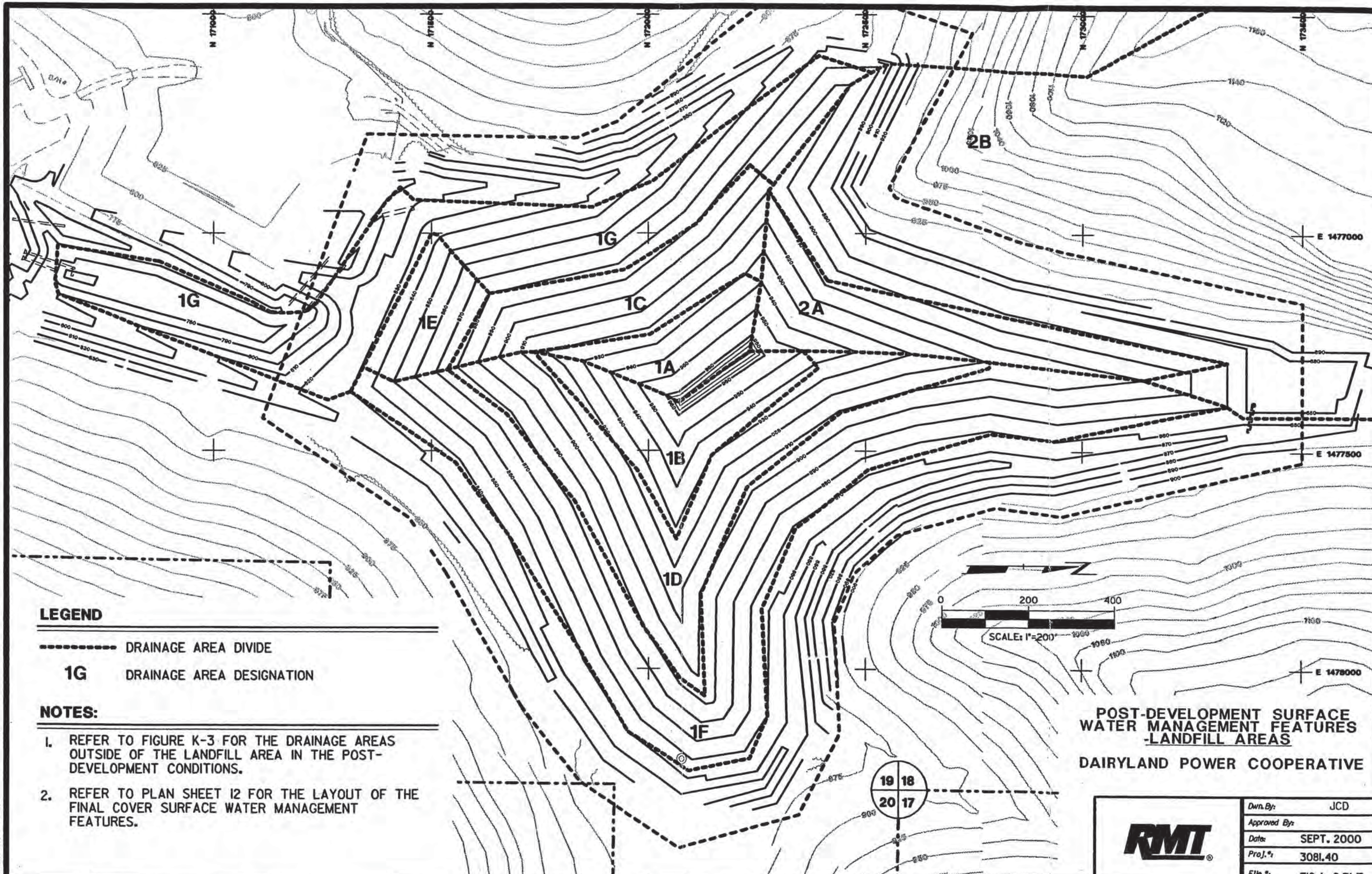
References

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

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

RMT COMPUTER AIDED DESIGN & DRAFTING

FIGURE K-2

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

RUNOFF CURVE NUMBER SUMMARY

::

Subarea Description	Area (acres)	CN (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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Landfill Runoff
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RUNOFF CURVE NUMBER DATA

::

Composite Area: 1A

SURFACE DESCRIPTION	AREA (acres)	CN	
Landfill Cover	1.40	74 ✓	
COMPOSITE AREA --->	1.40	74.0	(74)

::

Composite Area: 1B

SURFACE DESCRIPTION	AREA (acres)	CN	
Landfill Cover	2.20	74 ✓	
COMPOSITE AREA --->	2.20	74.0	(74)

::

Composite Area: 1C

SURFACE DESCRIPTION	AREA (acres)	CN	
Landfill Cover	2.90	74 ✓	
COMPOSITE AREA --->	2.90	74.0	(74)

::

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Composite Area: 1D

SURFACE DESCRIPTION	AREA (acres)	CN	
Landfill Cover	5.30	74	
COMPOSITE AREA --->	5.30	74.0	(74)

Composite Area: 1E

SURFACE DESCRIPTION	AREA (acres)	CN	
Landfill Cover	1.20	74	
COMPOSITE AREA --->	1.20	74.0	(74)

Composite Area: 1F

SURFACE DESCRIPTION	AREA (acres)	CN	
Landfill Cover	9.50	74	
COMPOSITE AREA --->	9.50	74.0	(74)

Composite Area: 1G

SURFACE DESCRIPTION	AREA (acres)	CN	
Landfill Cover	4.40	74	
Sedimentation Basin	3.00	98	
COMPOSITE AREA --->	7.40	83.7	(84)

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Landfill Runoff
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RUNOFF CURVE NUMBER SUMMARY

::

Subarea Description	Area (acres)	CN (weighted)
2A	2.70	74
2B	21.50	69

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Landfill Runoff
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RUNOFF CURVE NUMBER DATA

::

Composite Area: 2A

SURFACE DESCRIPTION	AREA (acres)	CN	
Landfill Cover	2.70	74	
COMPOSITE AREA --->	2.70	74.0	(74)

Composite Area: 2B

SURFACE DESCRIPTION	AREA (acres)	CN	
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)

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)

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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

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Executed: 09:48:41 04-09-1997 a:COVER1.TCT

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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	
$T = \dfrac{.007 * (n*L)^{0.8}}{P2^{0.5} * s^{0.4}}$	hrs	0.13	= 0.13

SHALLOW CONCENTRATED FLOW

Segment ID		2	
Surface (paved or unpaved)?		Unpaved	
Flow length, L	ft	420.0	
Watercourse slope, s	ft/ft	0.0200	
Avg.V = $Csf * (s)^{0.5}$	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	
$V = \dfrac{1.49 * r^{2/3} * s^{1/2}}{n}$	ft/s	0.0000	
Flow length, L	ft	0	
T = L / (3600*V)	hrs	0.00	= 0.00

::

TOTAL TIME (hrs) 0.18

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Feasibility Report
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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	

$$T = \frac{.007 * (n*L)^{0.8}}{P2^{0.5} * s^{0.4}}$$

T =	hrs	0.11	= 0.11

SHALLOW CONCENTRATED FLOW

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

$$Avg.V = Csf * (s)^{0.5}$$ 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

$$V = \frac{1.49 * r^{2/3} * s^{1/2}}{n}$$ ft/s 0.0000

Flow length, L	ft	0	
T = L / (3600*V)	hrs	0.00	= 0.00

::

TOTAL TIME (hrs) 0.23

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

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Feasibility Report
Landfill Final Cover
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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	
$T = \frac{.007 * (n*L)^{0.8}}{P2^{0.5} * s^{0.4}}$	hrs	0.14	= 0.14

SHALLOW CONCENTRATED FLOW

Segment ID		2	
Surface (paved or unpaved)?		Unpaved	
Flow length, L	ft	720.0	
Watercourse slope, s	ft/ft	0.0200	
$Avg.V = Csf * (s)^{0.5}$	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	
$V = \frac{1.49 * r^{2/3} * s^{1/2}}{n}$	ft/s	0.0000	
Flow length, L	ft	0	
T = L / (3600*V)	hrs	0.00	= 0.00

::

TOTAL TIME (hrs) 0.23

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

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Landfill Final Cover
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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	
$T = \dfrac{.007 * (n*L)^{0.8}}{P2^{0.5} * s^{0.4}}$	hrs	0.13	= 0.13

SHALLOW CONCENTRATED FLOW

Segment ID		2	
Surface (paved or unpaved)?		Unpaved	
Flow length, L	ft	1770.0	
Watercourse slope, s	ft/ft	0.0200	
$Avg.V = Csf * (s)^{0.5}$	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	
$V = \dfrac{1.49 * r^{2/3} * s^{1/2}}{n}$	ft/s	0.0000	
Flow length, L	ft	0	
T = L / (3600*V)	hrs	0.00	= 0.00

::

TOTAL TIME (hrs) 0.35

```
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
```

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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

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6/13/97

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	
$T = \frac{.007 * (n*L)^{0.8}}{P2^{0.5} * s^{0.4}}$	hrs	0.13	= 0.13

SHALLOW CONCENTRATED FLOW

Segment ID		2	
Surface (paved or unpaved)?		Unpaved	
Flow length, L	ft	2650.0	
Watercourse slope, s	ft/ft	0.0200	
$Avg.V = Csf * (s)^{0.5}$	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	
$V = \frac{1.49 * r^{2/3} * s^{1/2}}{n}$	ft/s	0.0000	
Flow length, L	ft	0	
T = L / (3600*V)	hrs	0.00	= 0.00

::

TOTAL TIME (hrs) 0.45

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

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Dairyland Power Coop.
Feasibility Report
Landfill Final Cover
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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	

$$T = \frac{.007 * (n*L)^{0.8}}{P2^{0.5} * s^{0.4}}$$ hrs 0.14 = 0.14

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	
Avg.V = Csf * (s)^0.5	ft/s	3.9521	4.5635	
T = L / (3600*V)	hrs	0.05 +	0.02	= 0.08

where: Unpaved Csf = 16.1345
Paved Csf = 20.3282

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	

$$V = \frac{1.49 * r^{2/3} * s^{1/2}}{n}$$ ft/s 0.0000

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

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

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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	
$T = \frac{.007 * (n*L)^{0.8}}{P2^{0.5} * s^{0.4}}$	hrs	0.16	= 0.16

SHALLOW CONCENTRATED FLOW

Segment ID		2	
Surface (paved or unpaved)?		Unpaved	
Flow length, L	ft	940.0	
Watercourse slope, s	ft/ft	0.0200	
$Avg.V = Csf * (s)^{0.5}$	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	
$V = \frac{1.49 * r^{2/3} * s^{1/2}}{n}$	ft/s	0.0000	
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
```

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 Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p 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.

Total Runoff =

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

= 6.2 ac-FT

>>>> Computer Modifications of Input Parameters <<<<<

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p 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.

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 <<<<

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (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

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Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 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 Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 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

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Composite Hydrograph Summary (cfs)

Subarea Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 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 Description	18.0 hr	19.0 hr	20.0 hr	22.0 hr	26.0 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

1 BLB
8/20/98

>>>> Input Parameters Used to Compute Hydrograph <<<<

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p 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.

Total Runoff =

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

= 8.8 ac-FT

>>>> Computer Modifications of Input Parameters <<<<<

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p 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.

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

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (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

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Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 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 Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 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

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
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Composite Hydrograph Summary (cfs)

Subarea Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 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 Description	18.0 hr	19.0 hr	20.0 hr	22.0 hr	26.0 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

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

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Fesibility Study
Landfill Cover
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>>>> Input Parameters Used to Compute Hydrograph <<<<

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p 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 <<<<<

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p 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
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>>>> Summary of Subarea Times to Peak <<<<

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (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 Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 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 Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 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 Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 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 Description	18.0 hr	19.0 hr	20.0 hr	22.0 hr	26.0 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 Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p 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 <<<<<

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p 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 <<<<

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

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

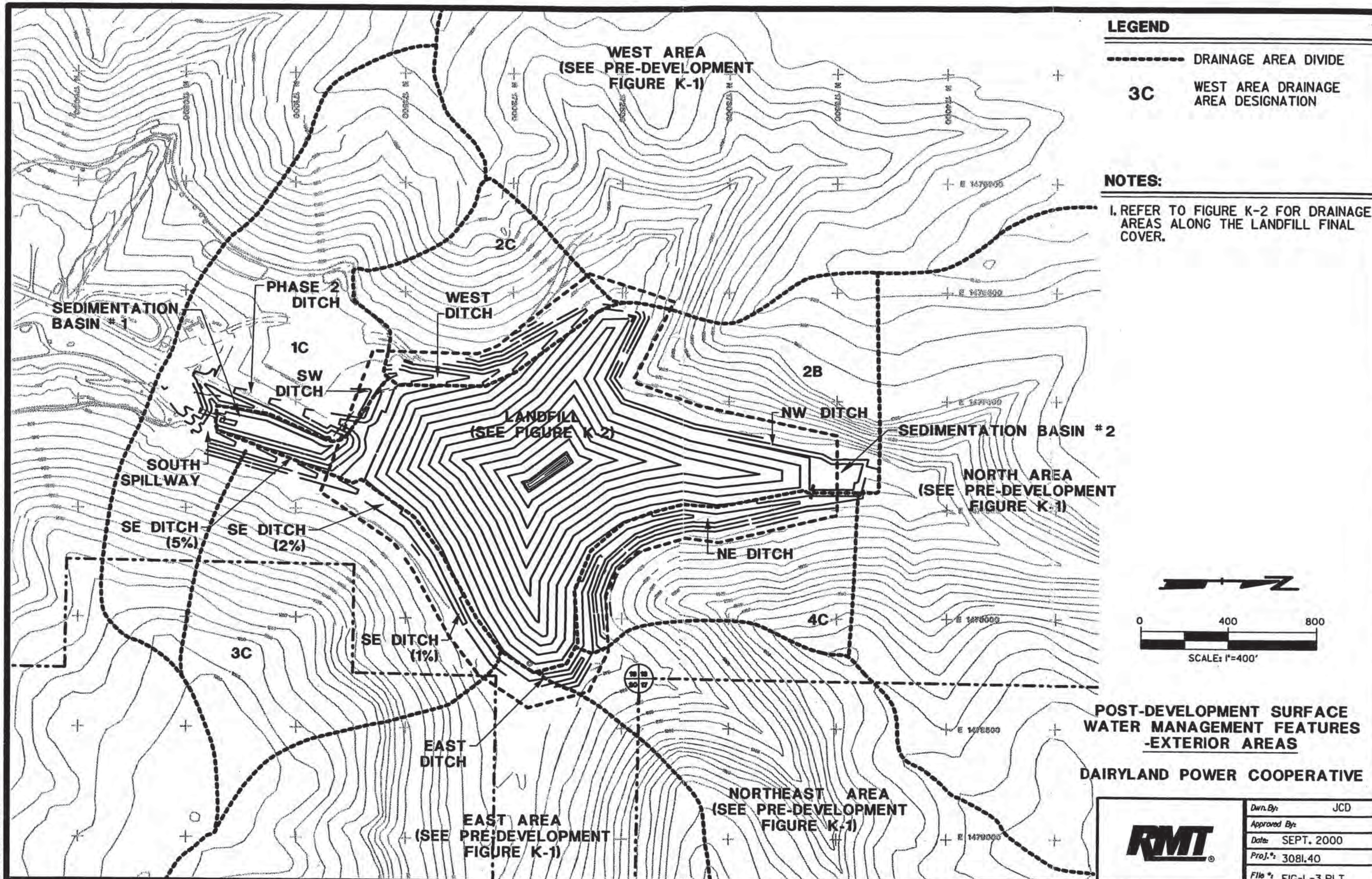
Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 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 Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 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 Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 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 Description	18.0 hr	19.0 hr	20.0 hr	22.0 hr	26.0 hr
2A	0	0	0	0	0
2B	2	2	1	1	0



RMT COMPUTER AIDED DESIGN & DRAFTING

FIGURE K-3

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 Description	Area (acres)	CN (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

SURFACE DESCRIPTION	AREA (acres)	CN	
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

SURFACE DESCRIPTION	AREA (acres)	CN	
Woods (85%)	12.80	55	
Graded Areas (15%)	2.20	61	
COMPOSITE AREA --->	15.00	55.9	(56)

Composite Area: 3C

SURFACE DESCRIPTION	AREA (acres)	CN	
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

SURFACE DESCRIPTION	AREA (acres)	CN	
Woods (75%)	12.00	55	
Graded Areas (25%)	4.00	61	
COMPOSITE AREA --->	16.00	56.5	(57)

Composite Area: East

SURFACE DESCRIPTION	AREA (acres)	CN	
Woods (60%)	312.00	55	
Fallow - Bare Soil (40%)	208.00	86	
COMPOSITE AREA --->	520.00	67.4	(67)

Composite Area: Northeast

SURFACE DESCRIPTION	AREA (acres)	CN	
Woods (75%)	60.00	55	
Fallow - Bare Soil (25%)	20.00	86	
COMPOSITE AREA --->	80.00	62.8	(63)

Composite Area: North

SURFACE DESCRIPTION	AREA (acres)	CN	
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

SURFACE DESCRIPTION	AREA (acres)	CN	
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

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

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                    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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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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                 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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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	
$T = \dfrac{.007 * (n*L)^{0.8}}{P2^{0.5} * s^{0.4}}$	hrs	0.32	= 0.32

SHALLOW CONCENTRATED FLOW

Segment ID		2	
Surface (paved or unpaved)?		Unpaved	
Flow length, L	ft	2000.0	
Watercourse slope, s	ft/ft	0.0700	
Avg.V = Csf * $(s)^{0.5}$	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	
$V = \dfrac{1.49 * r^{2/3} * s^{1/2}}{n}$	ft/s	7.8521	5.9356	
Flow length, L	ft	2500	3000	
T = L / (3600*V)	hrs	0.09 +	0.14	= 0.23

::

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	
$T = \dfrac{.007 * (n*L)^{0.8}}{P2^{0.5} * s^{0.4}}$	hrs	0.27	= 0.27

SHALLOW CONCENTRATED FLOW

Segment ID		2	
Surface (paved or unpaved)?		Unpaved	
Flow length, L	ft	600.0	
Watercourse slope, s	ft/ft	0.0700	
$Avg.V = Csf * (s)^{0.5}$	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	
$V = \dfrac{1.49 * r^{2/3} * s^{1/2}}{n}$	ft/s	%11.1045	
Flow length, L	ft	2400	
T = L / (3600*V)	hrs	0.06	= 0.06

::

TOTAL TIME (hrs) 0.37

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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	
$T = \dfrac{.007 * (n*L)^{0.8}}{P2^{0.5} * s^{0.4}}$	hrs	0.32	= 0.32

SHALLOW CONCENTRATED FLOW

Segment ID		2	
Surface (paved or unpaved)?		Unpaved	
Flow length, L	ft	1000.0	
Watercourse slope, s	ft/ft	0.0600	
$Avg.V = Csf * (s)^{0.5}$	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	
$V = \dfrac{1.49 * r^{2/3} * s^{1/2}}{n}$	ft/s	8.5502	
Flow length, L	ft	4200	
T = L / (3600*V)	hrs	0.14	= 0.14

::

TOTAL TIME (hrs) 0.53

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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
```

Quick TR-55 Ver.5.46 S/N:
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SUMMARY SHEET FOR Tc or Tt COMPUTATIONS
(Solved for Time using TR-55 Methods)

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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

```
Quick TR-55 Ver.5.46   S/N:
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                  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
```

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6/17/97

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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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	

$$T = \frac{.007 * (n*L)^{0.8}}{P2^{0.5} * s^{0.4}}$$ hrs 0.00 = 0.00

SHALLOW CONCENTRATED FLOW

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

$$Avg.V = Csf * (s)^{0.5}$$ 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	
$V = \frac{1.49 * r^{2/3} * s^{1/2}}{n}$	ft/s	6.7868	%16.8040	
Flow length, L	ft	1950	550	
T = L / (3600*V)	hrs	0.08 +	0.01	= 0.09

::

TOTAL TIME (hrs) 0.09

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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		

$$T = \frac{.007 * (n*L)^{0.8}}{P2^{0.5} * s^{0.4}}$$ hrs 0.00 = 0.00

SHALLOW CONCENTRATED FLOW

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

$$Avg.V = Csf * (s)^{0.5}$$ 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	
$V = \frac{1.49 * r^{2/3} * s^{1/2}}{n}$	ft/s	6.7868	X16.8040	
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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                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

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
                                        TOTAL TIME (hrs)         0.09
```

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                     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
```

/ BLB
6/17/97

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 Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p 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 Runoff
= 141.9 ac-ft

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 <<<<<

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p 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.

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 <<<<

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (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 Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 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 Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 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 Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 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 Description	18.0 hr	19.0 hr	20.0 hr	22.0 hr	26.0 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

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 Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p 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

Total Runoff
= 215.7 ac-ft

* 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 <<<<<

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p 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.

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

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

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (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 Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 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 Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 hr
IC	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

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 Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 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 Description	18.0 hr	19.0 hr	20.0 hr	22.0 hr	26.0 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
East	47	42	37	30	0
Northeast	6	6	5	4	0
North	19	17	15	13	0
West	10	8	7	6	0
Total (cfs)	90	80	71	59	0

Executed 09-18-2000 13:11:11

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

File Summary for Composite Hydrograph

Time (hrs)	POSTDV25 (cfs)	BSN1OUT1 (cfs)	BSN2OUT1 (cfs)	TPTPST25 (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 (hrs)	POSTDV25 (cfs)	BSN1OUT1 (cfs)	BSN2OUT1 (cfs)	TPTPST25 (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 (hrs)	POSTDV25 (cfs)	BSN1OUT1 (cfs)	BSN2OUT1 (cfs)	TPTPST25 (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

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

File Summary for Composite Hydrograph

Time (hrs)	POSTDV25 (cfs)	BSN1OUT1 (cfs)	BSN2OUT1 (cfs)	TPTPST25 (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

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File Summary for Composite Hydrograph

Combined Post-Development Hydrograph - 100 yr Storm
Basin 1 +
Basin 2 +
Surrounding Watershed.

Time (hrs)	POSTDV00 (cfs)	BSN1OUT2 (cfs)	BSN2OUT2 (cfs)	TOTPST00 (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

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

File Summary for Composite Hydrograph

Time (hrs)	POSTDV00 (cfs)	BSN1OUT2 (cfs)	BSN2OUT2 (cfs)	TOTPST00 (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

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

File Summary for Composite Hydrograph

Time (hrs)	POSTDV00 (cfs)	BSN1OUT2 (cfs)	BSN2OUT2 (cfs)	TOTPST00 (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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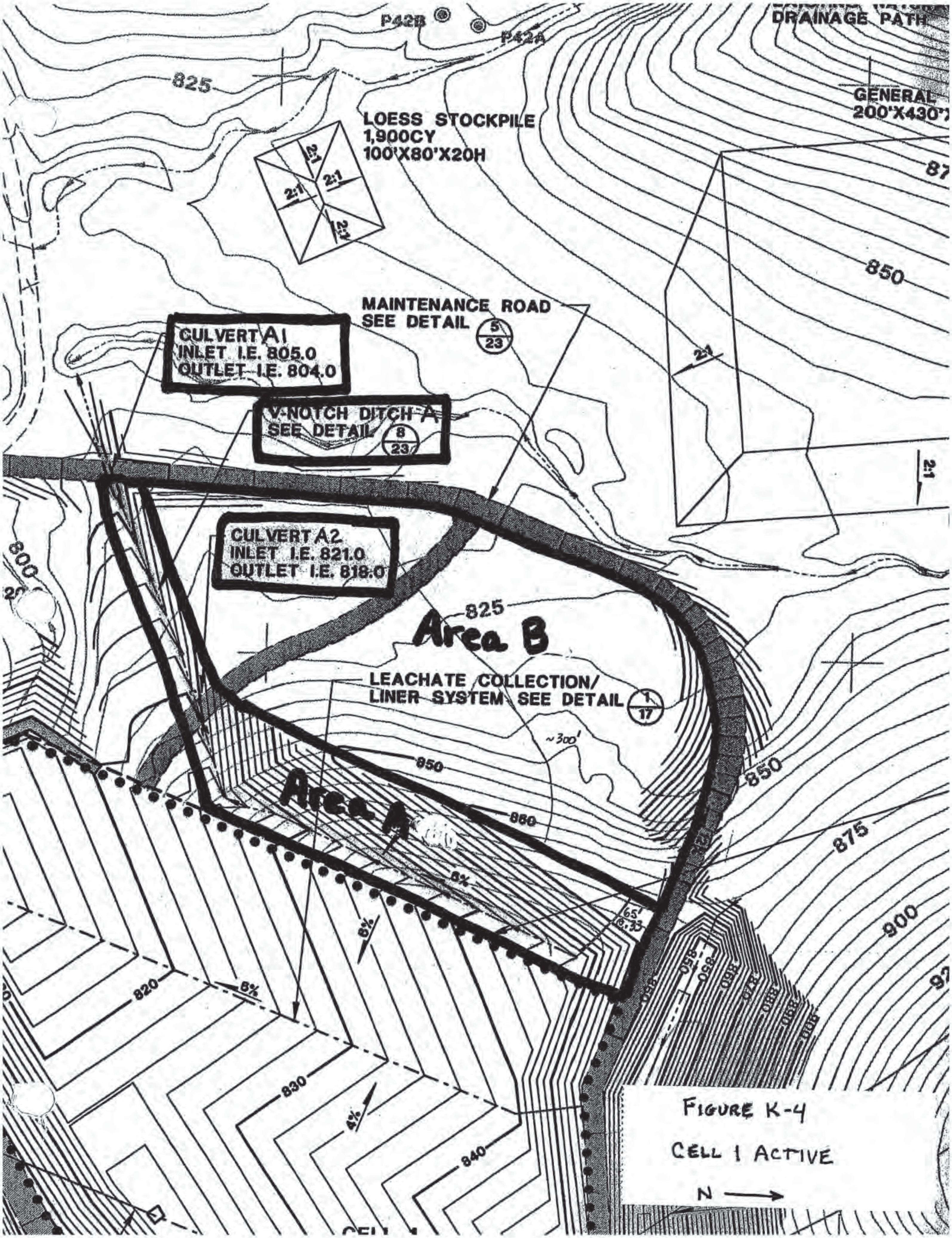
Data directory: p:\data\projects\3081\40\sw*.HYD

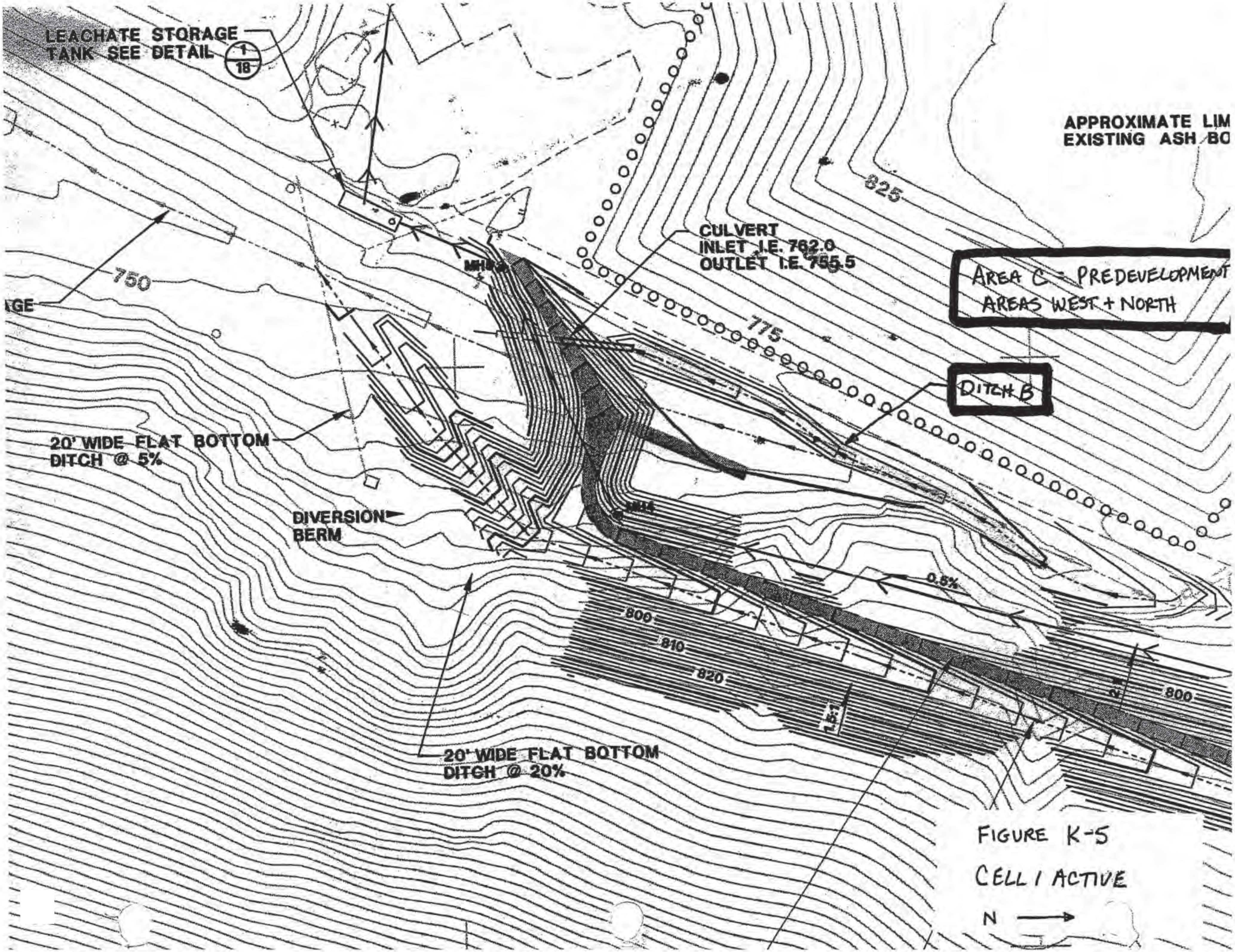
File Summary for Composite Hydrograph

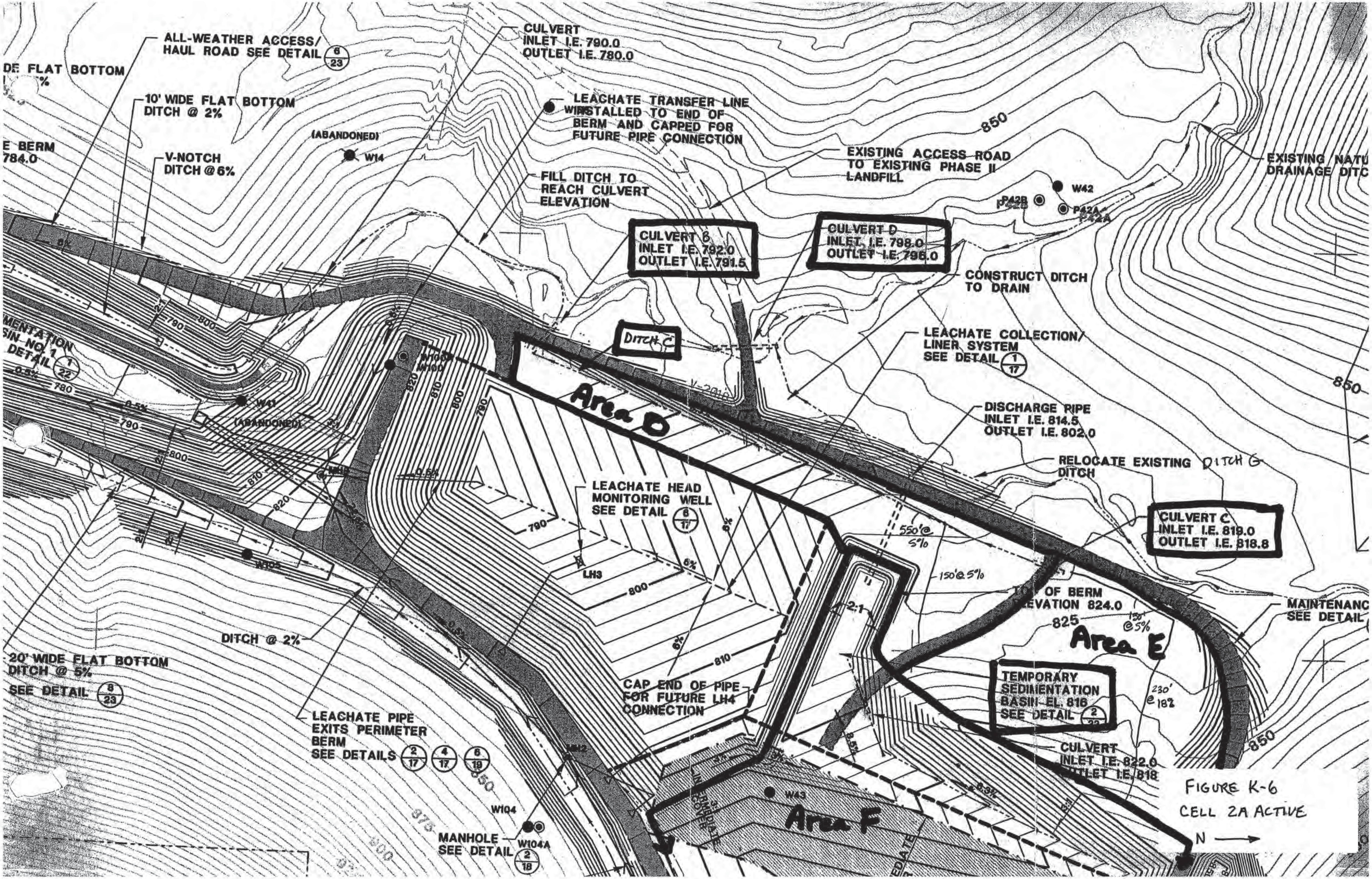
Time (hrs)	POSTDV00 (cfs)	BSN1OUT2 (cfs)	BSN2OUT2 (cfs)	TOTPST00 (Total)
23.20	41.0	1.8	1.0	43.8
23.30	40.0	1.6	1.0	42.6
23.40	38.0	1.5	1.0	40.5
23.50	37.0	1.4	1.0	39.4
23.60	35.0	1.4	1.0	37.3
23.70	34.0	1.3	1.0	36.3
23.80	32.0	1.2	1.0	34.2
23.90	31.0	1.2	1.0	33.2
24.00	30.0	1.2	0.9	32.1
24.10	28.0	1.1	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

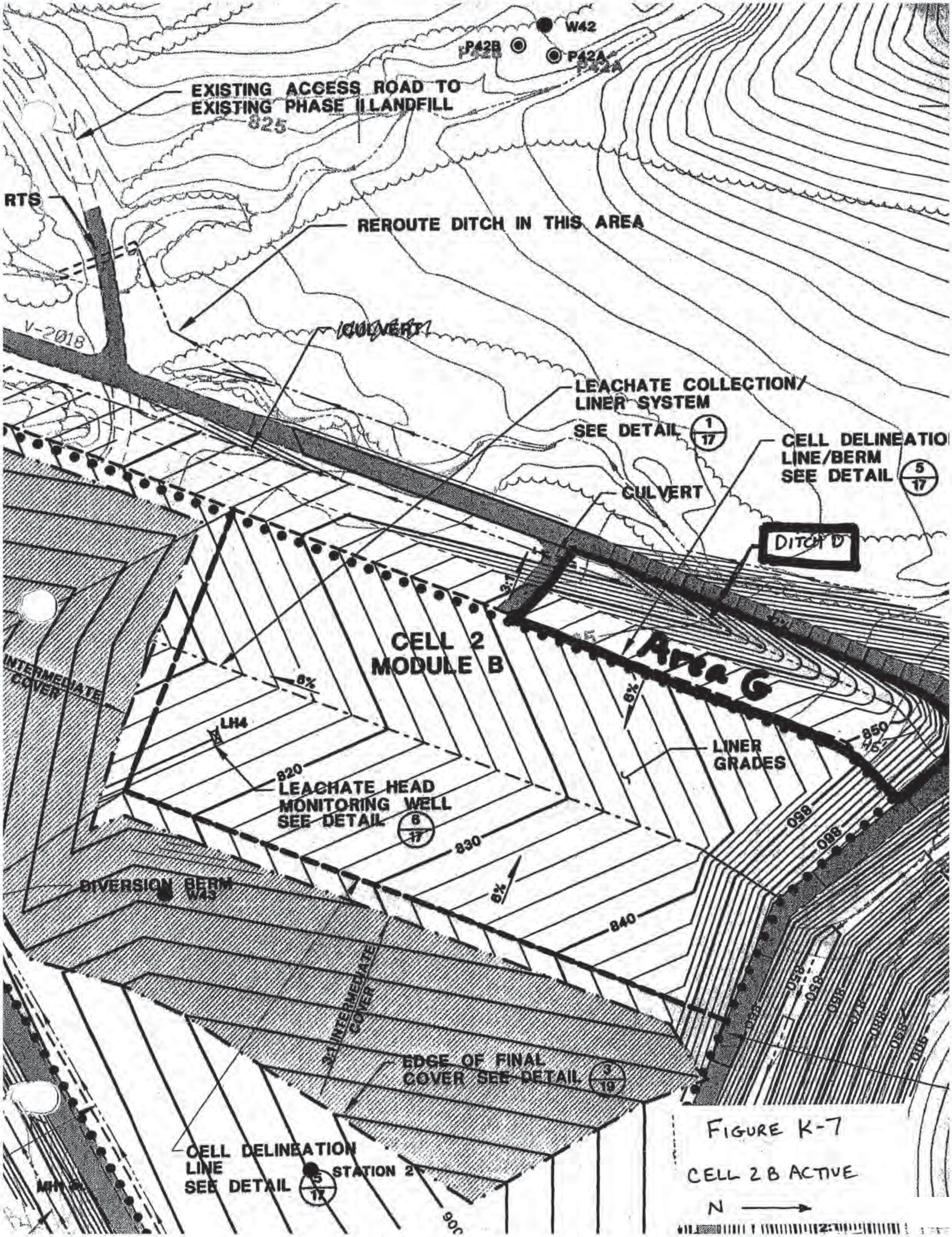


DRAINAGE PATH
P42B
P42A
825
LOESS STOCKPILE
1,900CY
100'X80'X20H
2:1
GENERAL
200'X430'
850
MAINTENANCE ROAD
SEE DETAIL 5/23
CULVERT A1
INLET I.E. 805.0
OUTLET I.E. 804.0
V-NOTCH DITCH A
SEE DETAIL 8/23
CULVERT A2
INLET I.E. 821.0
OUTLET I.E. 818.0
800
825
Area B
LEACHATE COLLECTION/
LINER SYSTEM SEE DETAIL 1/17
~300'
850
Area A
860
875
8%
65'
6.33
900
820
830
840
4%
FIGURE K-4
CELL 1 ACTIVE
N


LEACHATE STORAGE
TANK SEE DETAIL 1/18
APPROXIMATE LIM
EXISTING ASH BO
825
CULVERT
INLET I.E. 762.0
OUTLET I.E. 755.5
AREA C = PREDEVELOPMENT
AREAS WEST + NORTH
775
DITCH B
750
GE
MH
20' WIDE FLAT BOTTOM
DITCH @ 5%
DIVERSION
BERM
0.5%
800
810
820
800
20' WIDE FLAT BOTTOM
DITCH @ 20%
FIGURE K-5
CELL I ACTIVE
N



CULVERT
INLET I.E. 790.0
OUTLET I.E. 780.0
ALL-WEATHER ACCESS/
HAUL ROAD SEE DETAIL 6/23
10' WIDE FLAT BOTTOM
DITCH @ 2%
V-NOTCH
DITCH @ 6%
(ABANDONED)
W14
LEACHATE TRANSFER LINE
INSTALLED TO END OF
BERM AND CAPPED FOR
FUTURE PIPE CONNECTION
FILL DITCH TO
REACH CULVERT
ELEVATION
EXISTING ACCESS ROAD
TO EXISTING PHASE II
LANDFILL
850
W42
P42B
P42A
CULVERT B
INLET I.E. 792.0
OUTLET I.E. 791.5
CULVERT D
INLET I.E. 798.0
OUTLET I.E. 796.0
CONSTRUCT DITCH
TO DRAIN
DITCH C
LEACHATE COLLECTION/
LINER SYSTEM
SEE DETAIL 1/17
W41
(ABANDONED)
Area D
DISCHARGE PIPE
INLET I.E. 814.5
OUTLET I.E. 802.0
RELOCATE EXISTING DITCH G
DITCH
LEACHATE HEAD
MONITORING WELL
SEE DETAIL 6/17
LH3
790
800
810
CULVERT C
INLET I.E. 819.0
OUTLET I.E. 818.8
550'@ 5%
150'@ 5%
TOP OF BERM
ELEVATION 824.0
825
Area E
MAINTENANC
SEE DETAIL
W102
DITCH @ 2%
20' WIDE FLAT BOTTOM
DITCH @ 5%
SEE DETAIL 8/23
CAP END OF PIPE
FOR FUTURE LH4
CONNECTION
TEMPORARY
SEDIMENTATION
BASIN EL. 816
SEE DETAIL 2/22
LEACHATE PIPE
EXITS PERIMETER
BERM
SEE DETAILS 2/17 4/17 6/19
CULVERT
INLET I.E. 822.0
OUTLET I.E. 818
W43
Area F
W104
MANHOLE
SEE DETAIL 2/18
W104A
FIGURE K-6
CELL 2A ACTIVE
N →


W42
P42B
P42A
EXISTING ACCESS ROAD TO
EXISTING PHASE II LANDFILL
825
RTS
REROUTE DITCH IN THIS AREA
V-2018
CULVERT
LEACHATE COLLECTION/
LINER SYSTEM
SEE DETAIL 1/17
CELL DELINEATIO
LINE/BERM
SEE DETAIL 5/17
CULVERT
DITCH D
CELL 2
MODULE B
Area G
INTERMEDIATE COVER
8%
LH4
820
LEACHATE HEAD
MONITORING WELL
SEE DETAIL 6/17
LINER
GRADES
850
830
840
860
DIVERSION BERM
W43
INTERMEDIATE COVER
EDGE OF FINAL
COVER SEE DETAIL 3/19
CELL DELINEATION
LINE
SEE DETAIL 5/17
STATION 2
900
FIGURE K-7
CELL 2B ACTIVE
N

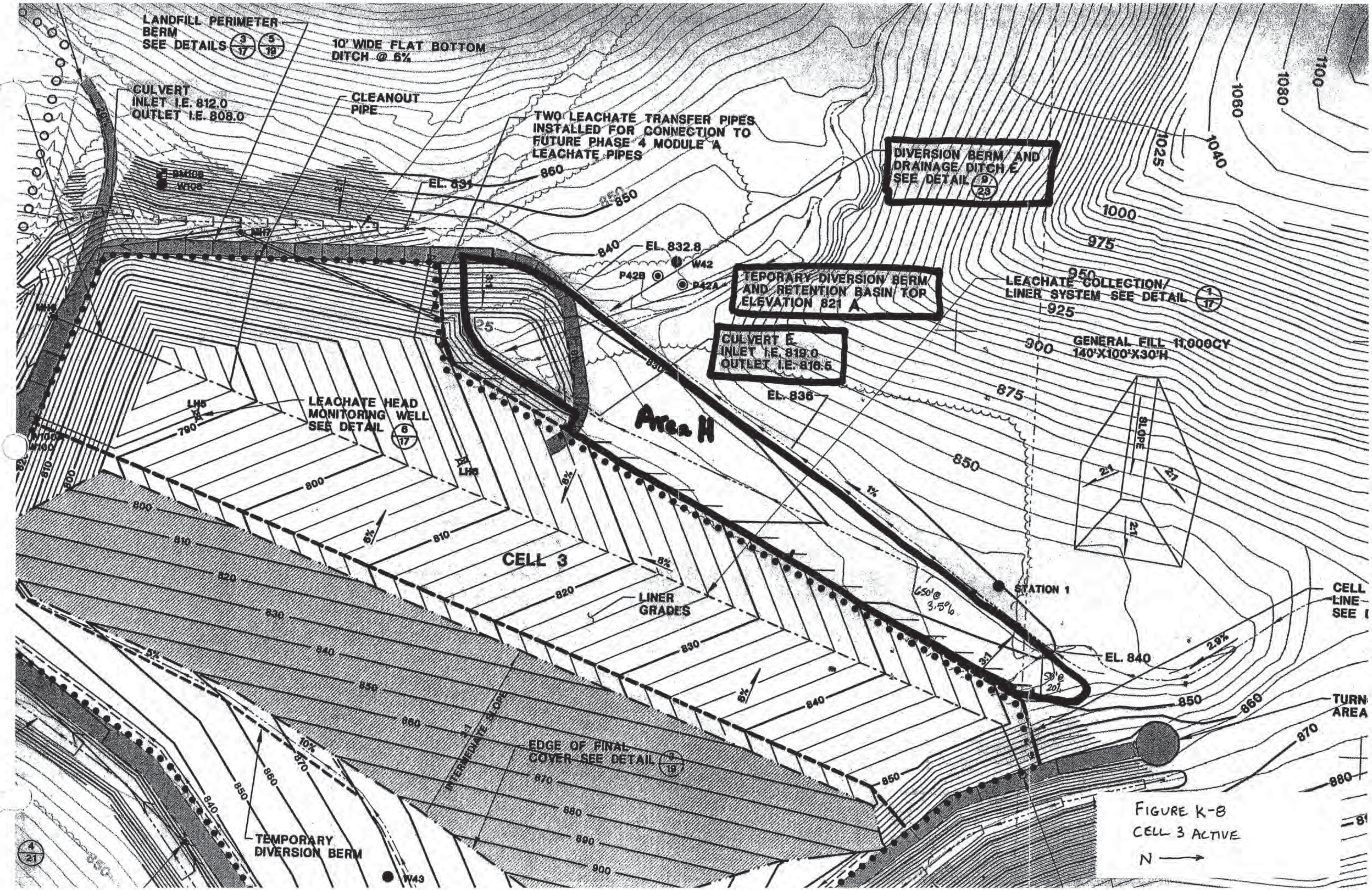


FIGURE K-8
CELL 3 ACTIVE
N →

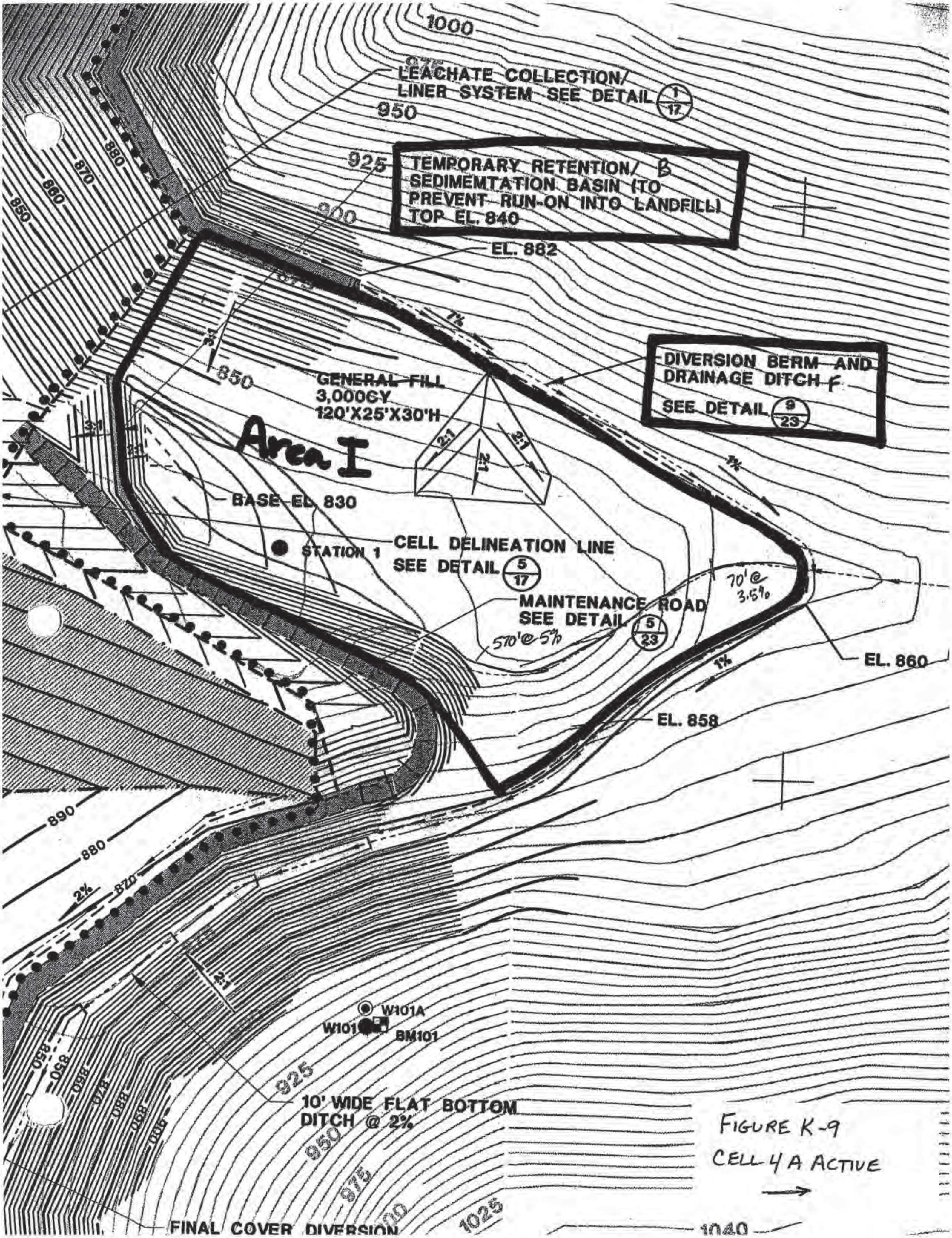


FIGURE K-9
CELL 4 A ACTIVE

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	
$T = \dfrac{.007 * (n*L)^{0.8}}{P2^{0.5} * s^{0.4}}$	hrs	0.18	= 0.18

SHALLOW CONCENTRATED FLOW

Segment ID		2	
Surface (paved or unpaved)?		Unpaved	
Flow length, L	ft	220.0	
Watercourse slope, s	ft/ft	0.0200	
$Avg.V = Csf * (s)^{0.5}$	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	
$V = \dfrac{1.49 * r^{2/3} * s^{1/2}}{n}$	ft/s	0.0000	
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:
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 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:
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 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 Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p 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 <<<<<

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p 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 <<<<

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (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 Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p 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 <<<<<

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p 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 <<<<

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (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 Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p 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 <<<<<

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p 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 <<<<

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (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 Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p 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 <<<<<

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p 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 <<<<

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (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 Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p 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 <<<<<

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p 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 <<<<

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (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 Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p 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 Description	Tc (hr)	* Tt (hr)	Tc (hr)	* Tt (hr)	Interpolated (Yes/No)	Ia/p 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 <<<<

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (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	84	88
		Good	65	75 =77	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:

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

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

[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.

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.

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.

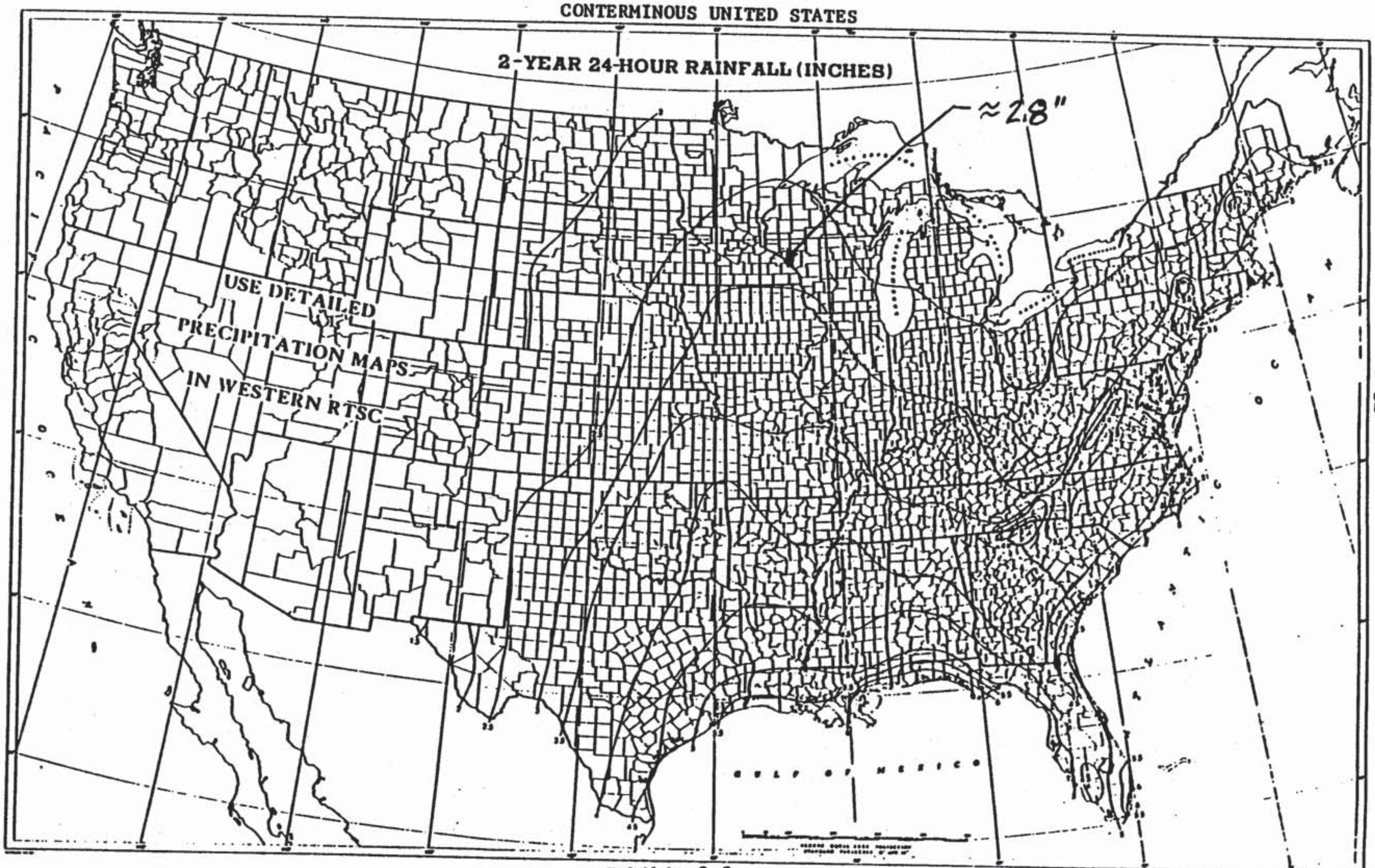
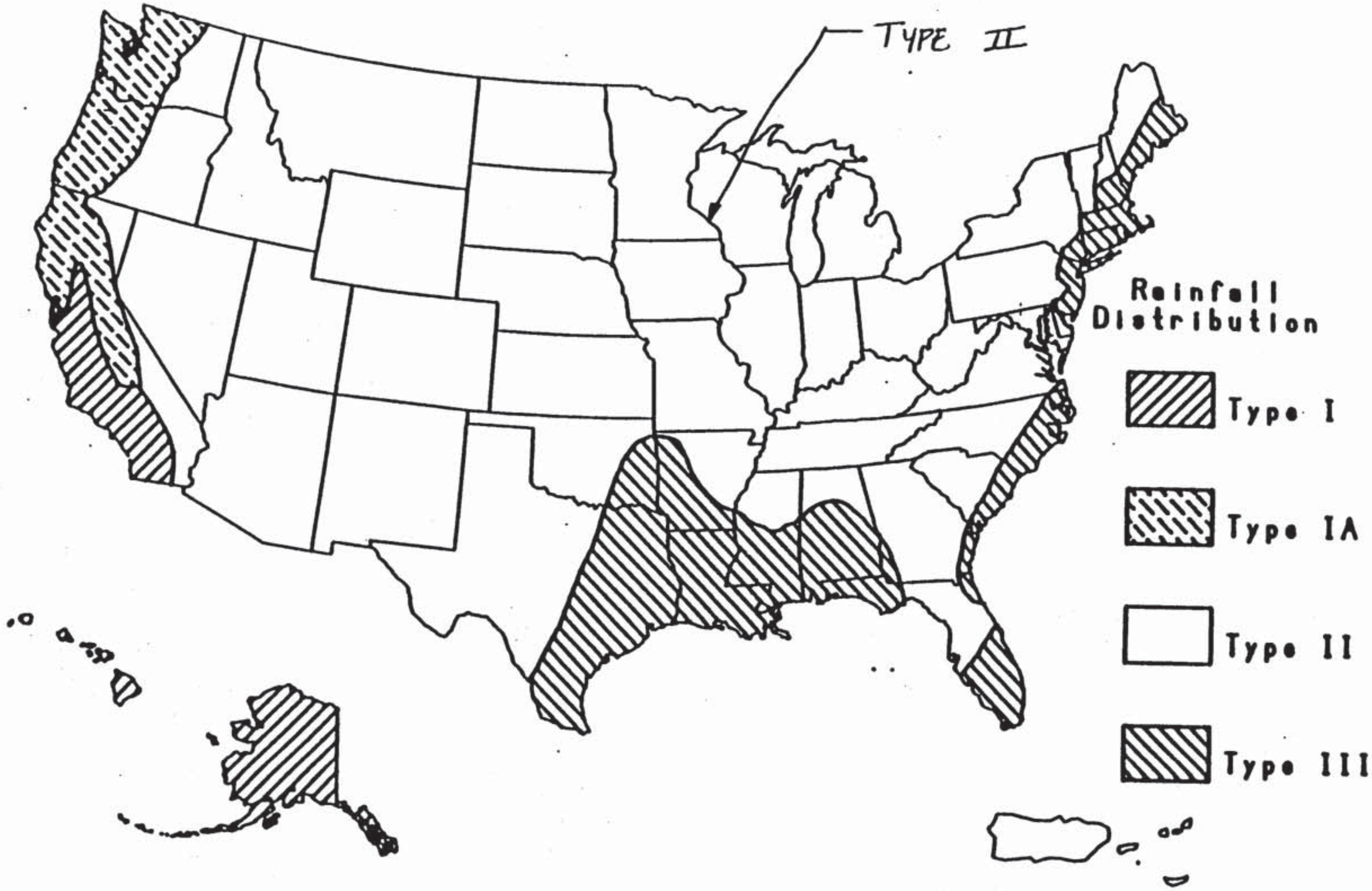


Exhibit 2-3
Sheet 1 of 5

Prepared by U. S. Weather Bureau

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

RMT®

744 Heartland Trail (53717-8923) P. O. Box 8923 (53708-8923) Madison, WI (608) 831-4444 FAX: (608) 831-3334 VOICE: (608) 831-1989

COMPUTATION SHEET

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.

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 By:	Date:	CHECKED By:	Date:	PROJECT/PROPOSAL NO.
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.

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			3081.40

References

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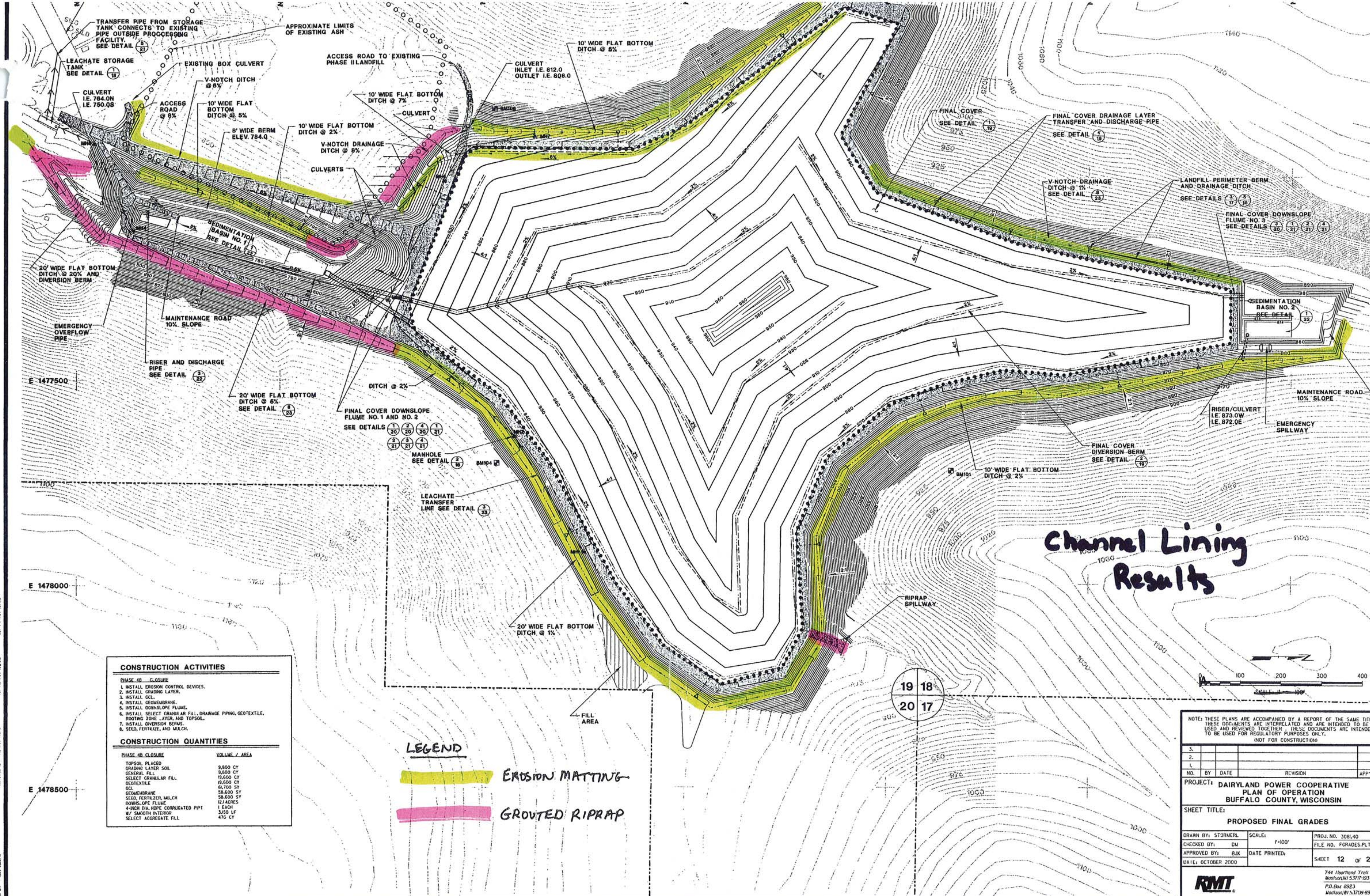

CONSTRUCTION ACTIVITIES

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, FERTILIZER, 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

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		✓BJF 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		√PGK 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		VOK 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 = (Bisection method until Va=Vb)	**1.071**	ft 0.9' freeboard
B. Channel flow area, Ac = (.5*Z1*D^2) + (B*D) + (.5*Z2*D^2)	2.870	sq ft
C. Wetted Perimeter, Pw = (D*(Z1^2+1)^.5) + B + (D*(Z2^2+1)^.5)	5.784	ft
D. Hydraulic radius, Rh = (Ac/Pw)	0.496	ft
E. Velocity and hydraulic radius, VR = (Va * Rh)	2.593	sfps
F. Channel flow Manning's coeff, nc = 0	0.051	
G. Trial velocity, Va = (Q/Ac)	5.226	fps
H. Resultant velocity, Vb = (1.49/nc) * (Rh^.667) * (S^.5)	**5.226**	fps > 4fps

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		VPJJK 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 = 0.992 ft 1' freeboard
(Bisection method until Va=Vb)

B. Channel flow area, Ac = 2.459 sq ft
(.5*Z1*D^2) + (B*D) + (.5*Z2*D^2)

C. Wetted Perimeter, Pw = 5.353 ft
(D*(Z1^2+1)^.5) + B + (D*(Z2^2+1)^.5)

D. Hydraulic radius, Rh = 0.459 ft
(Ac/Pw)

E. Velocity and hydraulic radius, VR = 2.802 sfps
(Va * Rh)

F. Channel flow Manning's coeff, nc = 0.041
0

G. Trial velocity, Va = 6.101 fps
(Q/Ac)

H. Resultant velocity, Vb = 6.101 fps > 4 fps
(1.49/nc) * (Rh^.667) * (S^.5)

use permanent erosion matting

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

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

Lining Type	Growth Habit	Veg. Den	Manning Coefficient	Permissible Shear (lb/sf)	Calculated Shear (lb/sf)	Safety Factor	Remark	
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		VØL 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 = (Bisection method until Va=Vb)	**2.593**	**ft** 0.4' freeboard
B. Channel flow area, Ac = (.5*Z1*D^2) + (B*D) + (.5*Z2*D^2)	16.814	sq ft
C. Wetted Perimeter, Pw = (D*(Z1^2+1)^.5) + B + (D*(Z2^2+1)^.5)	14.000	ft
D. Hydraulic radius, Rh = (Ac/Pw)	1.201	ft
E. Velocity and hydraulic radius, VR = (Va * Rh)	5.214	sfps
F. Channel flow Manning's coeff, nc = 0	0.039	
G. Trial velocity, Va = (Q/Ac)	4.342	fps
H. Resultant velocity, Vb = (1.49/nc) * (Rh^.667) * (S^.5)	**4.341**	**fps** > 4 fps

use permanent erosion matting

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

RMT, Inc.
Grass Channel Sizing Calculations

Site:	Dairyland Power Corp.	Date:	31-July-98
Project #:	3081.33	User:	SRC
Channel:	Ditch (1%)		
	Area 2B		✓ 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 = (Bisection method until Va=Vb)	2.512 ft 0.5' freeboard
B. Channel flow area, Ac = (.5*Z1*D^2) + (B*D) + (.5*Z2*D^2)	15.774 sq ft
C. Wetted Perimeter, Pw = (D*(Z1^2+1)^.5) + B + (D*(Z2^2+1)^.5)	13.560 ft
D. Hydraulic radius, Rh = (Ac/Pw)	1.163 ft
E. Velocity and hydraulic radius, VR = (Va * Rh)	5.383 sfps
F. Channel flow Manning's coeff, nc = 0	0.036
G. Trial velocity, Va = (Q/Ac)	4.628 fps
H. Resultant velocity, Vb = (1.49/nc) * (Rh^.667) * (S^.5)	4.627 fps > 4 fps

use permanent erosion matting

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

√BKB
10/6/98

****

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

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

Lining Type	Growth Habit	Veg. Den	Manning Coefficient	Permissible Shear (lb/sf)	Calculated Shear (lb/sf)	Safety Factor	Remark
P300			0.049	8.00	1.77	4.52	STABLE ✓

Staple E
Phase 3 (Mature Vegetation)

COMPUTATION SHEET

RMT Inc.
744 Heartland Trail P.O. Box 8923 Madison, WI 53708-8923 (608) 831-4444 FAX: (608) 831-3334 VOICE: (608) 831-1989

PROJECT / PROPOSAL NAME	PREPARED		CHECKED		PROJECT / PROPOSAL NO.
DAIRYLAND POWER COOP.	By: BJK	Date: 5/9/97	By: BLG	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)

COMPUTATION SHEET

RMT Inc.
744 Heartland Trail P.O. Box 8923 Madison, WI 53708-8923 (608) 831-4444 FAX: (608) 831-3334 VOICE: (608) 831-1989

PROJECT / PROPOSAL NAME	PREPARED		CHECKED		PROJECT / PROPOSAL NO.
DAIRYLAND POWER COOP	By: BJK	Date:	By: [illegible]	Date: 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 ~ 1.3%
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)

RMT
744 Heartland Trail
Madison, WI 53717-1934
Tel. (608) 831-4444 • Fax (608) 831-3334

PROJECT / PROPOSAL NAME / LOCATION:		PROJECT / PROPOSAL NO.
SUBJECT: Dairyland Power Coop		3081.40
PREPARED BY: BJK	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

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

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:

The information presented herein is for general information only. While every effort has been made to ensure its accuracy, this information should not be used for a specific application without independent professional examination and verification of its suitability, applicability and accuracy.

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

EC-Design 2000 Channel Analysis Report

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:

	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	0.0260	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 Veleocity (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

EC-Design 2000 Channel Analysis Report

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) 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:	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:

	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	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:

	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	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	Velocity Max. Allowed	Velocity Safety Factor	Shear Stress (lbs/sqft) Actual	Shear Stress Max. Allowed	Shear Stress 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) 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:	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	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	6.5	23.3	3.6	2.8	9.4	3.3	2.8325	323.0	Yes
	Bottom:	PYRAMAT	0.0280	7.3	23.3	3.2	3.5	9.4	2.7			
	Right:	PYRAMAT	0.0280	6.5	23.3	3.6	2.8	9.4	3.3			
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 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:	Flow\Velocity:	Channel Geometry:
Designed By: **FLOW**	Discharge (cfs): **323.00**	Bed Slope (ft/ft): **0.05000**
	Flow Duration (hrs): **1.00**	Req. Freeboard (ft): **0.00**
Channel Side Slopes:	Average Velocity (ft/s): **0.00**	Channel Length (ft): **240.00**
Left Slope (xH:1V): **2.00**		Bottom Width (ft): **10.00**
Right Slope (xH:1V): **2.00**		Channel Depth (ft): **4.00**

Channel Bend:	Vegetation:	Soil Filled:
Channel Bend: **No**	Vegetated: **Yes**	Soil Filled: **No**
Bend Radius (ft): **0.00**	Vegetation Class: **C**	
Outside Bend:		

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 Velocity (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

EC-Design 2000 Channel Analysis Report

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 Max. Allowed	Velocity Safety Factor	Shear Stress (lbs/sqft) Actual	Shear Stress 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 Velocity (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	Velocity Max. Allowed	Velocity Safety Factor	Shear Stress (lbs/sqft) Actual	Shear Stress Max. Allowed	Shear Stress Safety Factor	Flow Depth (ft)	Discharge (cfs)	OK?
	Left:	LANDLOK TRM	0.0250	4.7	16.5	3.5	6.3	4.7	0.8			
Analysis #1	Bottom:	LANDLOK TRM	0.0250	4.6	16.5	3.5	6.2	4.7	0.8	1.2450	15.0	No
	Right:	LANDLOK TRM	0.0250	4.7	16.5	3.5	6.3	4.7	0.8			
	Left:	LANDLOK TRM	0.0250	4.7	16.8	3.6	6.3	6.5	1.0			
Analysis #2	Bottom:	LANDLOK TRM	0.0250	4.6	16.8	3.6	6.2	6.5	1.1	1.2450	15.0	No
	Right:	LANDLOK TRM	0.0250	4.7	16.8	3.6	6.3	6.5	1.0			
	Left:	PYRAMAT	0.0280	4.7	23.3	5.0	6.3	9.4	1.5			
Analysis #3	Bottom:	PYRAMAT	0.0280	4.7	23.3	5.0	6.2	9.4	1.5	1.2502	15.0	Yes
	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

EC-Design 2000 Channel Analysis Report

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) 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	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

EC-Design 2000 Channel Analysis Report

Suggested Vegetation for: La Crosse,WI

Species	Scentific Name	Retardance Class	Seed Rate (lbs/ac)	Height at Maturity (in)	Recommended Planting Dates
All Season Grasses					
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

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	~~583~~ 561 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	~~583~~ 561 CFS[1] ✓	1%	10' FLAT
DITCH F	CELL 4A ACTIVE	~~433~~ 373 CFS[2]	1%	10' FLAT
DITCH G	CELL 2A ACTIVE	360 CFS[4]		

NOTES
1. FLOWS FROM PREDEVELOPMENT AREAS NORTH + WEST (See p. 95) @ 12.6 hrs
2. FLOWS FROM PREDEVELOPMENT AREAS NORTH + 2B @ 12.6 HRS (See p. 66/95)
3. PERMANANT DITCHES SIZED UNDER POST-DEVELOPMENT CALCULATIONS.
4. FLOW FROM PREDEVELOPMENT ~~AR~~ AREA NORTH (See p. 95)

SW DITCH	CELL 2A ACTIVE	561 CFS[1]	5%	10' FLAT

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

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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) 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	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 Veleocity (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 - for Type "D" Veg. Retardence	2	

II. Peak Flow Calculations.

A. Trial flow depth, D = (Bisection method until Va=Vb)	**0.550**	**ft**
B. Channel flow area, Ac = (.5*Z1*D^2) + (B*D) + (.5*Z2*D^2)	2.870	sq ft
C. Wetted Perimeter, Pw = (D*(Z1^2+1)^.5) + B + (D*(Z2^2+1)^.5)	10.549	ft
D. Hydraulic radius, Rh = (Ac/Pw)	0.272	ft
E. Velocity and hydraulic radius, VR = (Va * Rh)	0.569	sfps
F. Channel flow Manning's coeff, nc = 0	0.075	
G. Trial velocity, Va = (Q/Ac)	2.091	fps
H. Resultant velocity, Vb = (1.49/nc) * (Rh^.667) * (S^.5)	**2.091**	**fps** ✓OK

Invoke Solution Macro by typing - 'ctrl' D

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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:		Flow\Velocity:		Channel Geometry:	
Designed By:	**FLOW**	Discharge (cfs):	**583.00**	Bed Slope (ft/ft):	**0.01000**
Channel Side Slopes:		Flow Duration (hrs):	**1.00**	Req. Freeboard (ft):	**0.00**
Left Slope (xH:1V):	**3.00**	Average Velocity (ft/s):	**0.00**	Channel Length (ft):	**1000.0**
Right Slope (xH:1V):	**10.00**			Bottom Width (ft):	**10.00**
				Channel Depth (ft):	**3.00**
Channel Bend:		**Vegetation:**		**Soil Filled:**	
Channel Bend:	**No**	Vegetated:	**No**	Soil Filled:	**Yes**
Bend Radius (ft):	**0.00**	Vegetation Class:			
Outside Bend:					
Factor of Safety:	**1.00**			**Functional Longevity:**	**60**

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**	**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:

	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	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) Computed	Max Allowed	Safety Factor	Shear Stress (lbs/sqft) 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

Project 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) Computed	Velocity (ft/s) Max Allowed	Velocity (ft/s) Safety Factor	Shear Stress (lbs/sqft) Computed	Shear Stress (lbs/sqft) Max Allowed	Shear Stress (lbs/sqft) 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

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: 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

Left (H:1 V)	2.000
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) Computed	Velocity Max Allowed	Velocity Safety Factor	Shear Stress (lbs/sqft) Computed	Shear Stress Max Allowed	Shear Stress 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) Computed	Velocity (ft/s) Max Allowed	Velocity (ft/s) Safety Factor	Shear Stress (lbs/sqft) Computed	Shear Stress (lbs/sqft) Max Allowed	Shear Stress (lbs/sqft) Safety Factor
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

Avg. Flow Depth (ft) 2.040

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

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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.

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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

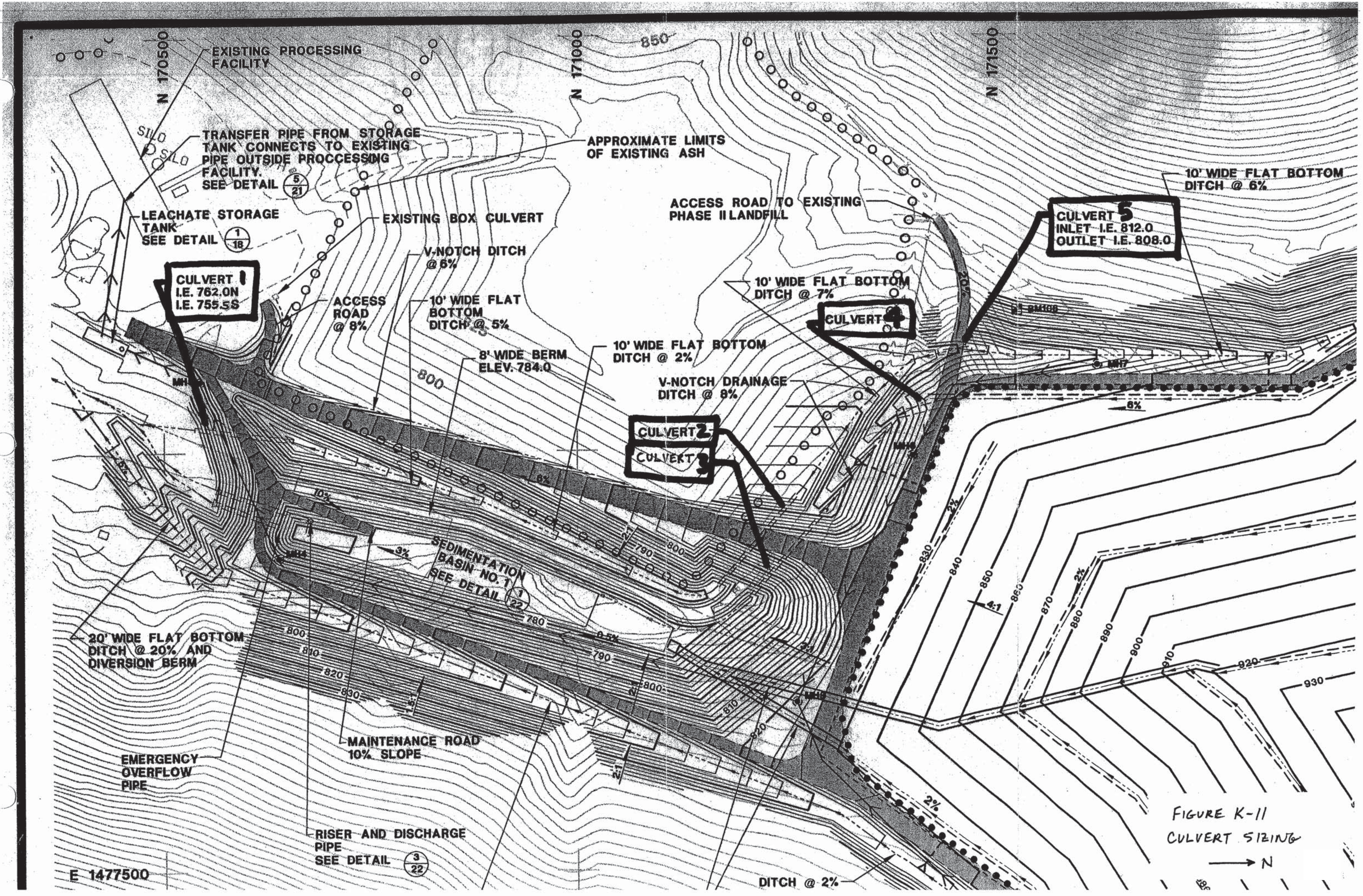
Note:
Culvert lengths to be adjusted based on available culvert section lengths.

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.



N 170500
N 171000
N 171500
850
EXISTING PROCESSING FACILITY
SILO
SILO
TRANSFER PIPE FROM STORAGE TANK CONNECTS TO EXISTING PIPE OUTSIDE PROCCESSING FACILITY. SEE DETAIL 5/21
APPROXIMATE LIMITS OF EXISTING ASH
ACCESS ROAD TO EXISTING PHASE II LANDFILL
10' WIDE FLAT BOTTOM DITCH @ 6%
CULVERT 5
INLET I.E. 812.0
OUTLET I.E. 808.0
LEACHATE STORAGE TANK SEE DETAIL 1/18
EXISTING BOX CULVERT
V-NOTCH DITCH @ 6%
CULVERT 1
I.E. 762.0N
I.E. 755.5S
ACCESS ROAD @ 8%
10' WIDE FLAT BOTTOM DITCH @ 5%
10' WIDE FLAT BOTTOM DITCH @ 7%
CULVERT 4
8' WIDE BERM ELEV. 784.0
10' WIDE FLAT BOTTOM DITCH @ 2%
V-NOTCH DRAINAGE DITCH @ 8%
800
CULVERT 2
CULVERT 3
SEDIMENTATION BASIN NO. 1 SEE DETAIL 1/22
20' WIDE FLAT BOTTOM DITCH @ 20% AND DIVERSION BERM
MAINTENANCE ROAD 10% SLOPE
EMERGENCY OVERFLOW PIPE
RISER AND DISCHARGE PIPE SEE DETAIL 3/22
E 1477500
DITCH @ 2%
FIGURE K-11
CULVERT SIZING
→ N

Calculations – Post-closure Landfill Conditions

COMPUTATION SHEET

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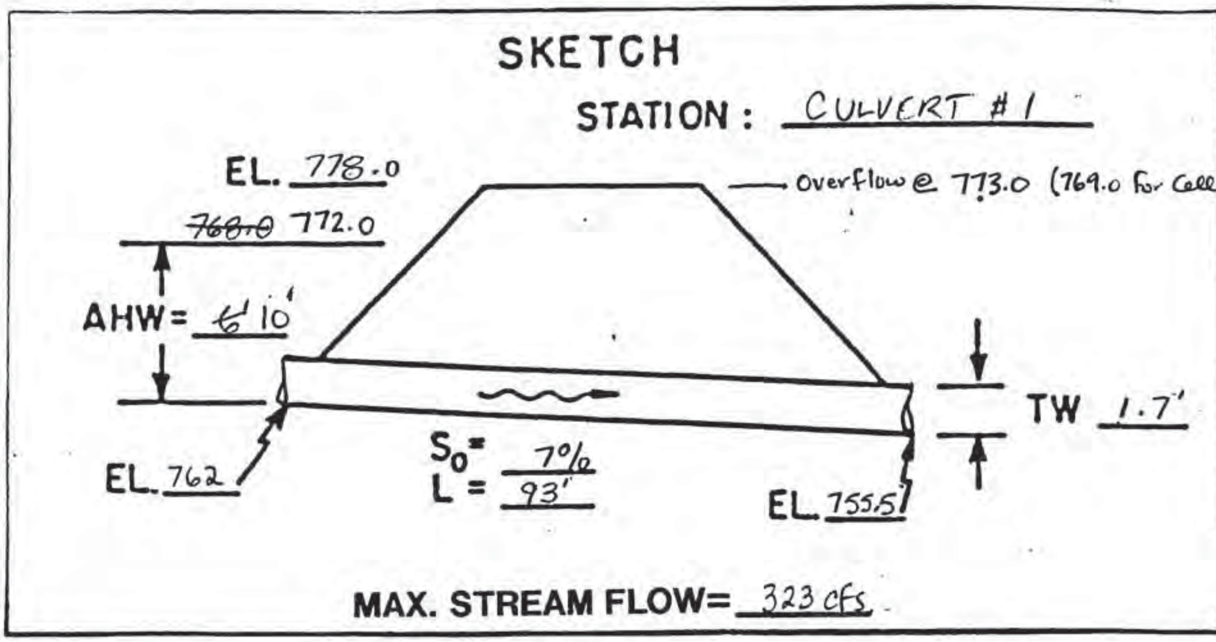
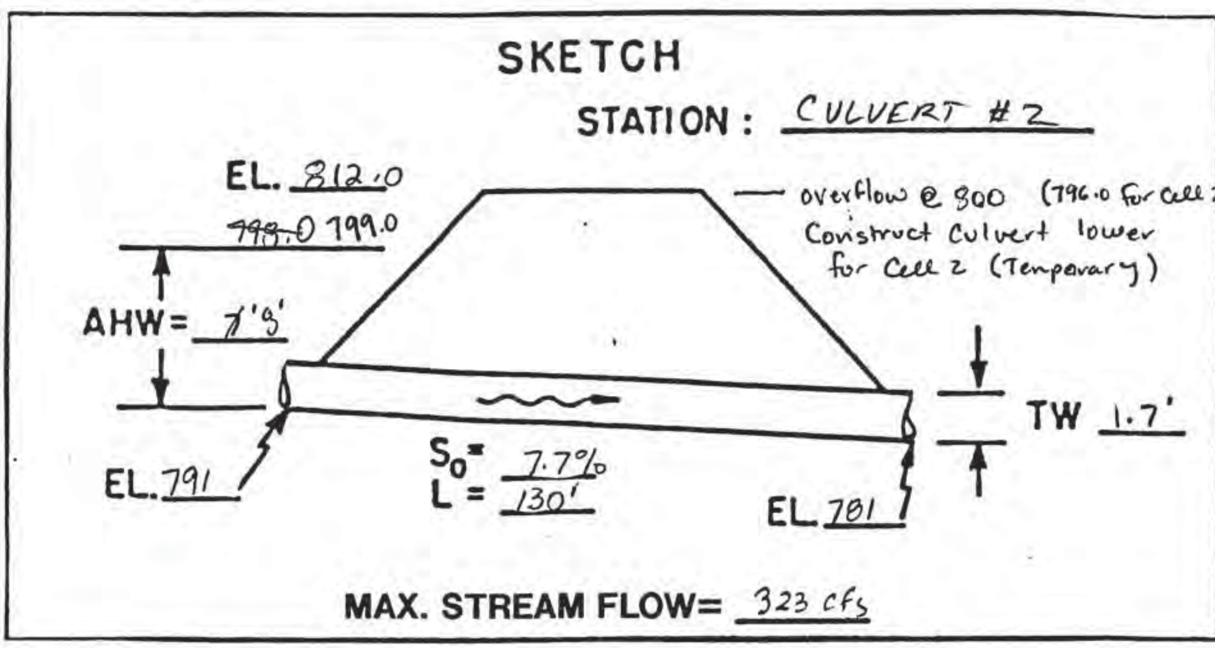
DPC - PLAN OF OPERATION	By: BJK	Date: 9/00	By:	Date:	3081.40

Rev. 7/03
BJK





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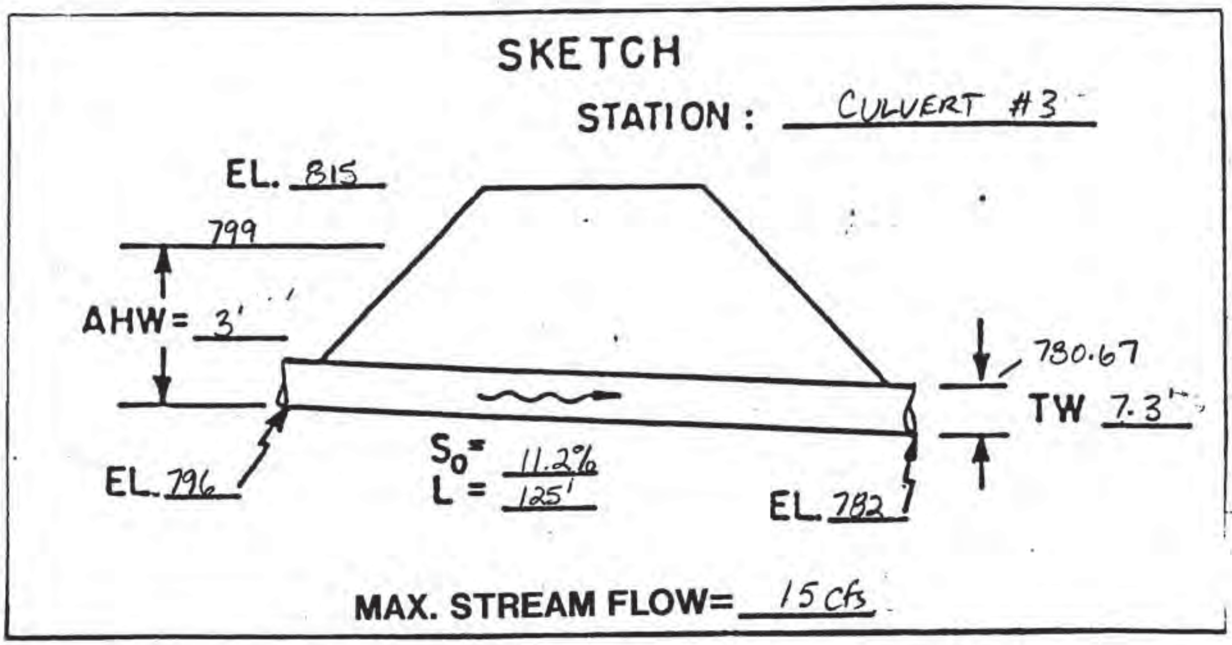
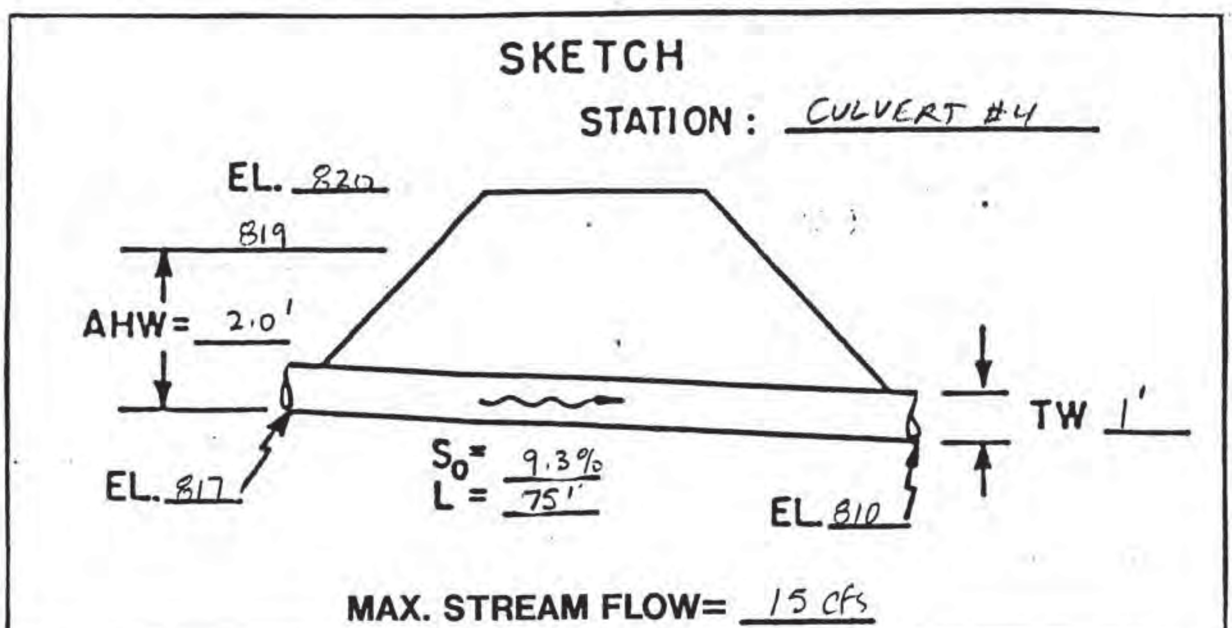
DPC · PLAN OF OPERATION	BJN	9/00			30[illegible]1.40





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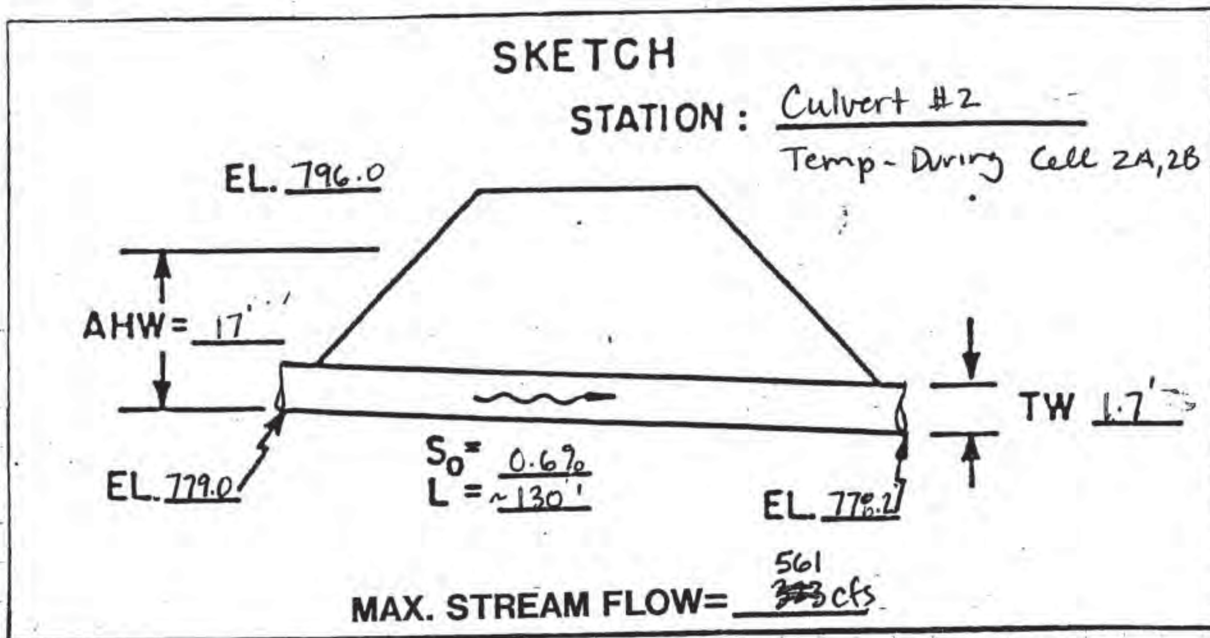
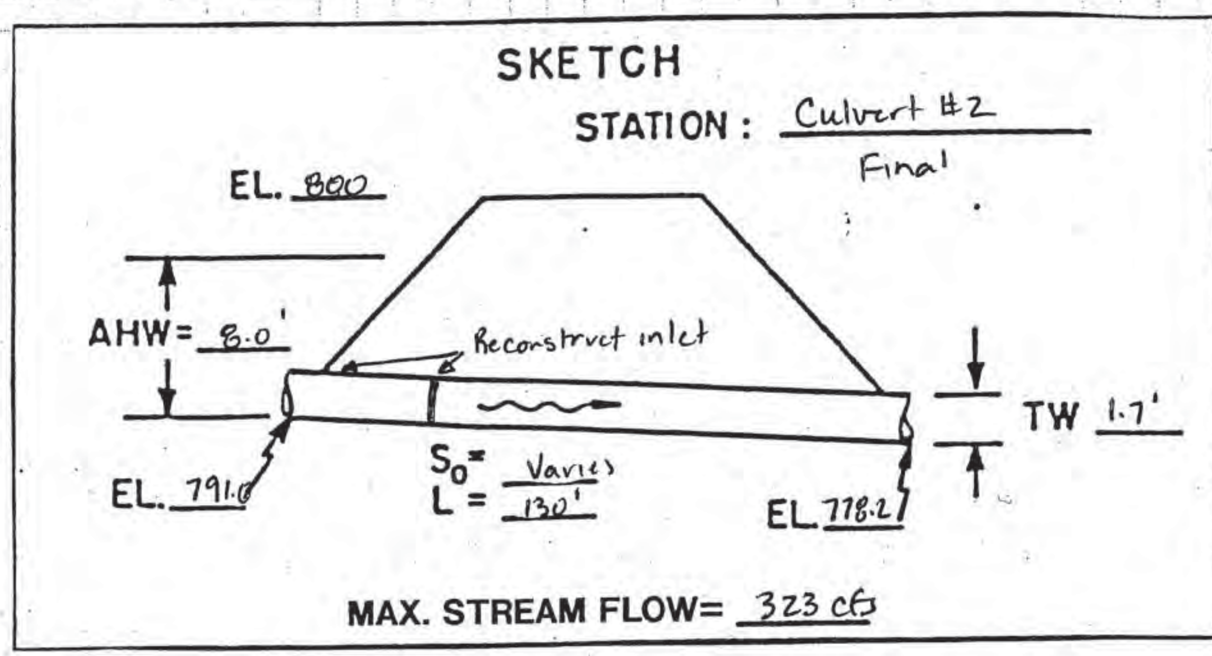
Dairyland Power – Phase IV	By: BJT	Date: 7/03	By:	Date:	3061.56





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 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		

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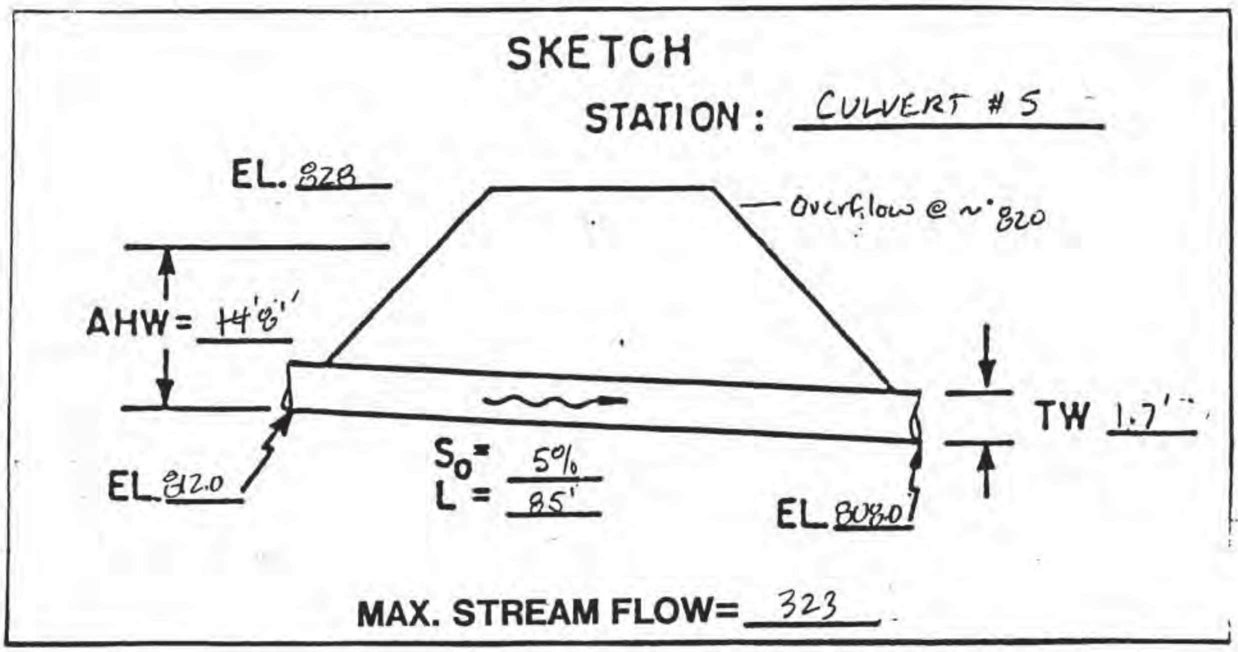
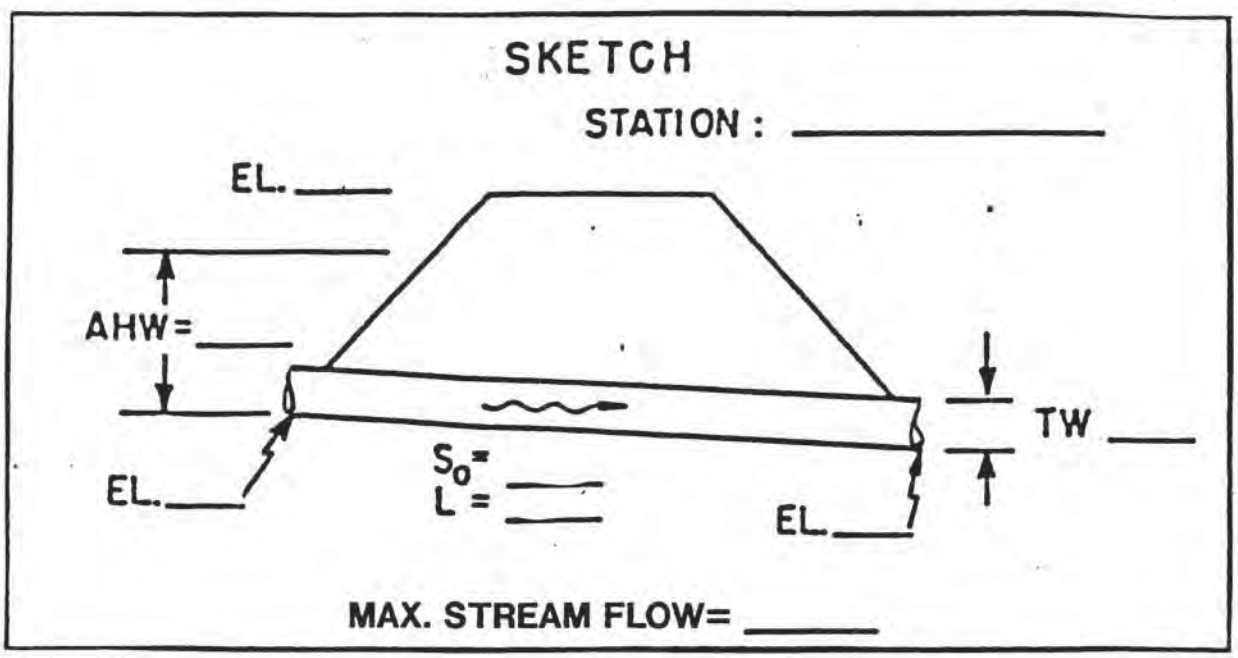
DPC POO	BJP	9/01			3091.40





PROJECT: DPC POO

DESIGNER: BJK

DATE: 9/2000

HYDROLOGIC AND CHANNEL INFORMATION

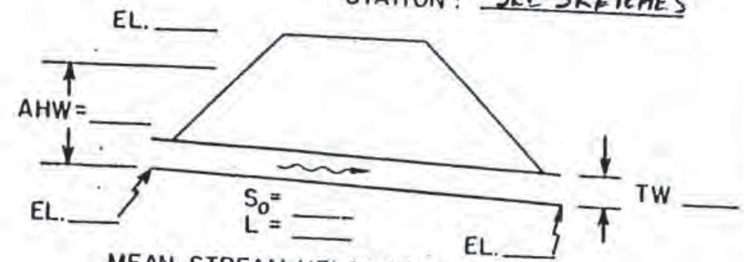
Q_1 = SEE SKETCHES TW_1 = ____

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: INLET CONT. $\frac{HW}{D}$	INLET CONT. HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
CULVERT #1 CMP	162 EA	2 - 60"	1.2	6'												
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			Not Rec.
																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				
CULVERT #3 CMP	15	30"	0.77	1.9	0.5	0.8	1.3	1.9	7.3'	7.3'	6'	2.1				Not Rec.
																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

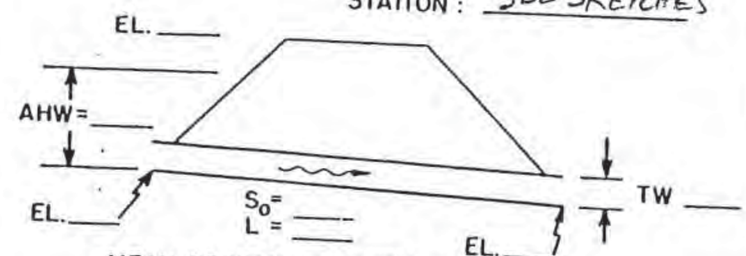
Q_1 = SEE SKETCHES TW_1 = ______

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: INLET CONT.		OUTLET CONTROL $HW=H+h_o-LS_o$								CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
			$\frac{HW}{D}$	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	~~5.6~~ 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

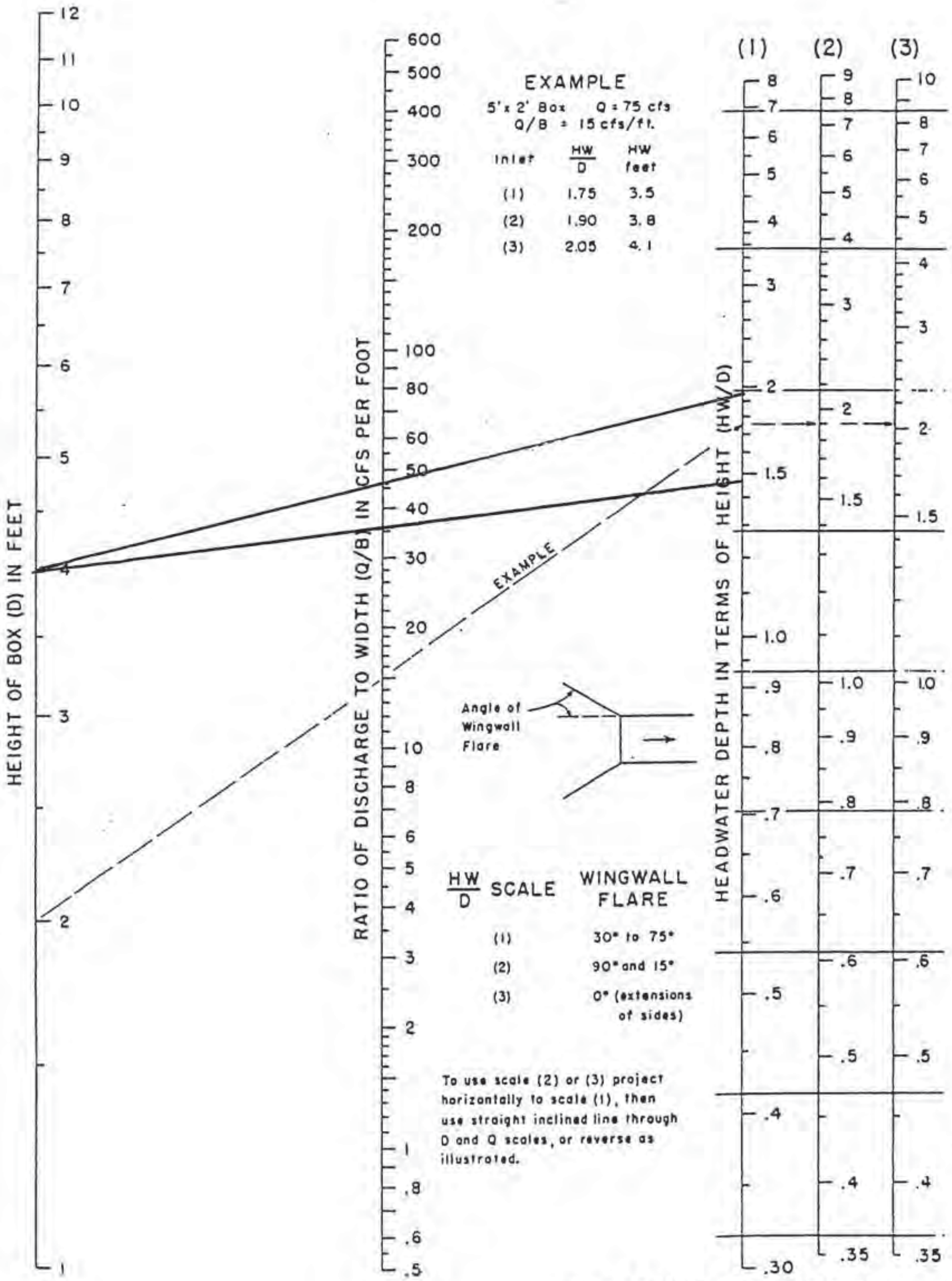
Outlet Control, Full or Partly Full

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

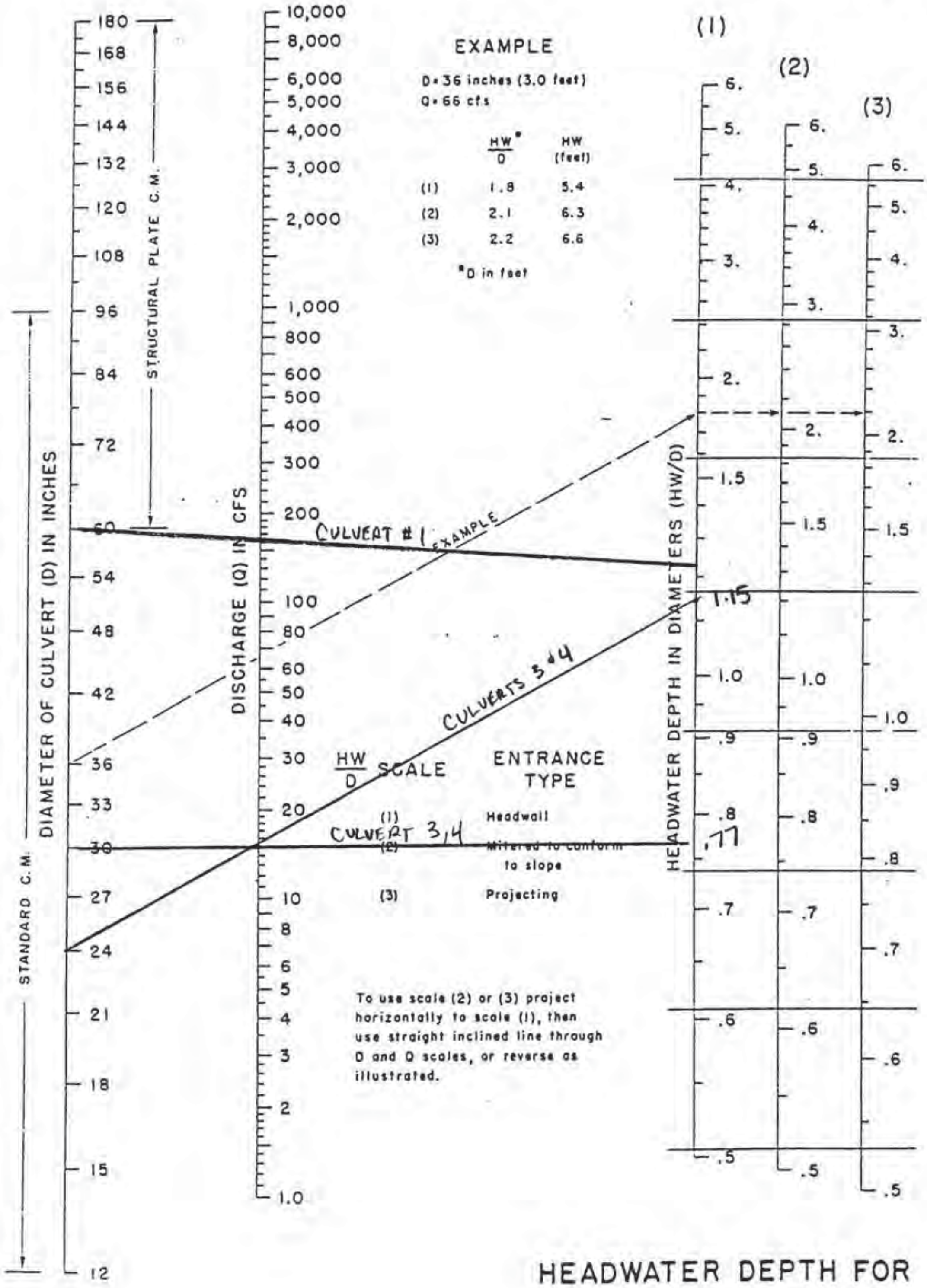
*Note: "End Section conforming to fill slope," made of either metal or concrete, are the sections commonly available from manufacturers. From limited hydraulic tests they are equivalent in operation to a headwall in both inlet and outlet control. Some end sections, incorporating a closed taper in their 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



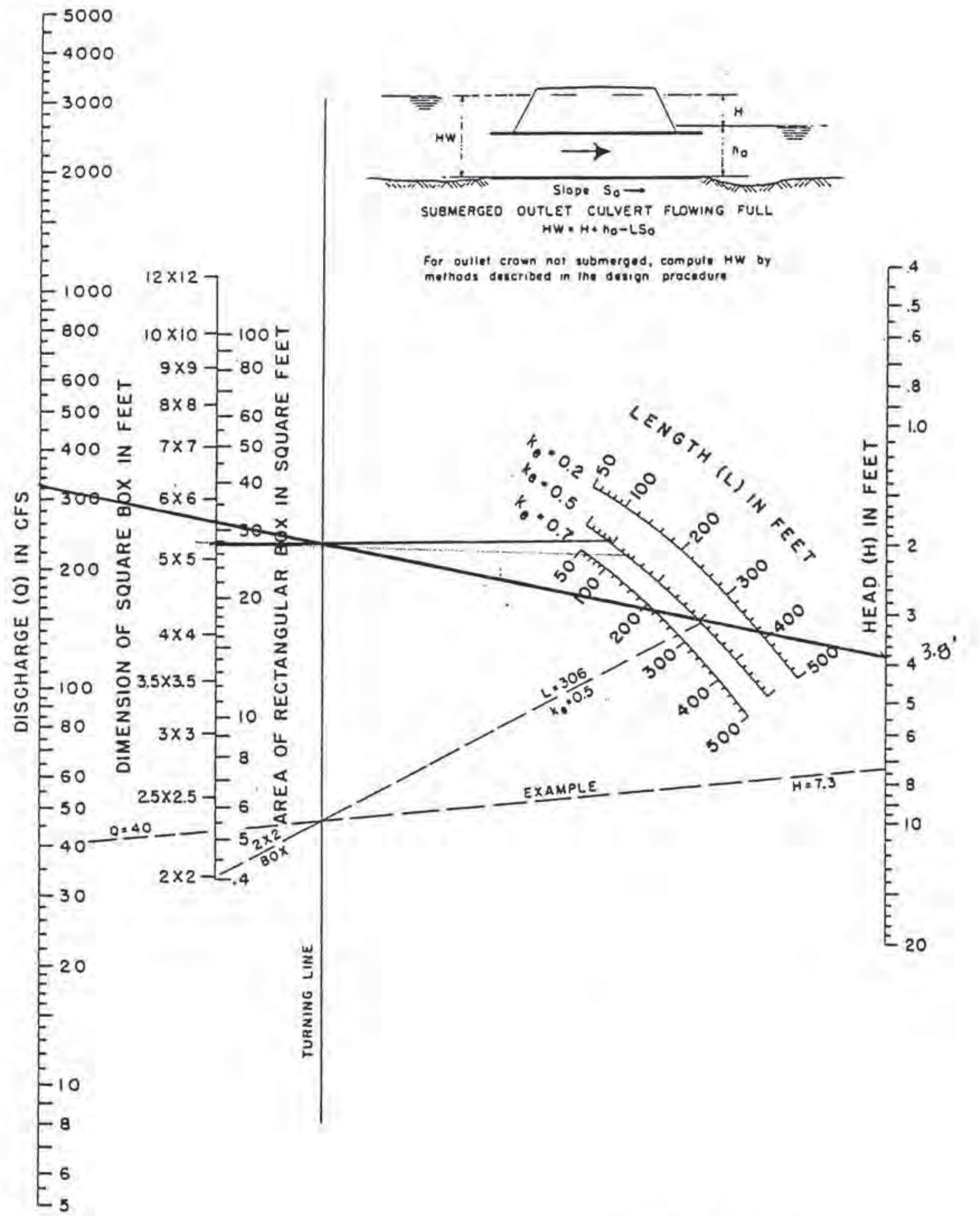
HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

CHART 5



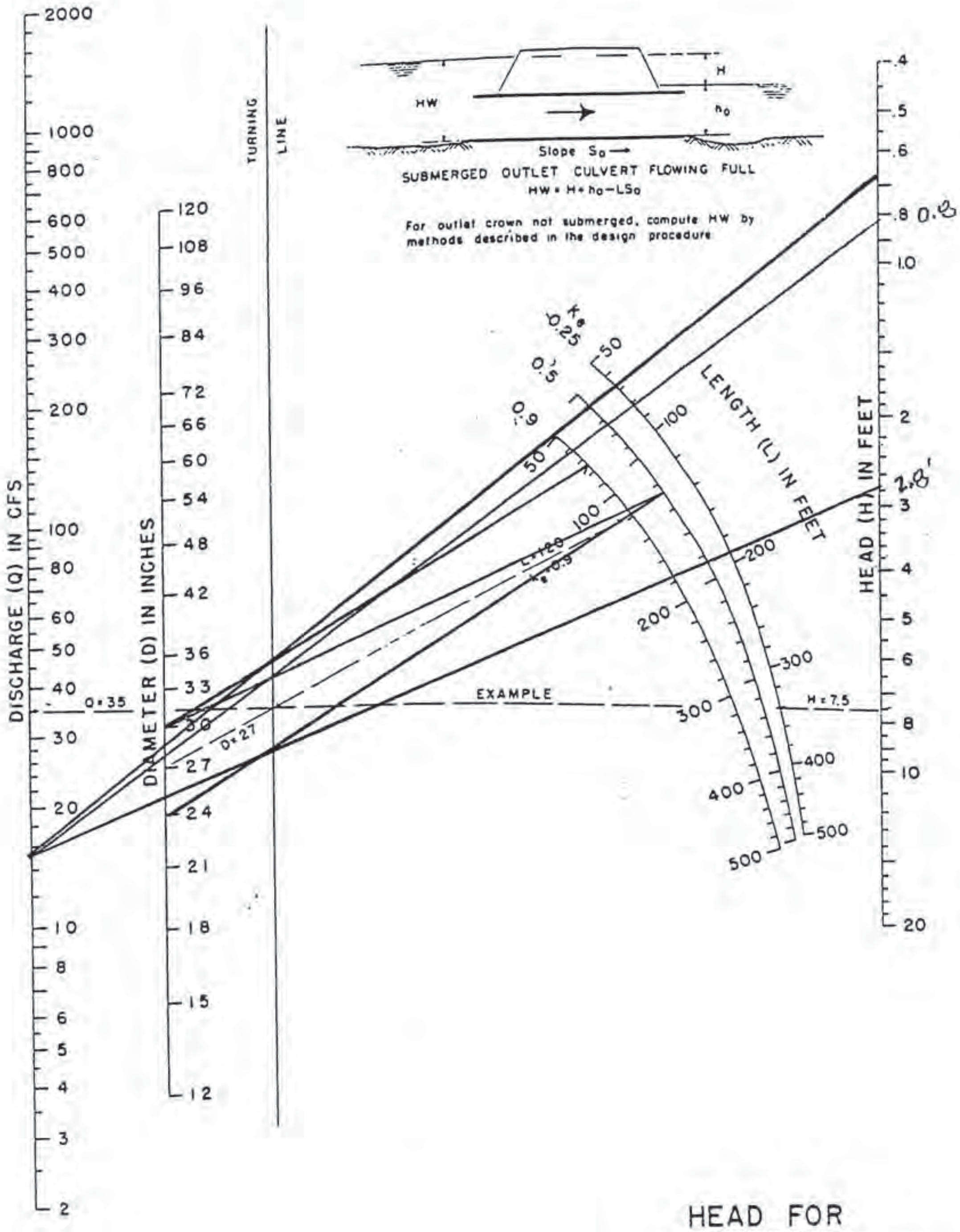
HEADWATER DEPTH FOR
C. M. PIPE CULVERTS
WITH INLET CONTROL

CHART 8

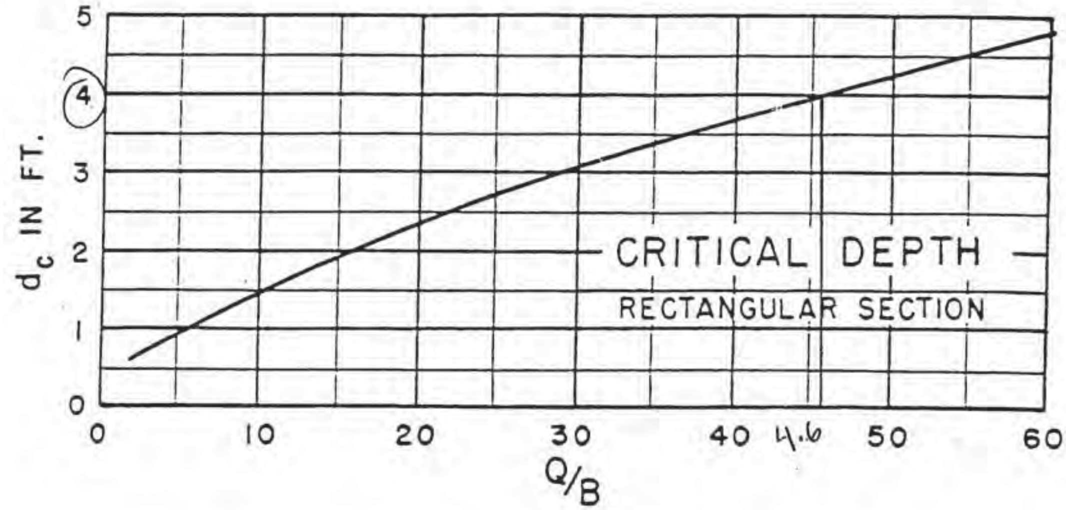


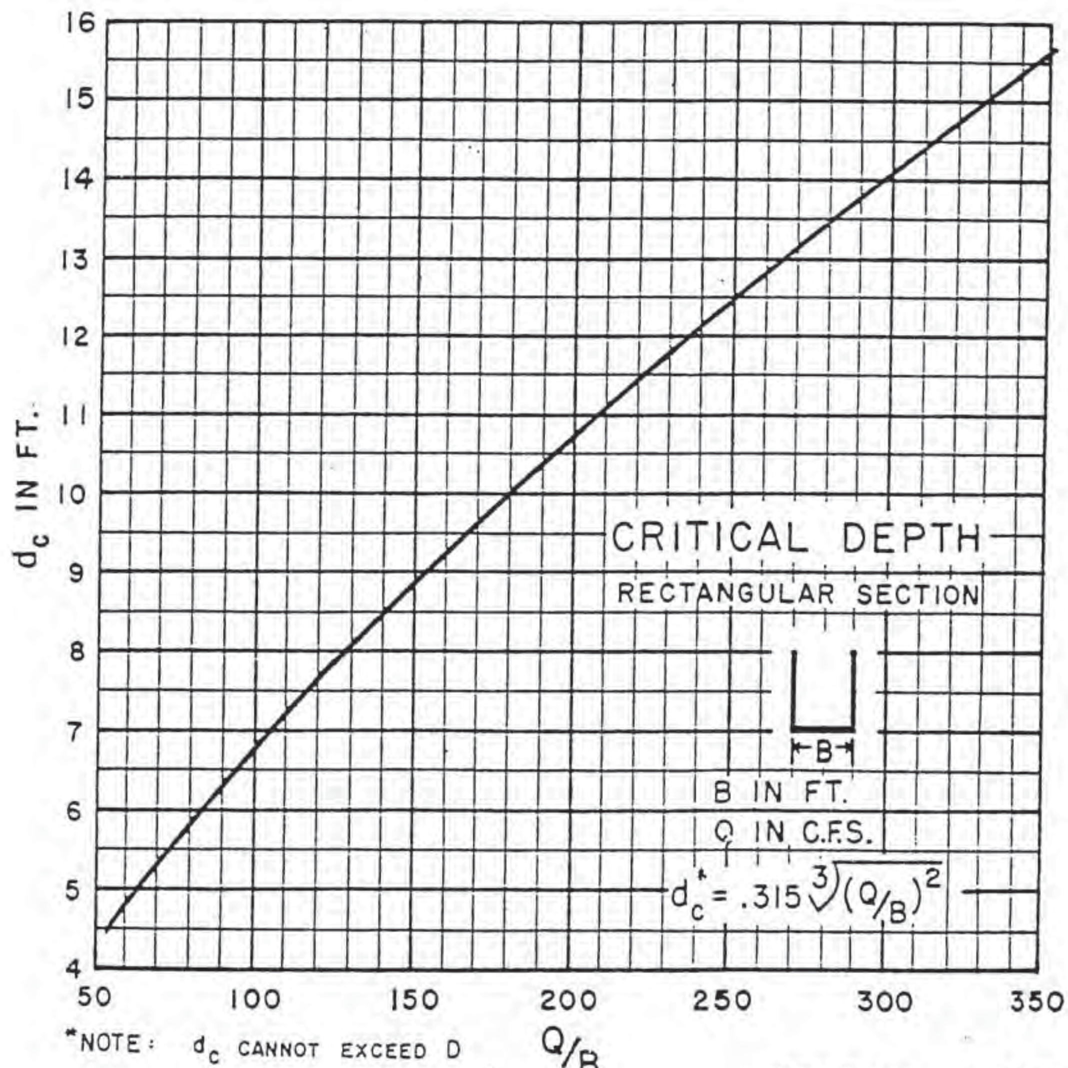
HEAD FOR
CONCRETE BOX CULVERTS
FLOWING FULL
$n = 0.012$

CHART 11



HEAD FOR
STANDARD
C. M. PIPE CULVERTS
FLOWING FULL
n = 0.024

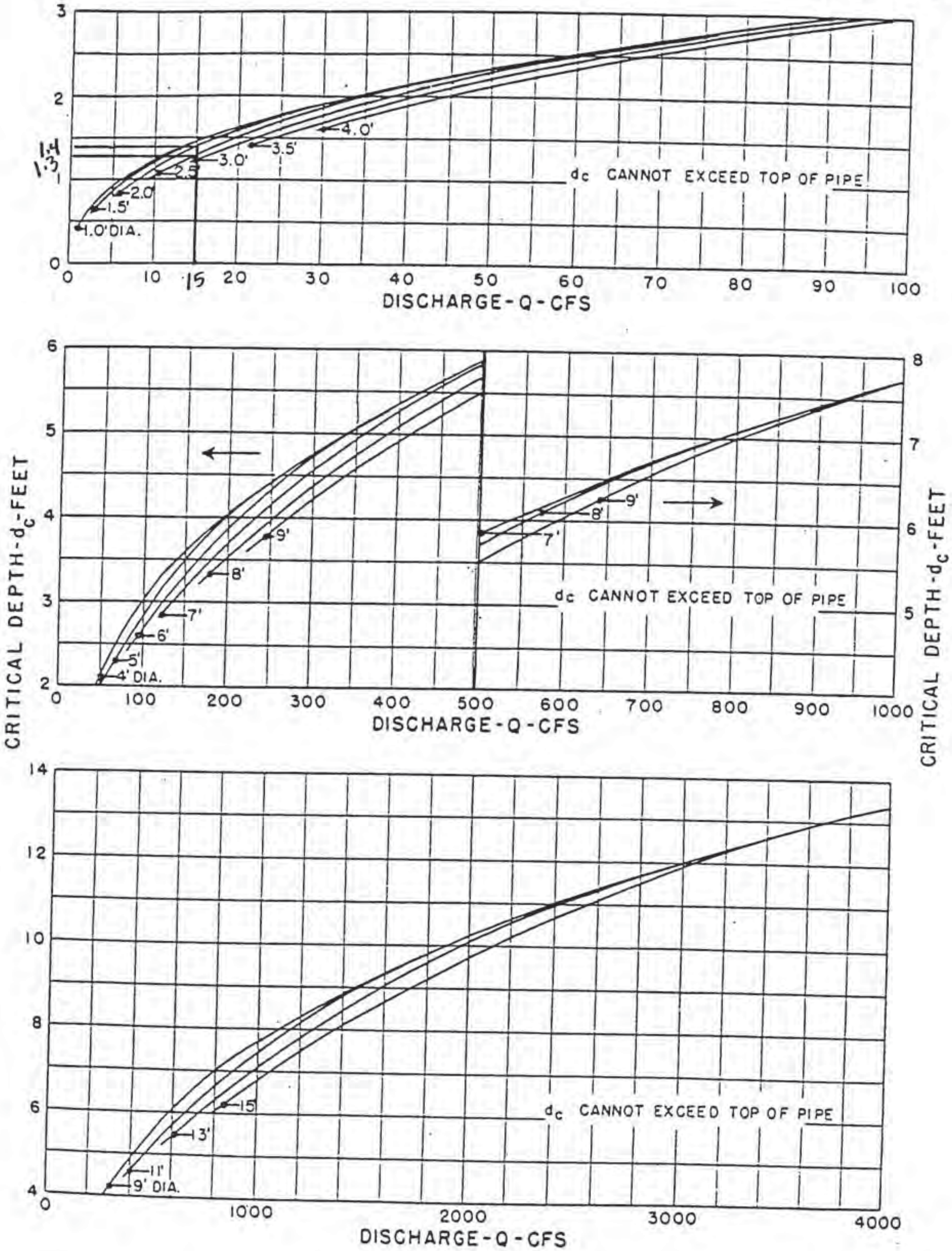




*NOTE: d_c CANNOT EXCEED D

CRITICAL DEPTH
RECTANGULAR SECTION

CHART 16



CRITICAL DEPTH
CIRCULAR PIPE

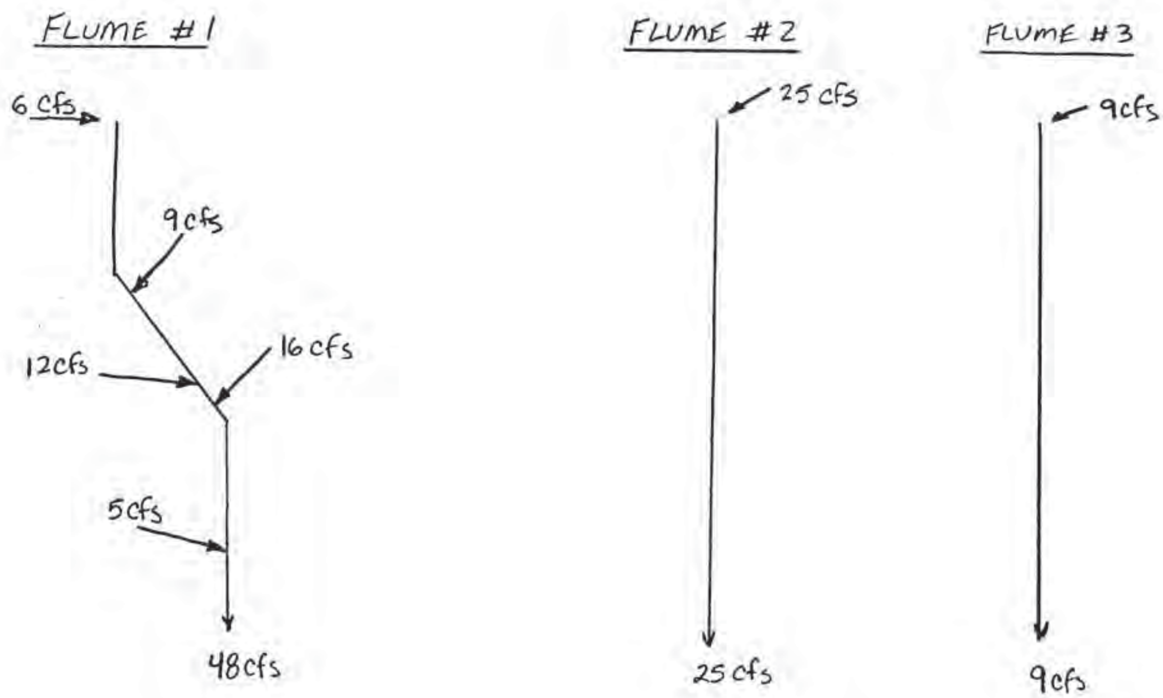
RMT
744 Heartland Trail
Madison, WI 53717-1934
Tel. (608) 831-4444 • Fax (608) 831-3334

SHEET ____ OF ____

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



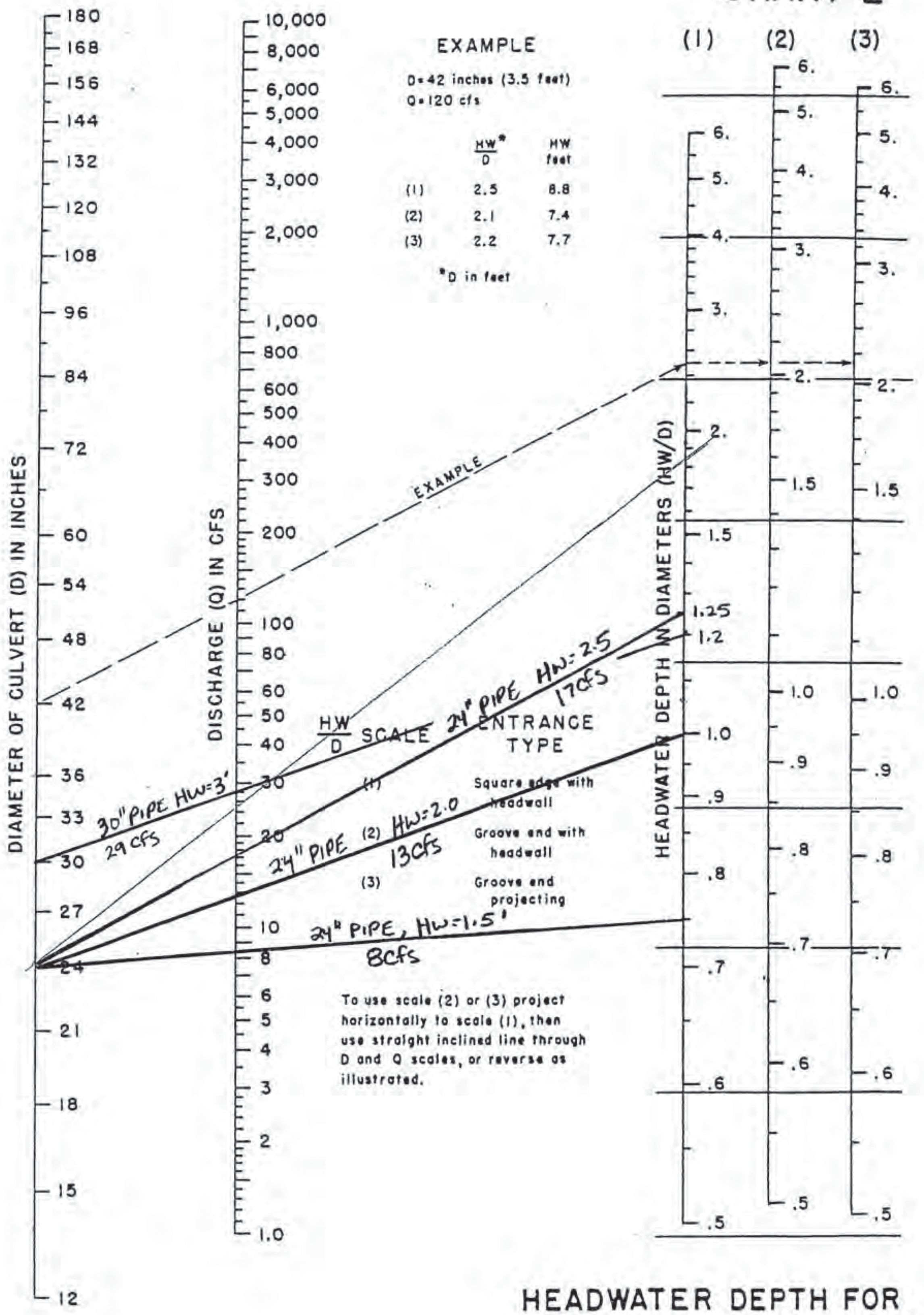
NOTE: PEAK FLOWS OBTAINED FROM RUNOFF CALCULATIONS
PEAK FLOWS ADDED TO OBTAIN TOTALS (CONSERVATIVE)

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'

FORM 383A

CHART 2



HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

RMT
744 Heartland Trail
Madison, WI 53717-1934
Tel. (608) 831-4444 • Fax (608) 831-3334

SHEET ____ OF ____

PROJECT / PROPOSAL NAME / LOCATION: DAIRYLAND POWER - POO		PROJECT / PROPOSAL NO.
SUBJECT: FLUME SIZING		308140
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
$A = \pi D^2/4 = \pi (1.5)^2/4 = 1.77 \text{ ft}^2$

$$Q_{FULL} = \frac{1.49}{0.01} (0.375)^{2/3} (0.20)^{1/2} (1.77)$$

$= 61$ cfs > 48 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

United States Department of the Interior

BUREAU OF RECLAMATION

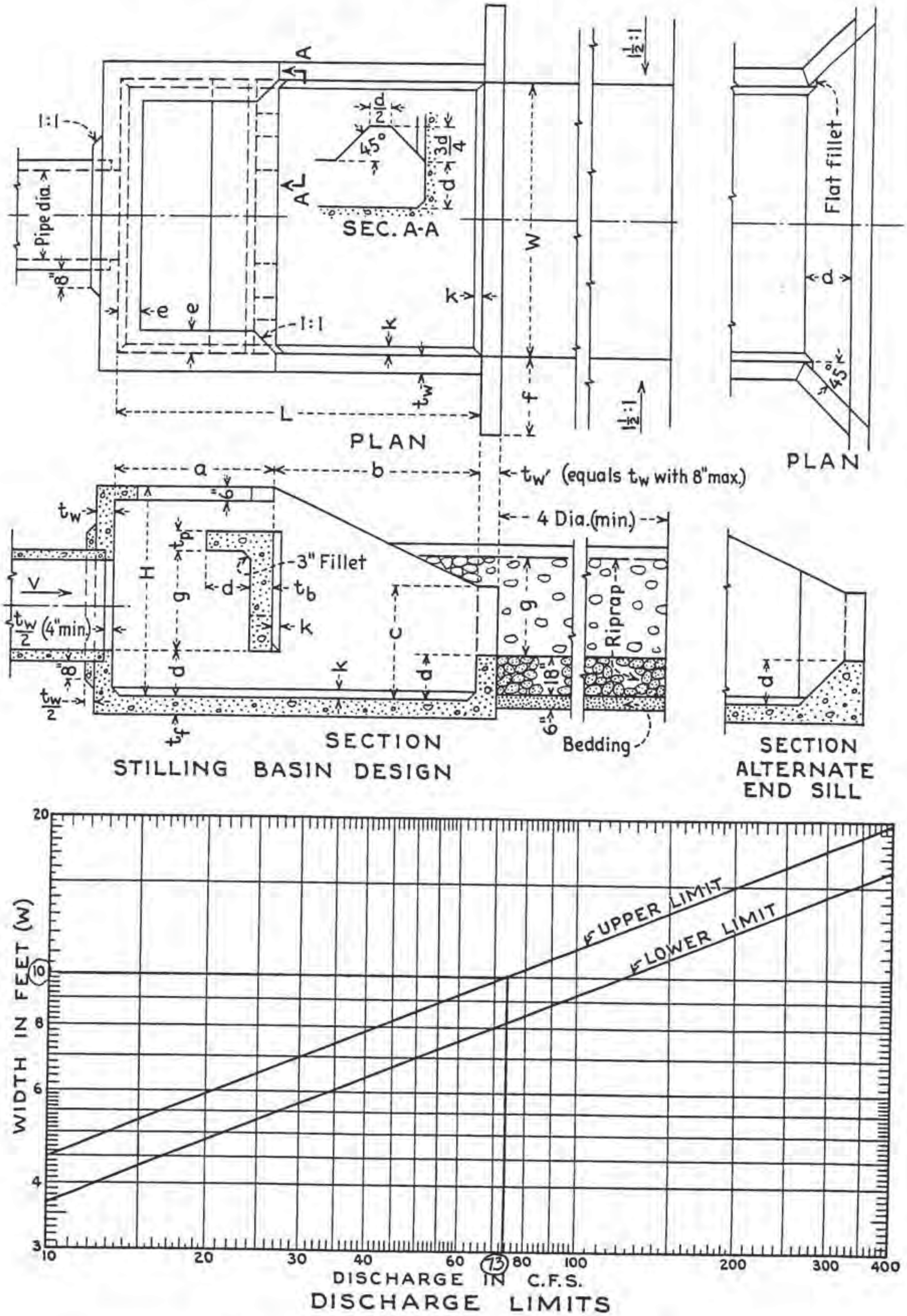


FIGURE 42.—*Impact-type energy dissipator (Basin VI).*

TABLE 11.—*Stilling basin dimensions (Basin VI). Impact-type energy dissipator.*

Suggested pipe size[1]		Max discharge Q	Feet and inches										Inches					
Dia In.	Area (sq ft)		W	H	L	a	b	c	d	e	f	g	t_w	t_f	t_b	t_p	K	Suggested riprap size
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(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

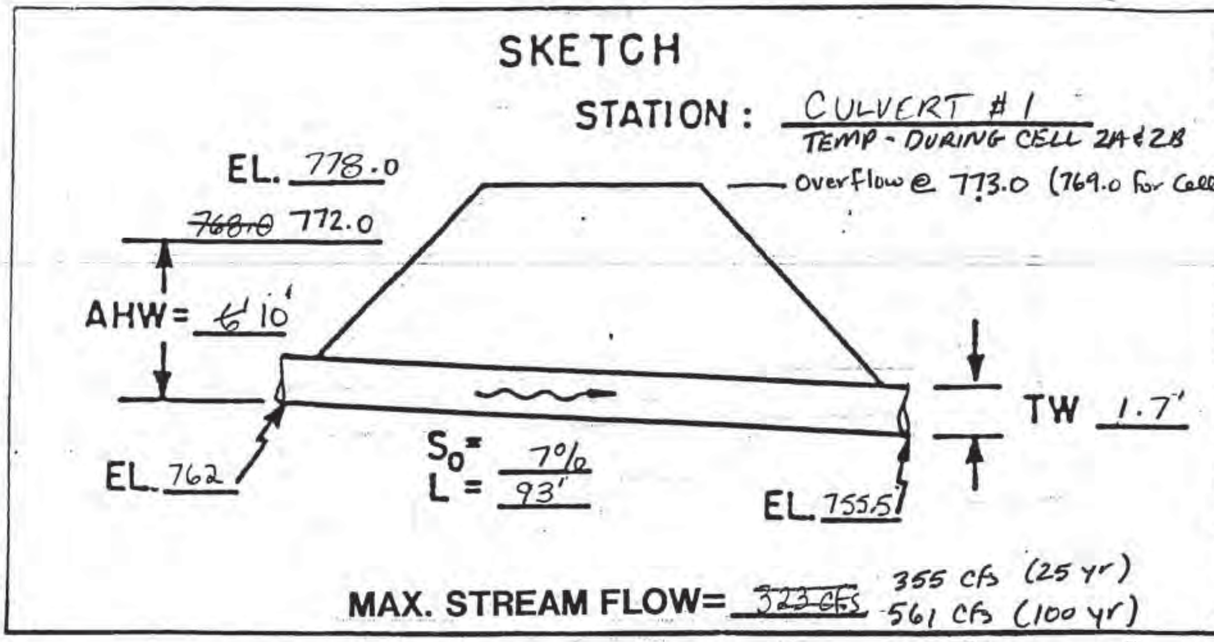
COMPUTATION SHEET

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



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 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 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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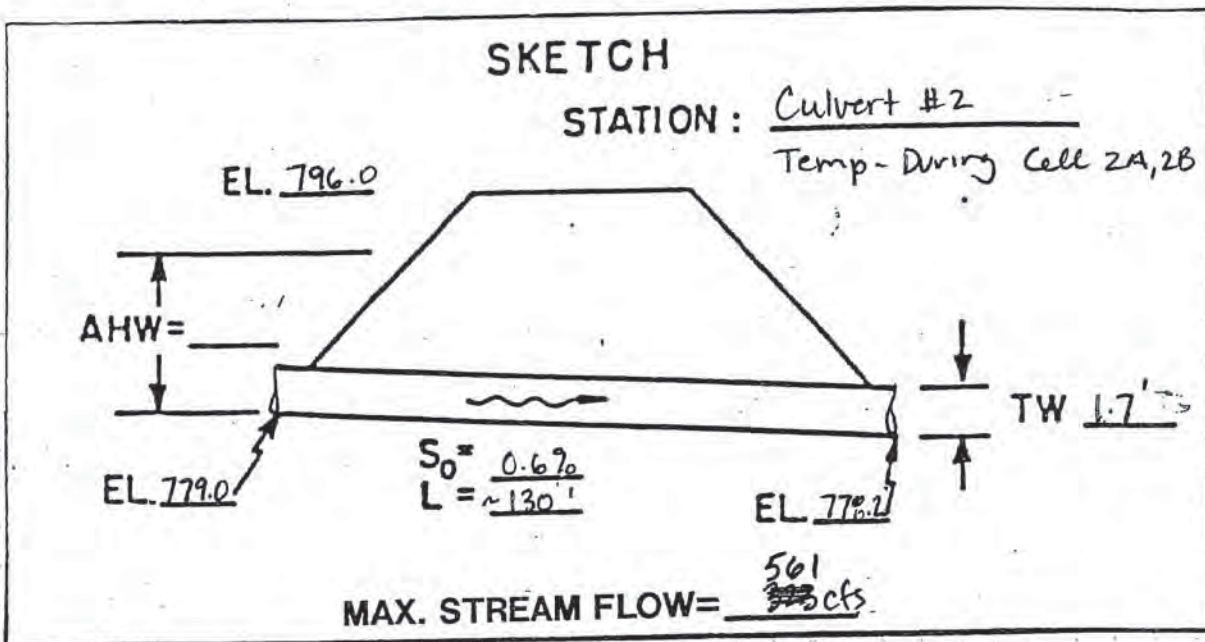
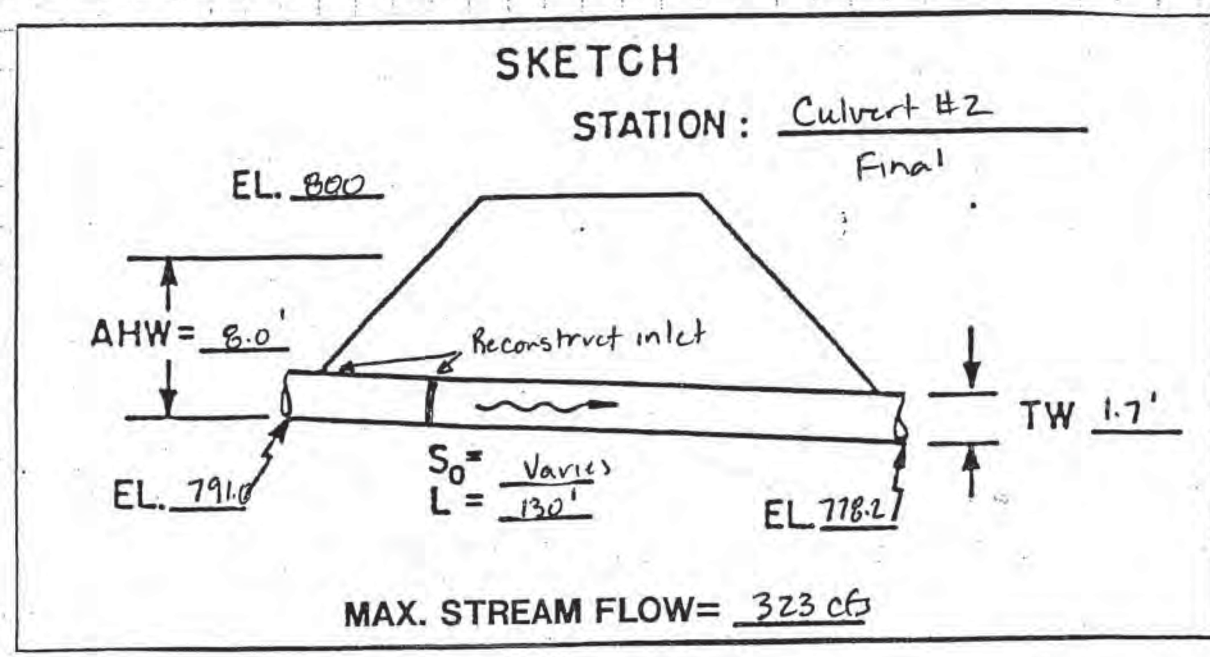
744 Heartland Trail P.O. Box 8923 Madison, WI 53708-8923 (608) 831-4444 FAX: (608) 831-3334

SHEET ______ OF ______

PROJECT / PROPOSAL NAME	PREPARED		CHECKED		PROJECT/PROPOSAL NO.
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.®

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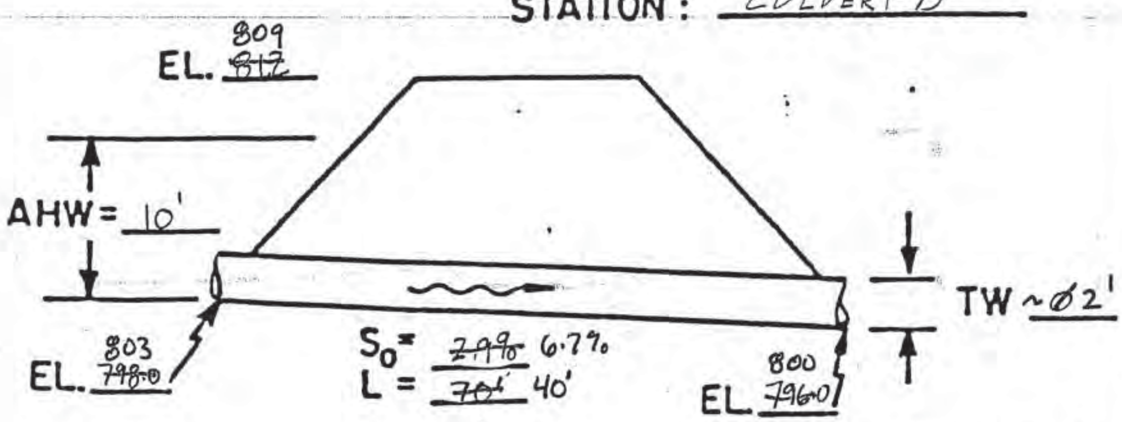
SHEET ______ OF ______

PROJECT / PROPOSAL NAME	PREPARED By:	Date:	CHECKED By:	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 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 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

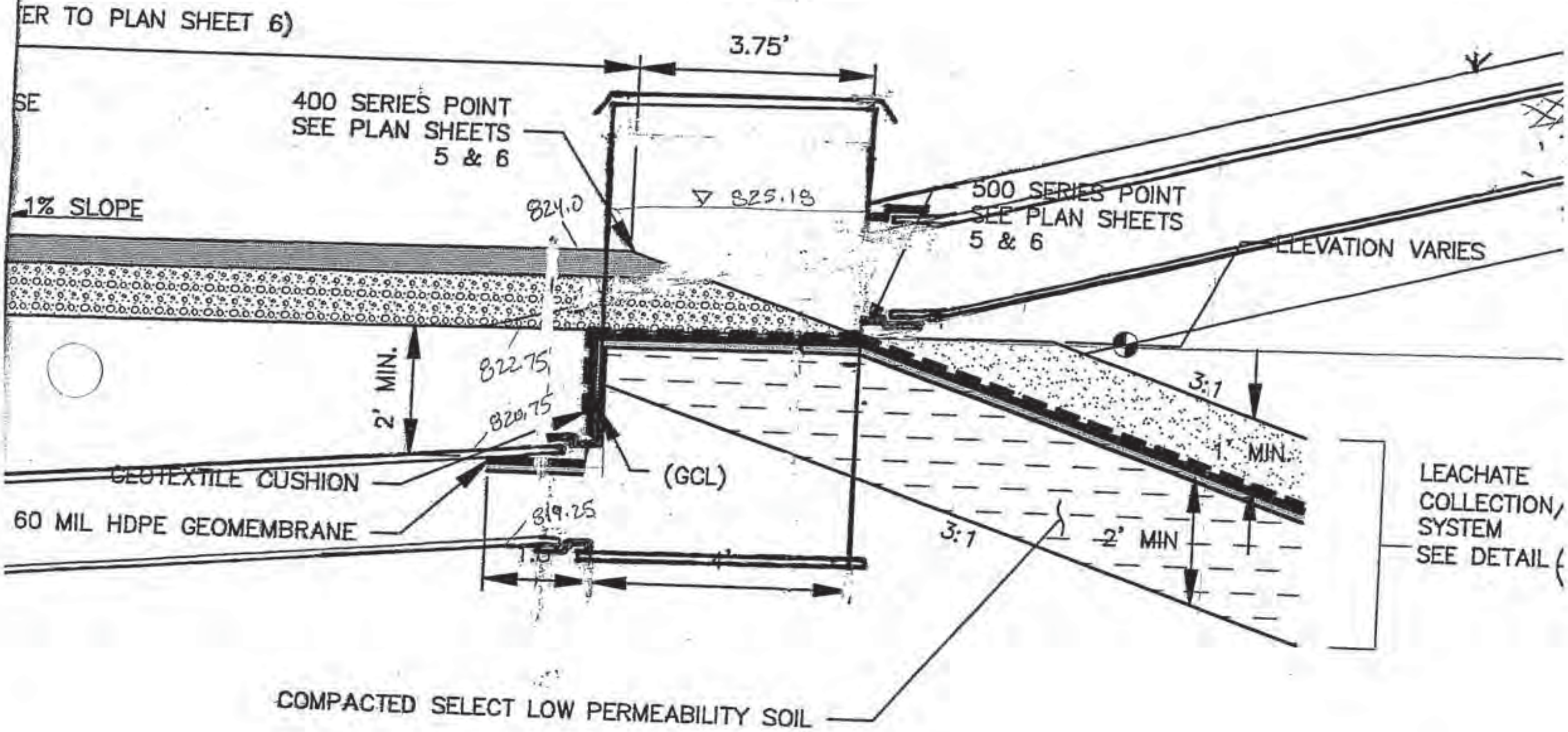
Inlet Control Properties			
Inlet Control HW Elev	825.18 ft	Flow Control	Submerged
Inlet Type	Square edge w/headwall	Area Full	7.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

... SUPPLY
LARRY WOOD
262-255-3030
5/27/03

\$65/VF × 7 VF BARREL
PLATE 1"

2,200 - 2,500 (incl. \$500 for lid)

... flange
lid add \$500



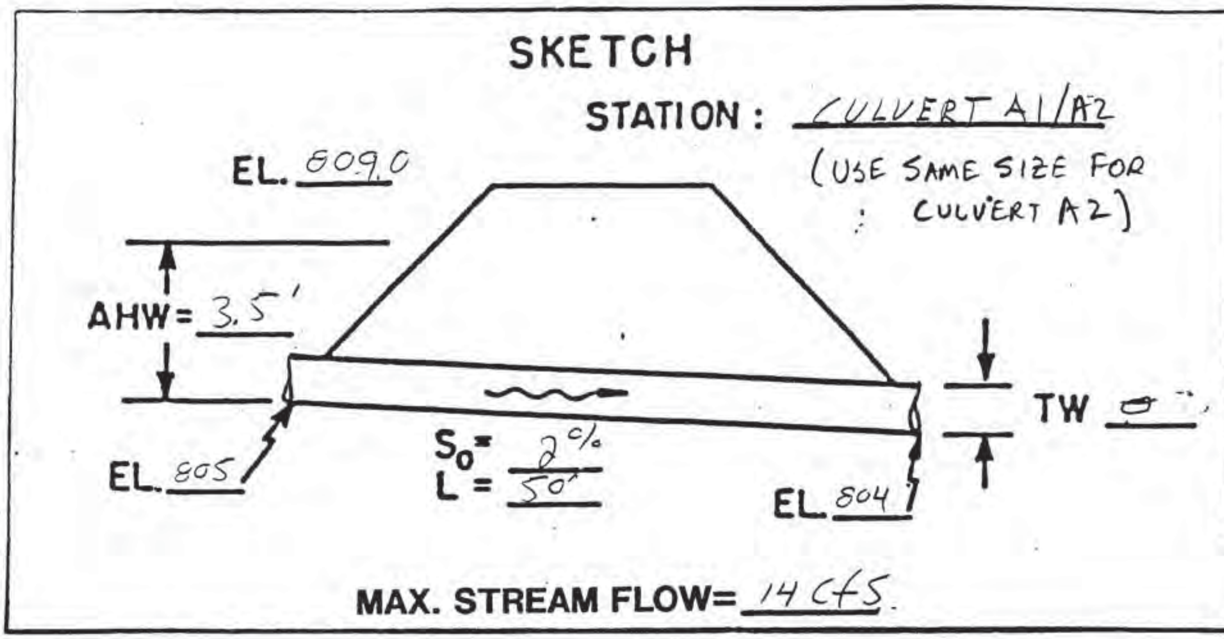
COMPUTATION SHEET

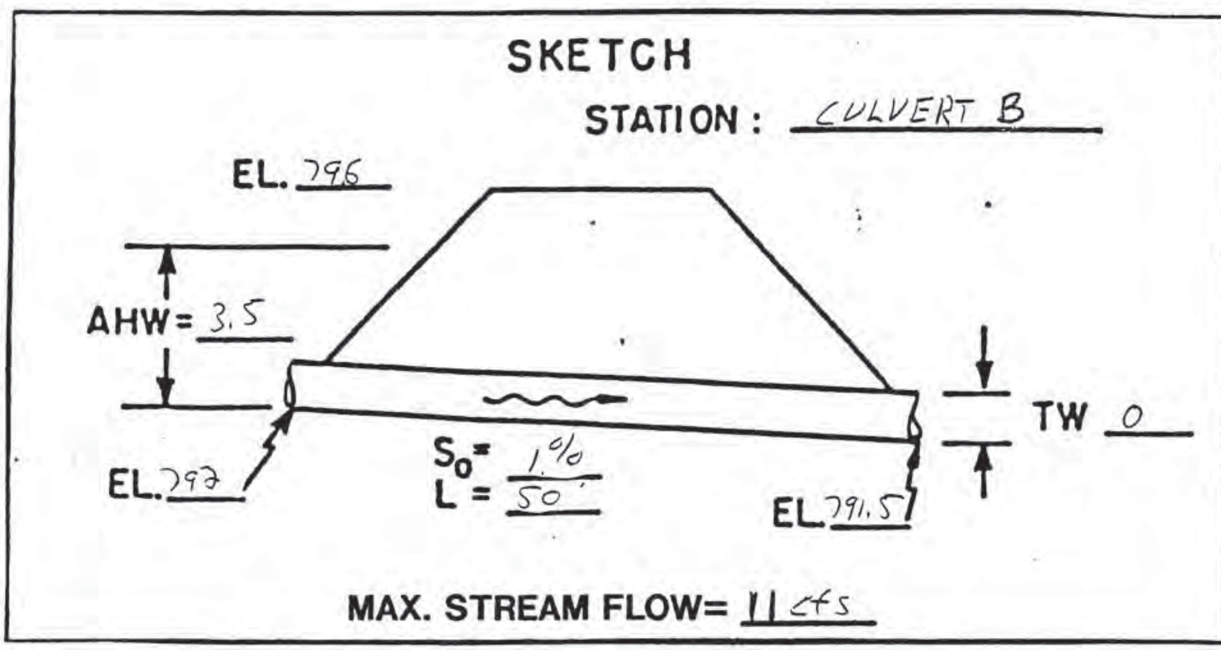
RMT INC.

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	SAA	9/29/00	BJK		3CE1.40





COMPUTATION SHEET

RMT INC.

SHEET ______ OF ______

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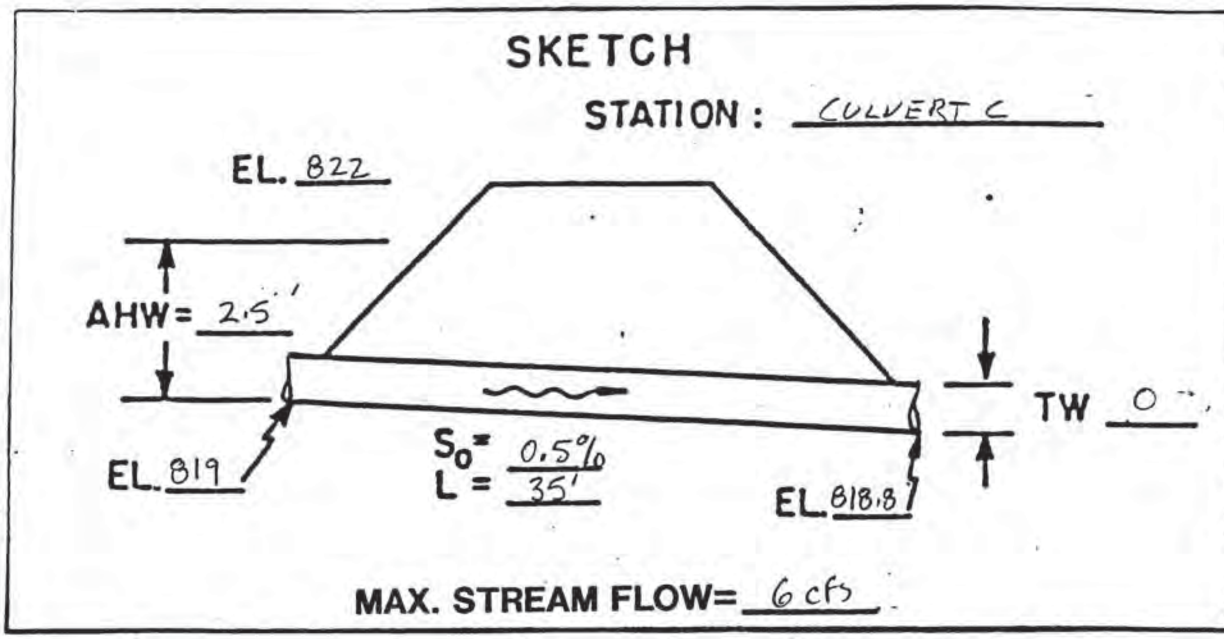
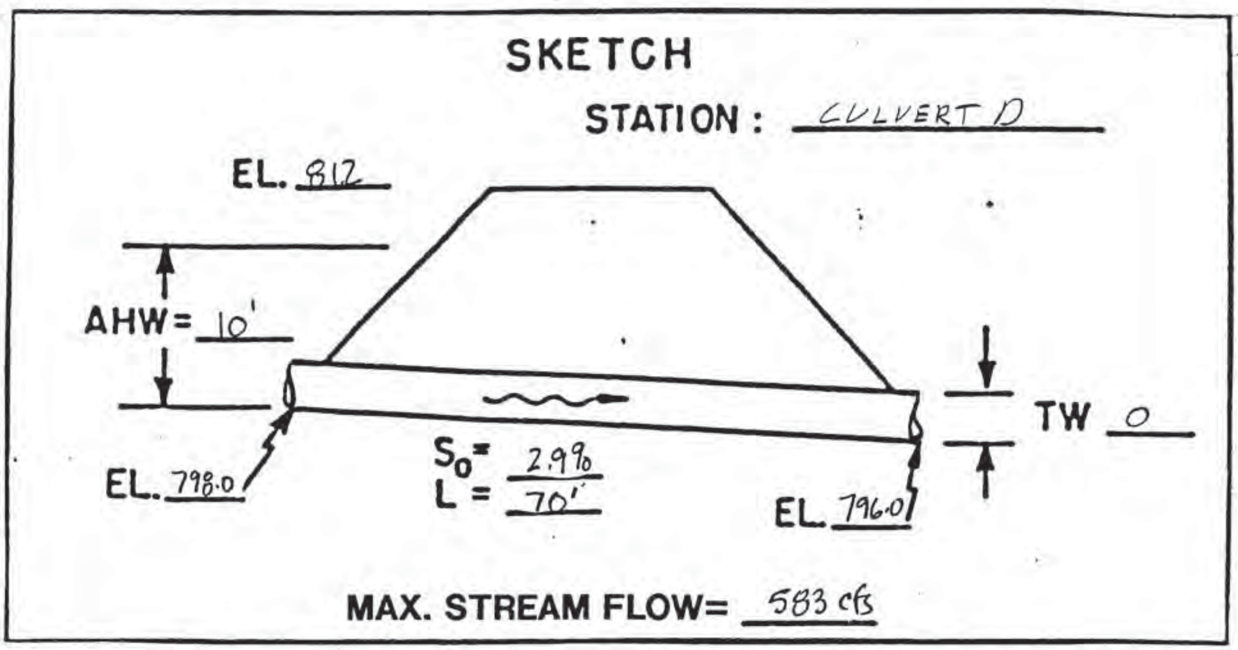
PROJECT / PROPOSAL NAME	PREPARED By:	Date:	CHECKED By:	Date:	PROJECT/PROPOSAL NO.
DPC- PLAN OF OPERATION	KAA	9/29/00			30E).4C





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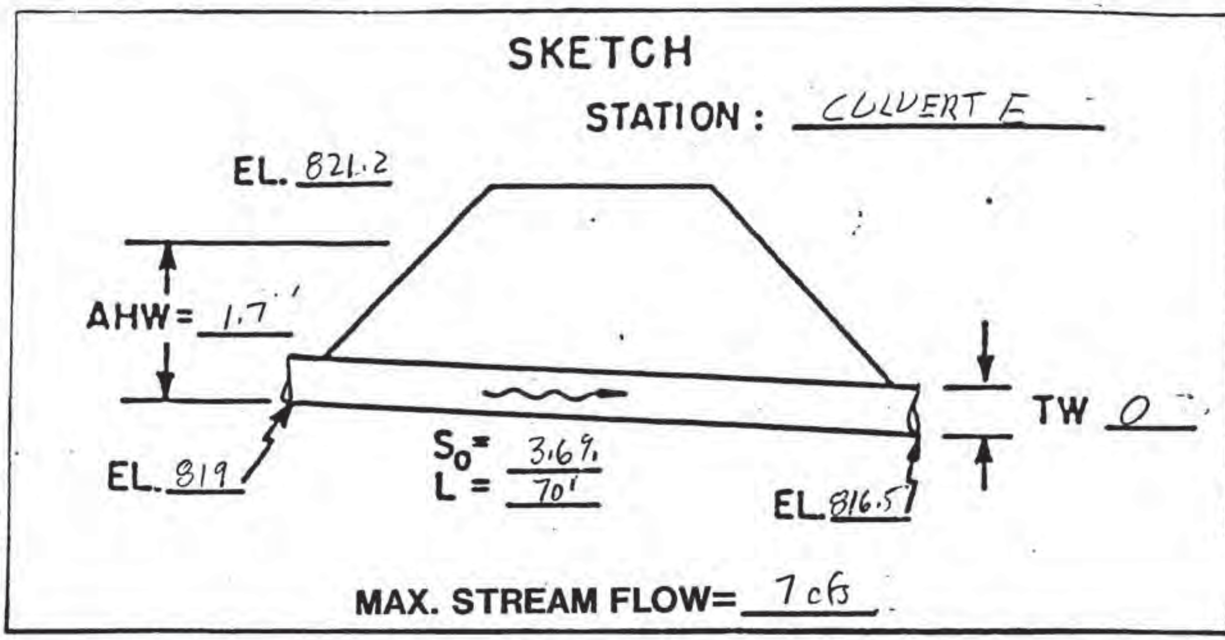
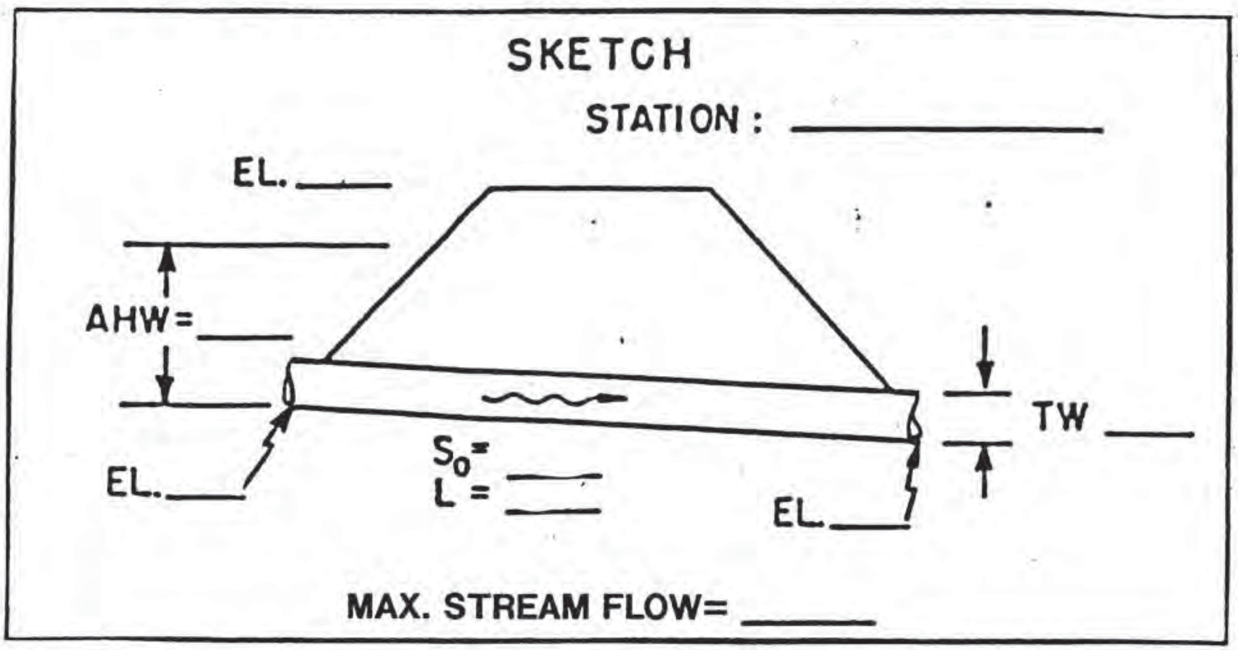
RMT INC.
744 Heartland Trail P.O. Box 8923 Madison, WI 53708-8923 (608) 831-4444 FAX: (608) 831-3334

SHEET ______ OF ______

PROJECT / PROPOSAL NAME	PREPARED By:	Date:	CHECKED By:	Date:	PROJECT/PROPOSAL NO.
DPC - PLAN OF OPERATION	BAA	9/29/??			3C81.4C





PROJECT: DPC PCO

DESIGNER: BAA

DATE: 9/29/60

HYDROLOGIC AND CHANNEL INFORMATION

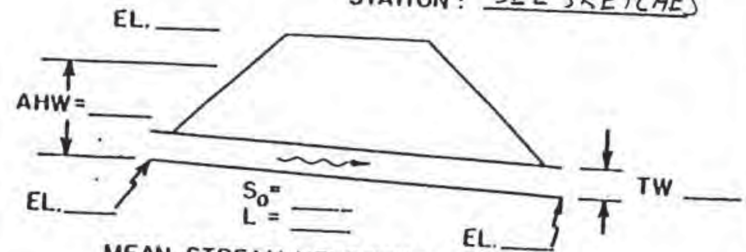
Q_1 = SEE SKETCHES　　TW_1 = ______

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: INLET CONT. $\frac{HW}{D}$	INLET CONT. HW	OUTLET CONTROL $HW = H + h_o - LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
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

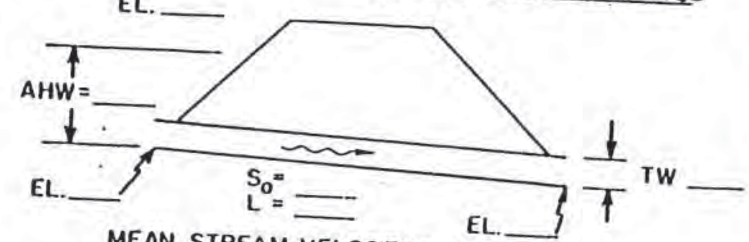
Q_1 = SEE SKETCHES　　TW_1 = ______

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



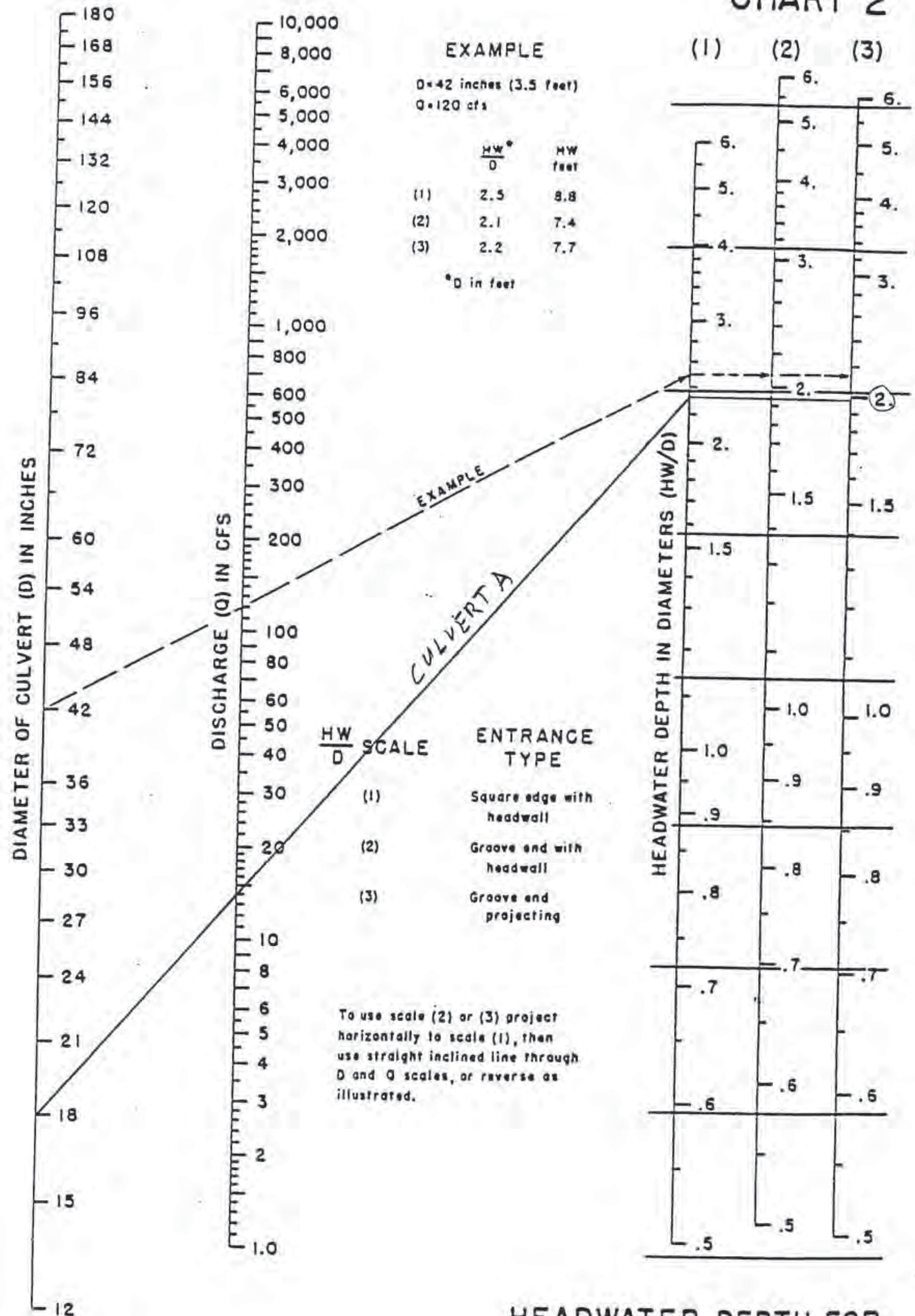
MEAN STREAM VELOCITY = ______
MAX. STREAM VELOCITY = ______

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	INLET CONT. HW	OUTLET CONTROL $HW = H + h_o - LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
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:

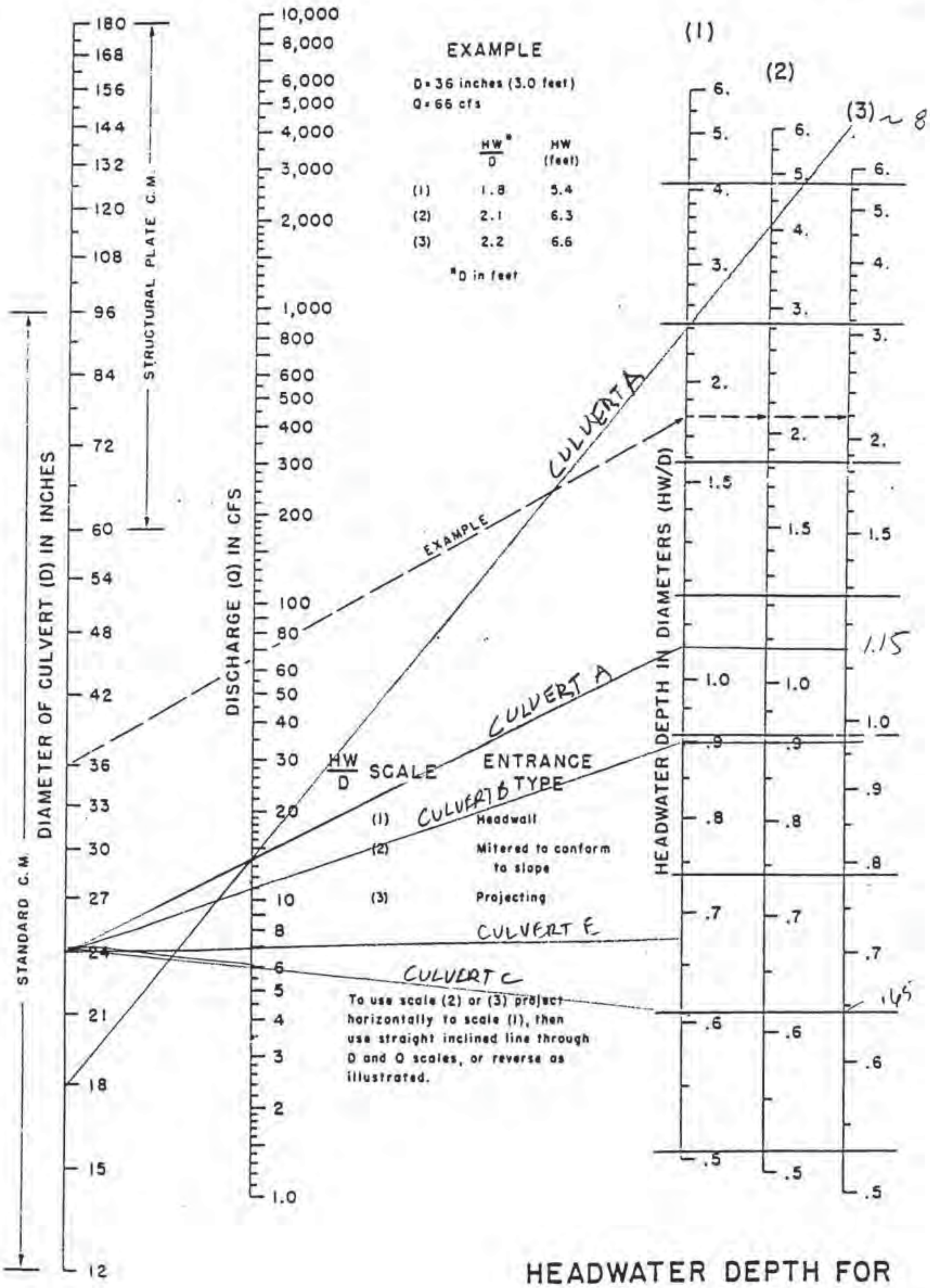
Figure 7

CHART 2



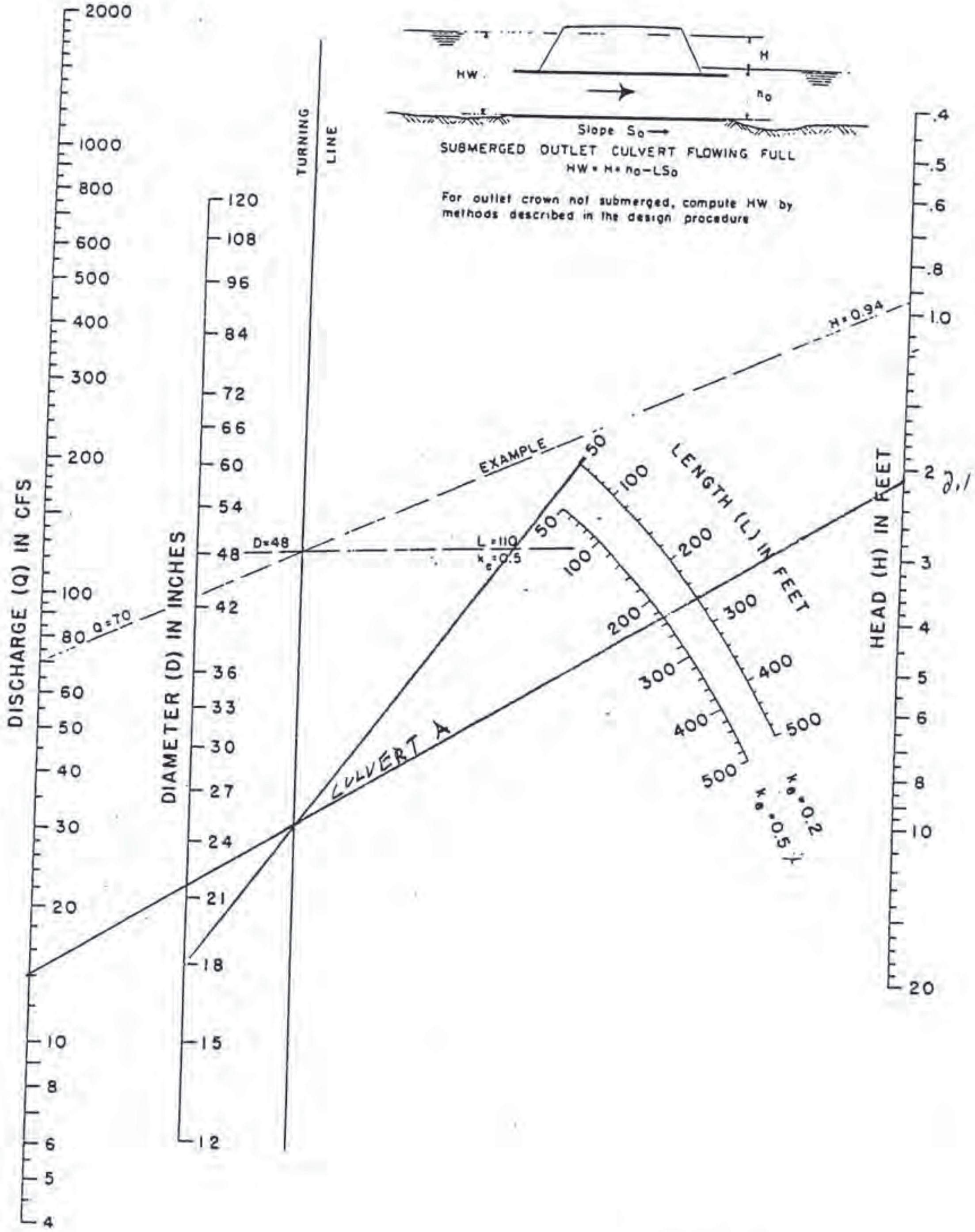
HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

CHART 5



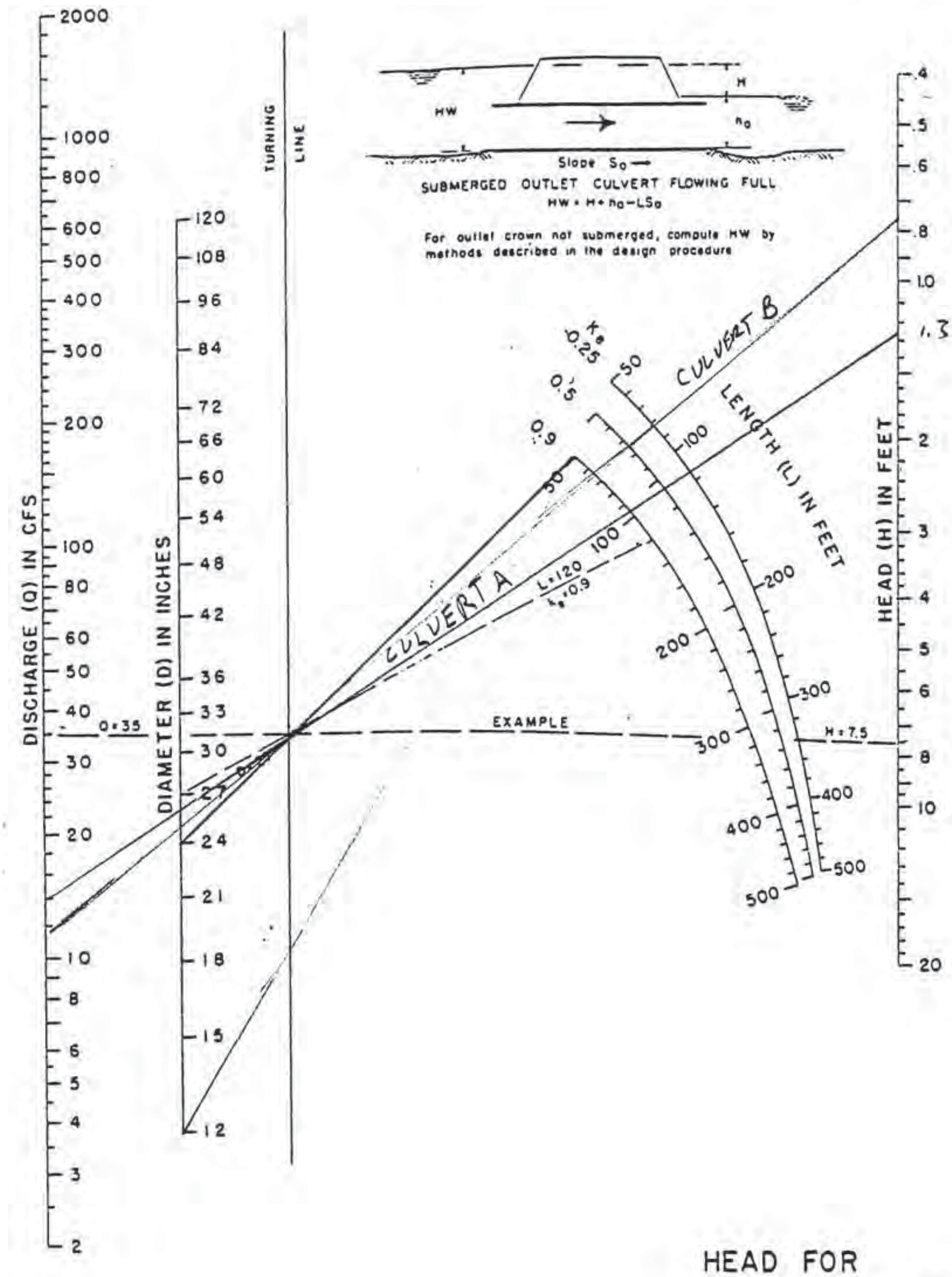
HEADWATER DEPTH FOR
C. M. PIPE CULVERTS
WITH INLET CONTROL

CHART 9



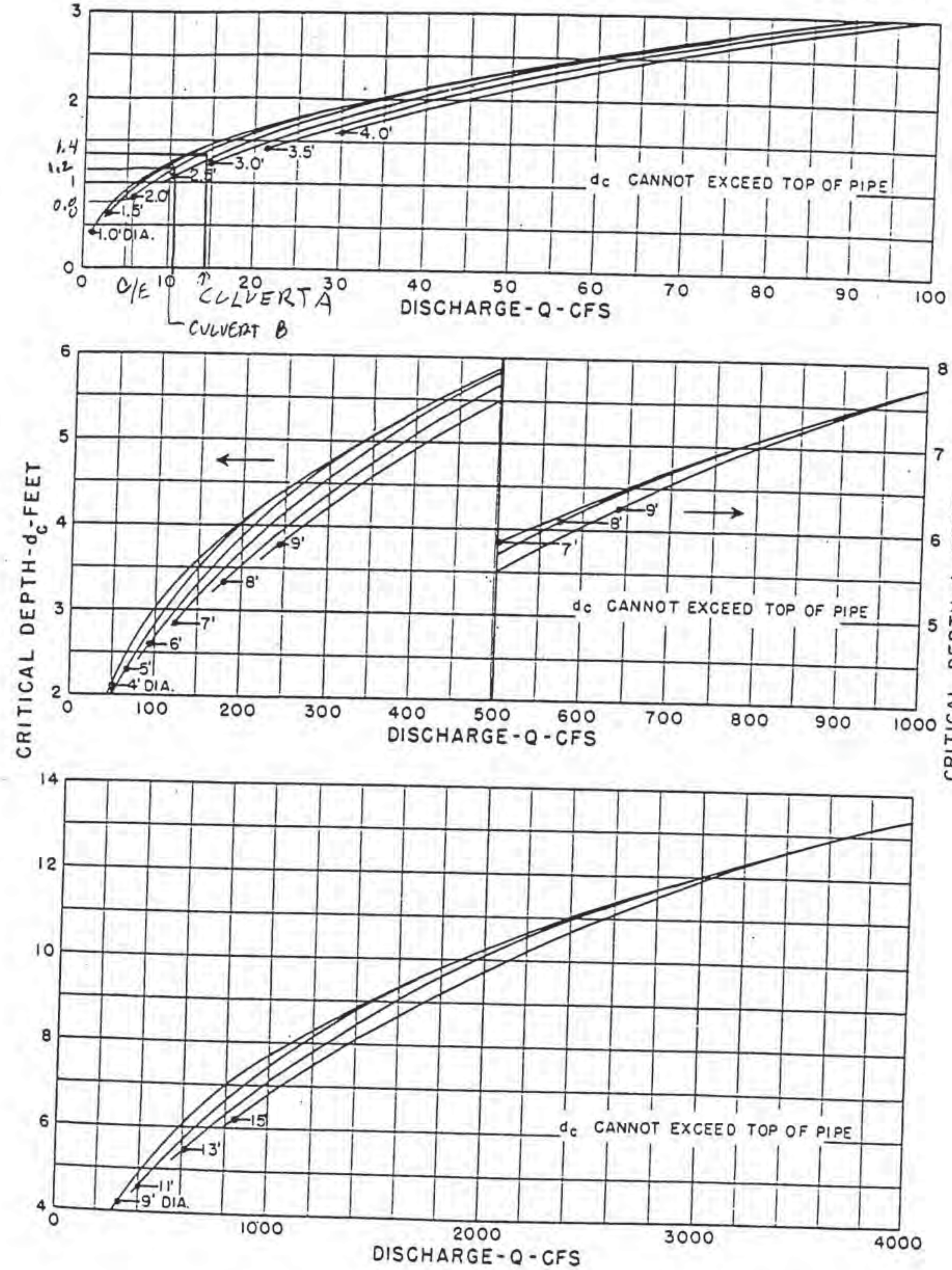
HEAD FOR
CONCRETE PIPE CULVERTS
FLOWING FULL
n = 0.012

CHART 11



HEAD FOR
STANDARD
C. M. PIPE CULVERTS
FLOWING FULL
n = 0.024

CHART 16



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 feet	Material	Type	Density	LS	C
0 - 30	Est. Veg.	Mix	75-95%	4.10	.020
30 - 50	P300	Mix	75-95%	7.35	.002

Slope Reach feet	Material	Type	Density	ASLbare inch	ASLmat inch	SLT inch	Sf	Recommend
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			

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

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)

- 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

$$Runoff\ Volume(ft^3): Rain\ Event\ (inches) \times \frac{1 ft}{12\ inches} \times Area\ (acres) \times \frac{43{,}560\ ft^2}{1\ acre}$$

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)	2.75 acre(s)
Thickness:	1 feet	4 feet
Porosity:	0.25	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	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.

TRC

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.[illegible]9)	**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

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

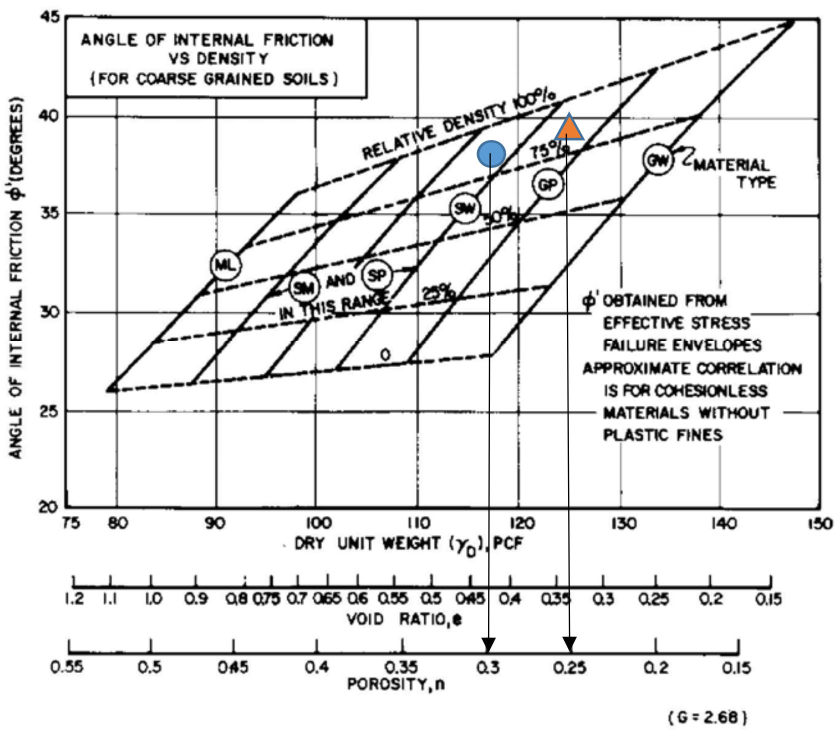
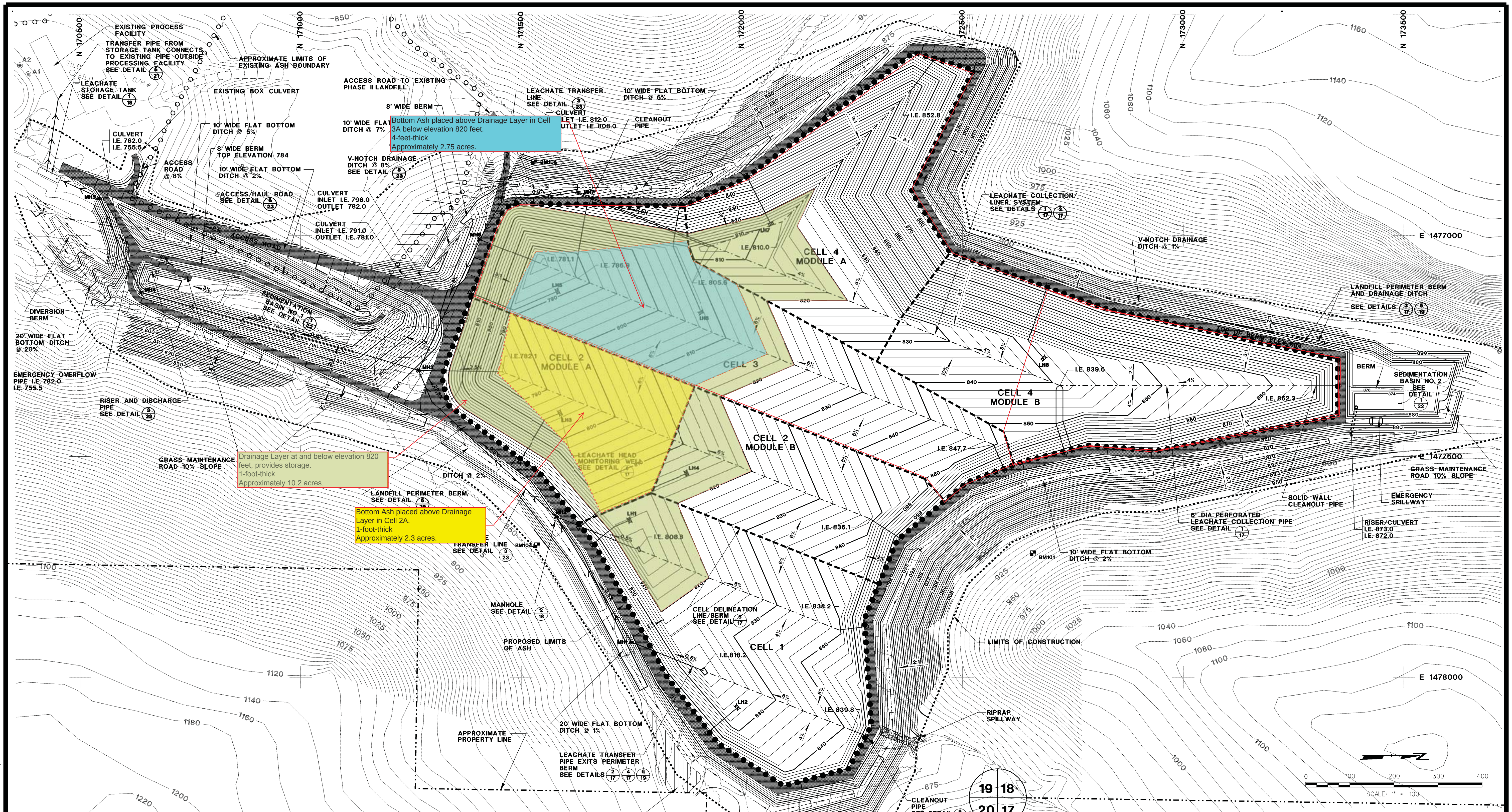


Figure from NavFac DM 7.1 (1986)

Drainage Layer Sand - Poorly Graded Sand (SP)

Bottom Ash - Poorly Graded Sand (SP) to
Poorly Graded Gravel (GP)



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.				

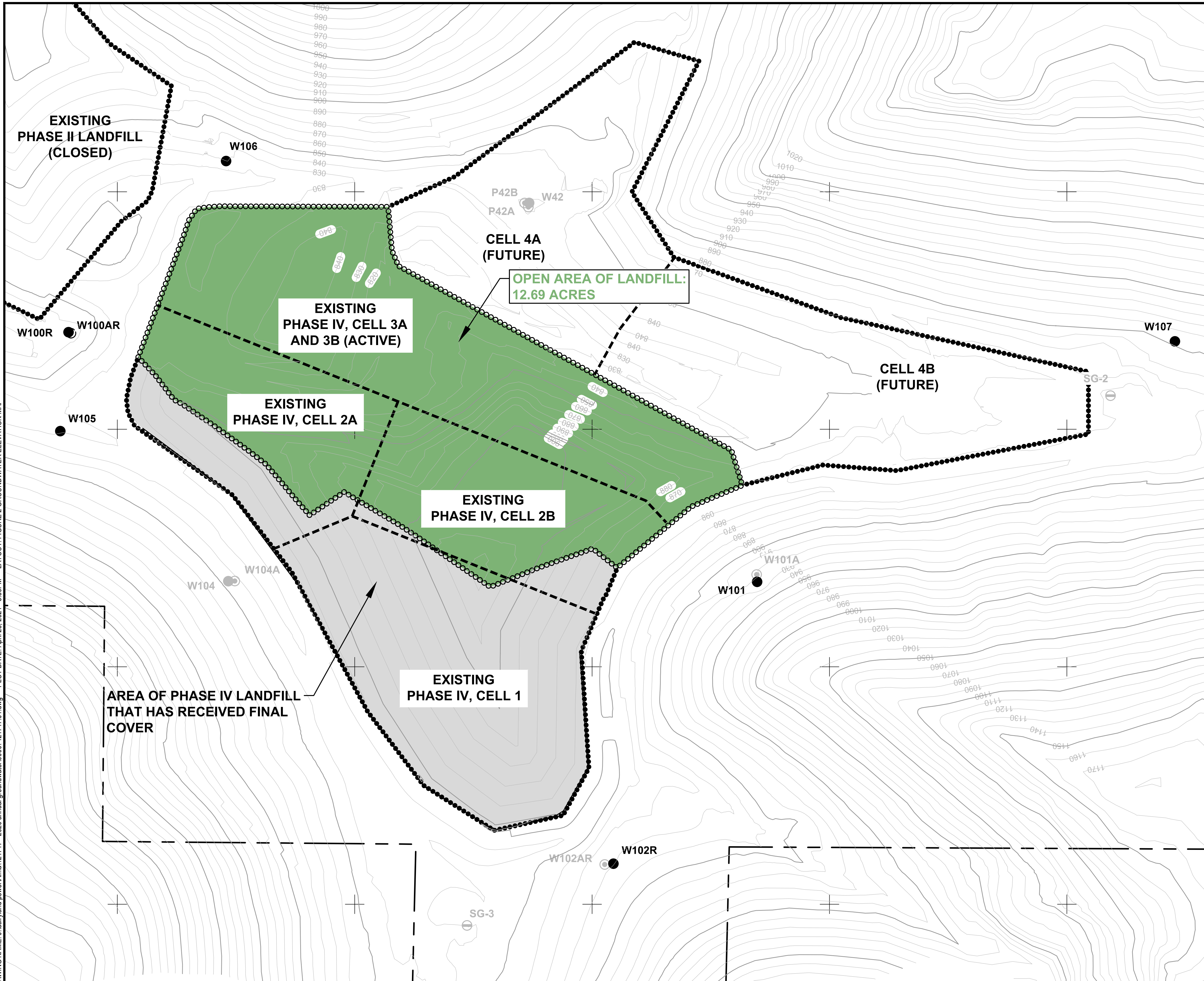
PROJECT: DAIRYLAND POWER COOPERATIVE
PLAN OF OPERATION
BUFFALO COUNTY, WISCONSIN

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		

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



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.

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

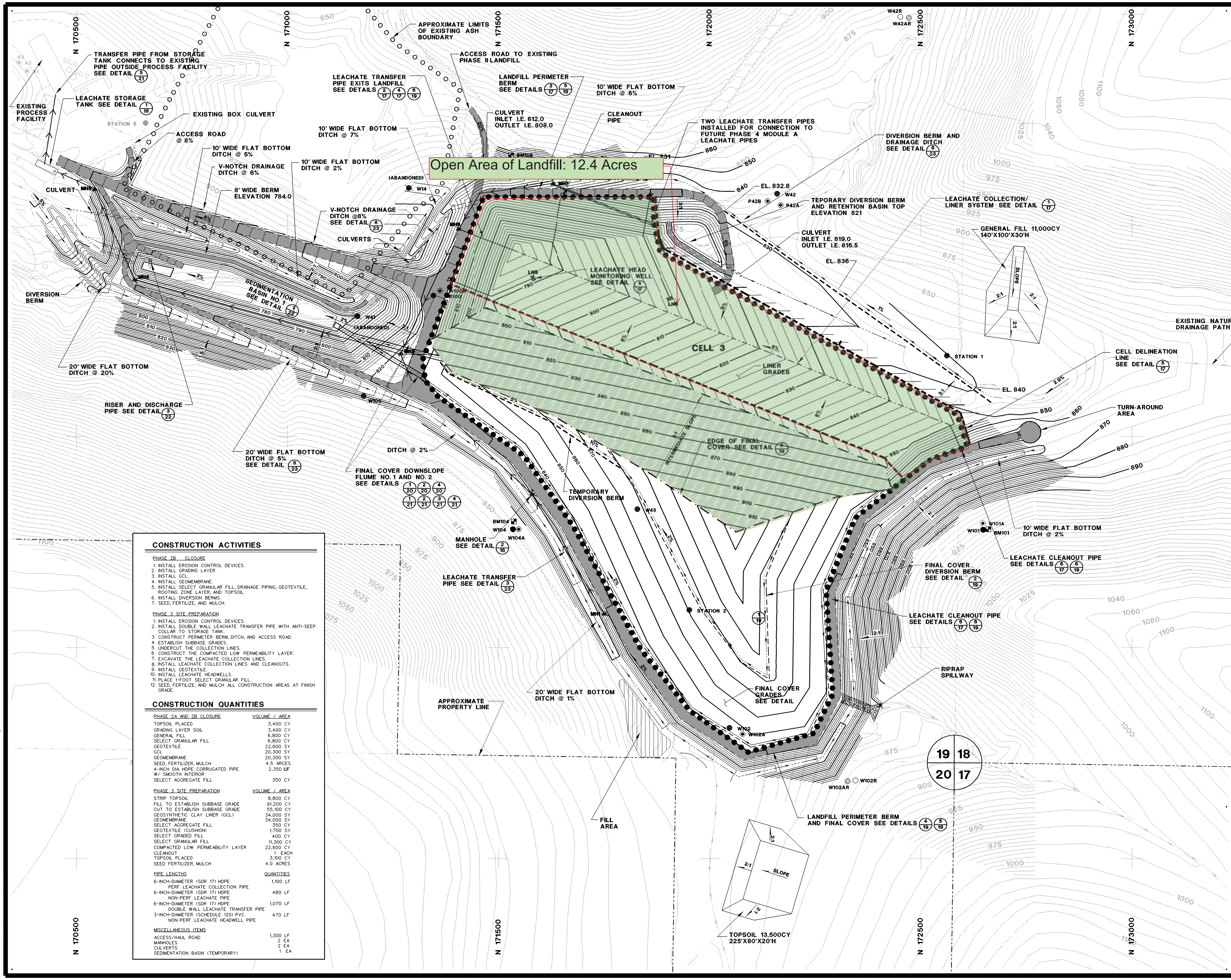
DRAWN BY:	S. HAMWAY	PROJ NO.:	421717
CHECKED BY:	B. KAHNK	FIGURE 1	
APPROVED BY:			
DATE:	OCTOBER 2021		

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

FILE NO.: 421717.01.dwg

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

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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: **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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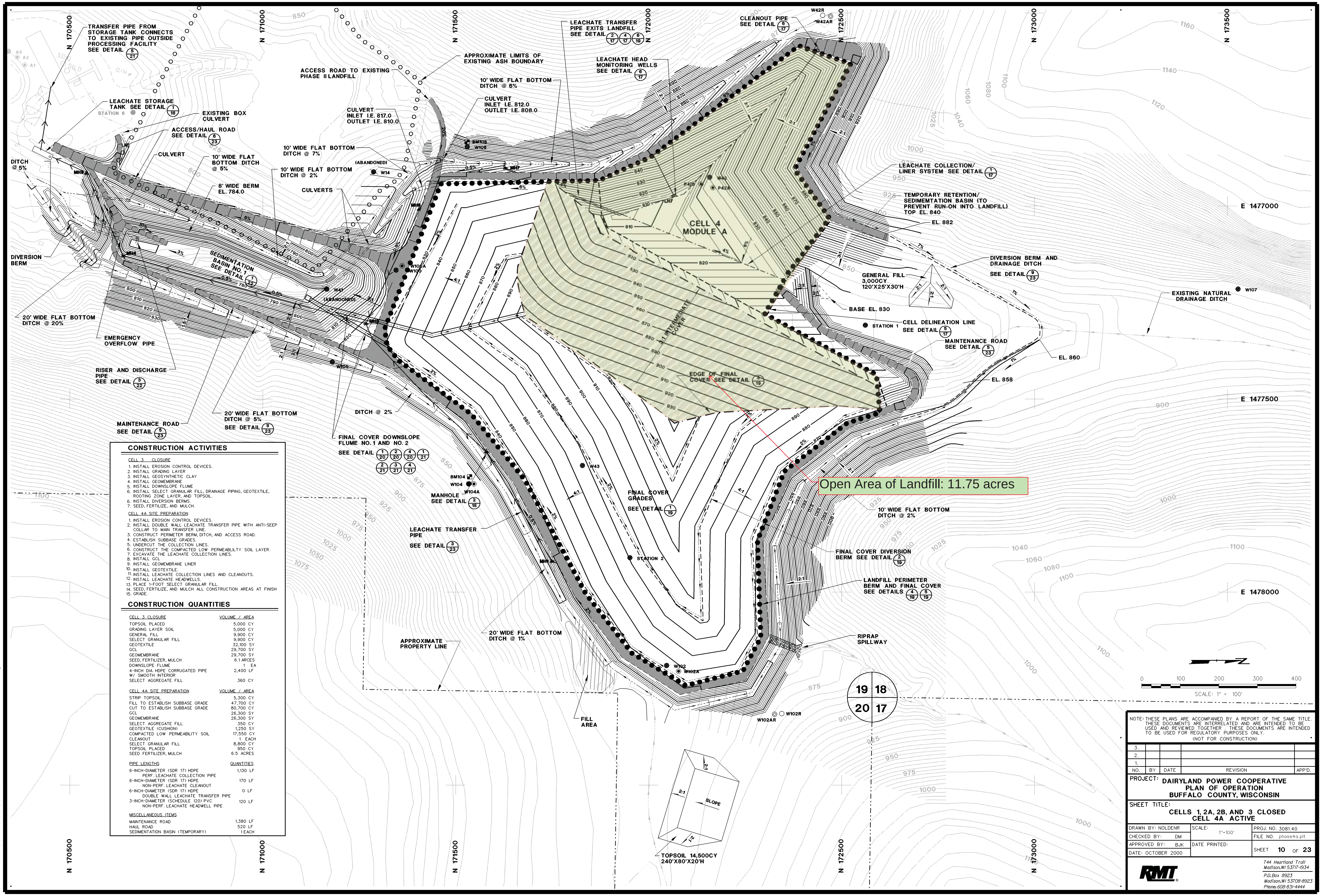
RMT COMPUTER AIDED DESIGN & DRAFTING



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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NO.	BY	DATE	REVISION	APP'D.
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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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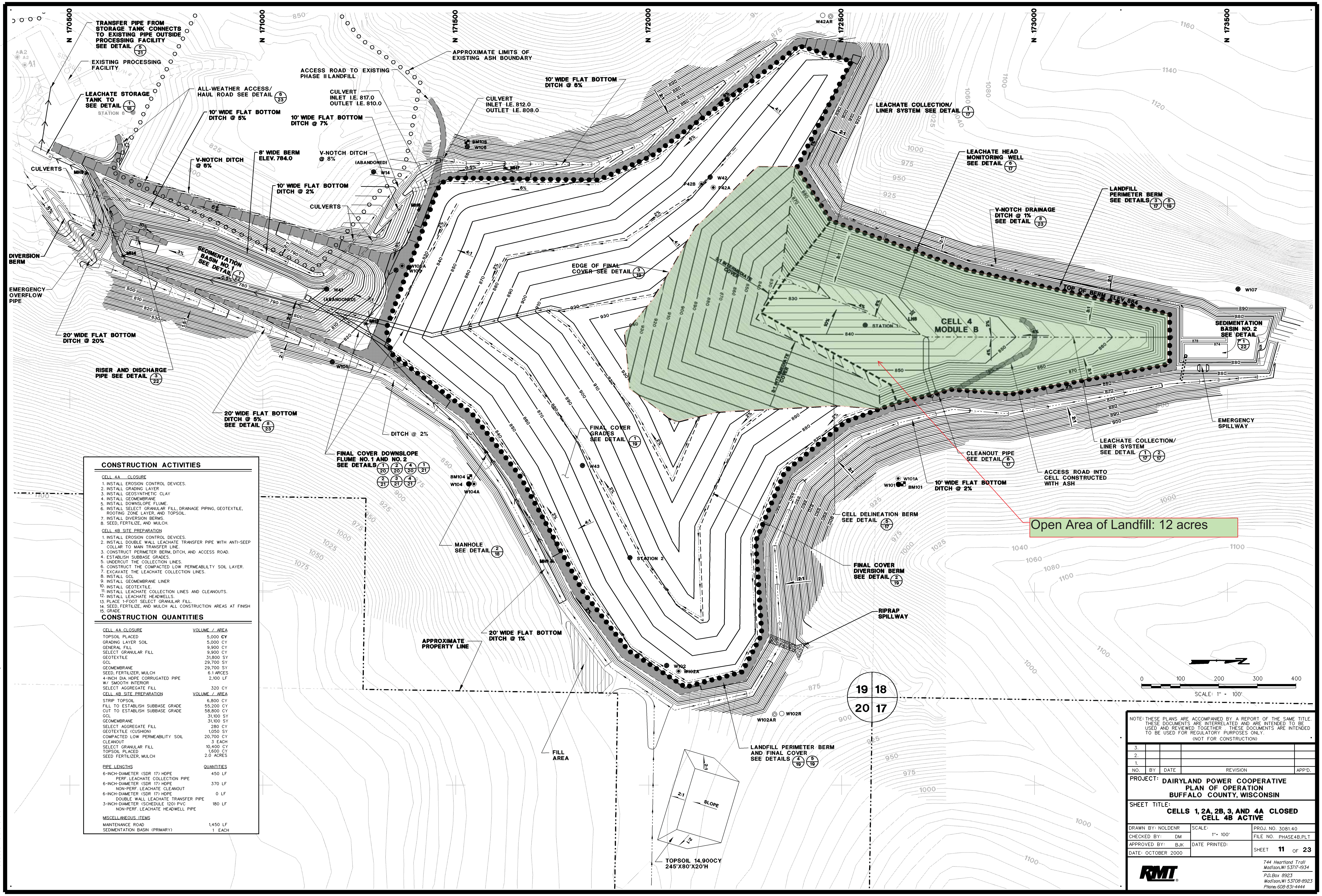
RMT COMPUTER AIDED DESIGN & DRAFTING



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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(NOT FOR CONSTRUCTION)

NO.	BY	DATE	REVISION	APP'D.
3.				
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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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744 Heartland Trail
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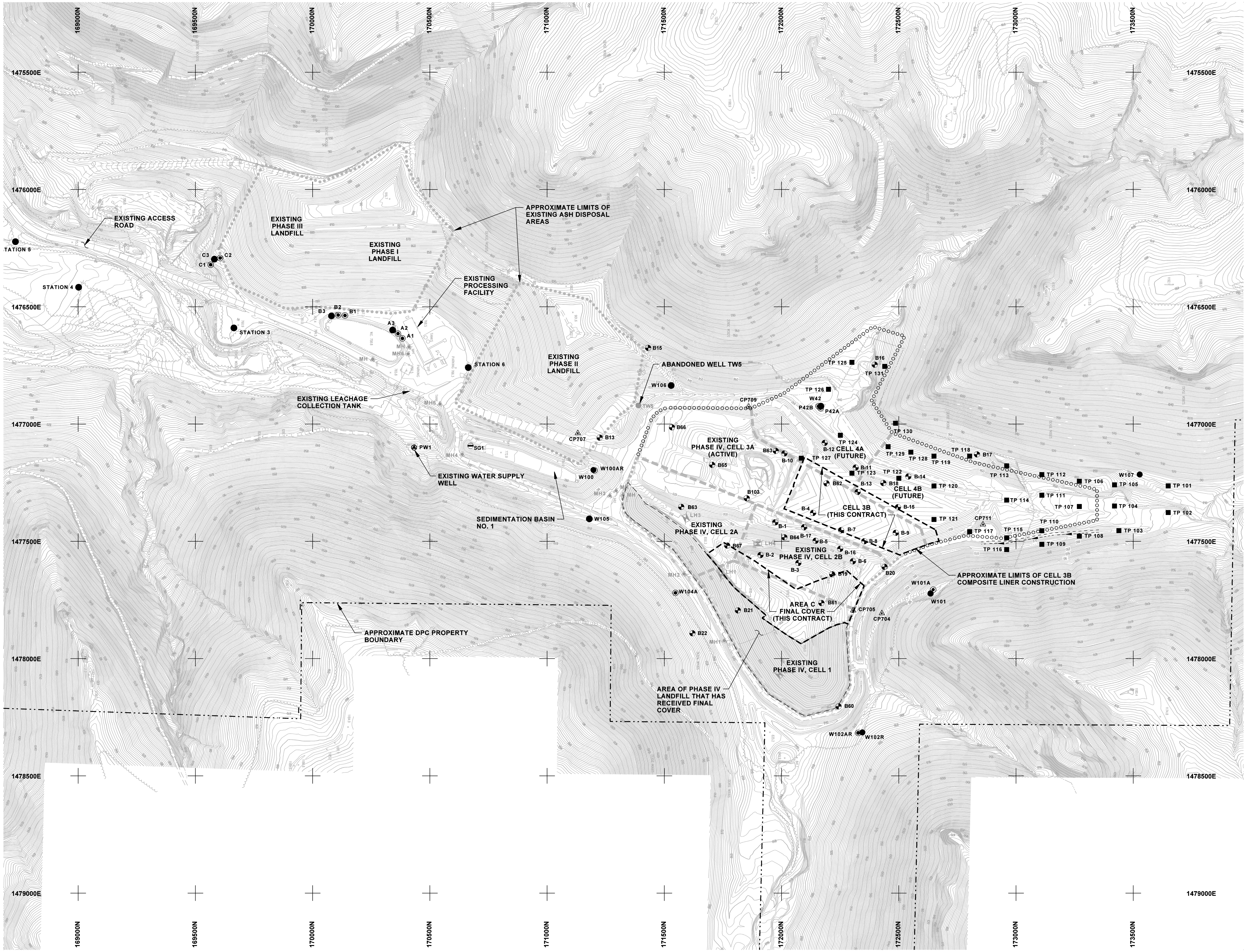
Phone: 608-831-4444

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:	PROJ. NO. 216851.0004
CHECKED BY: DM	AS SHOWN	FILE NO. 215851.0004.SHT03-EC.PLT
APPROVED BY: TWM	DATE PRINTED:	**SHEET 3 OF 13**
DATE: MARCH 2015		

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NOTE:

GRADES SHOWN INSIDE THE TOP OF THE PERIMETER 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

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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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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

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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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Madison, WI 53708-8923
Phone: 608-831-4444

RMT COMPUTER AIDED DESIGN & DRAFTING

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.				
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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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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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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
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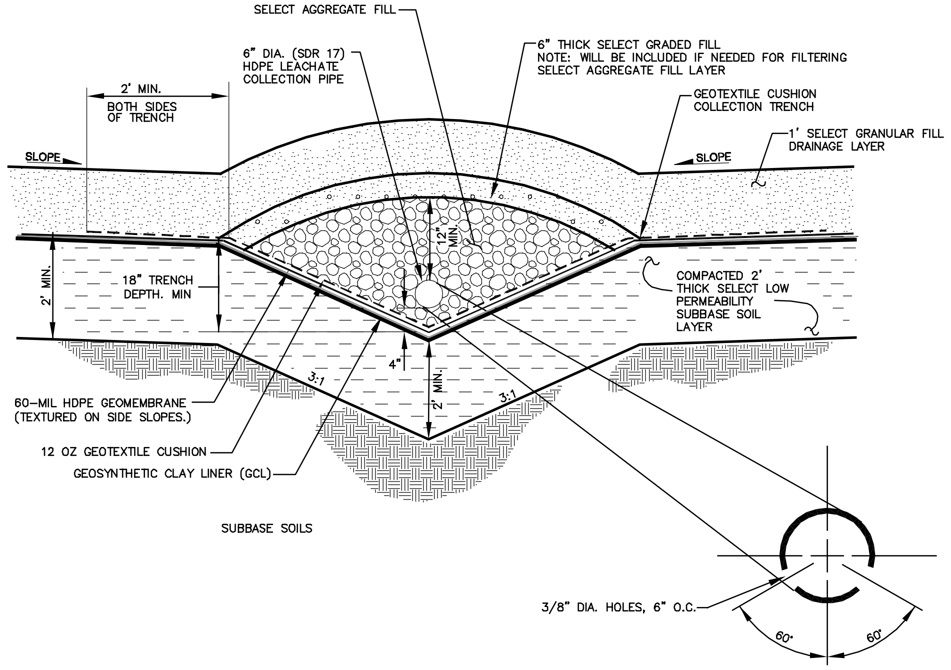
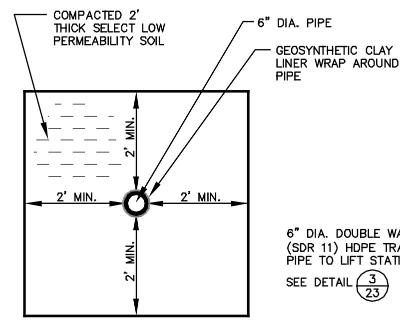


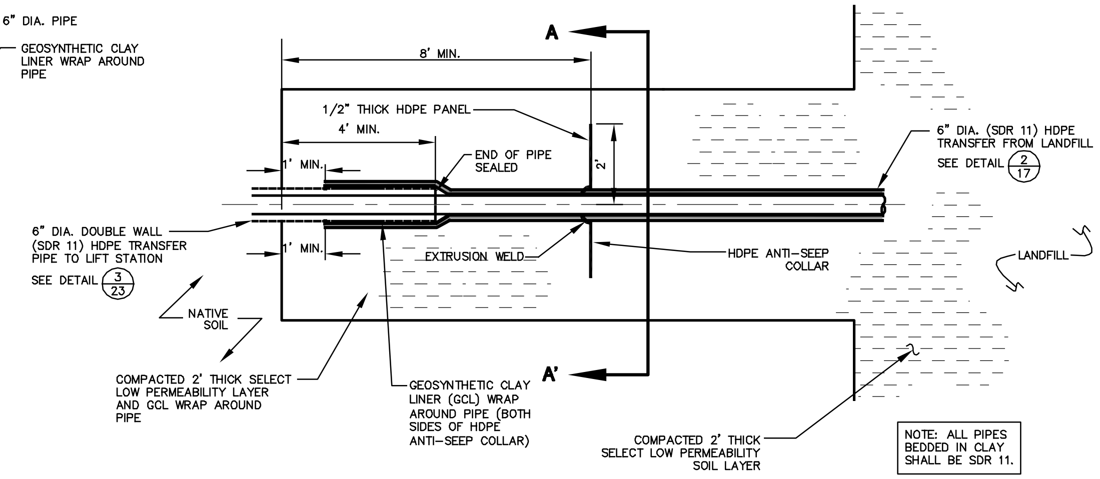
LEACHATE COLLECTION/LINER SYSTEM

1/17

(NOT TO SCALE)



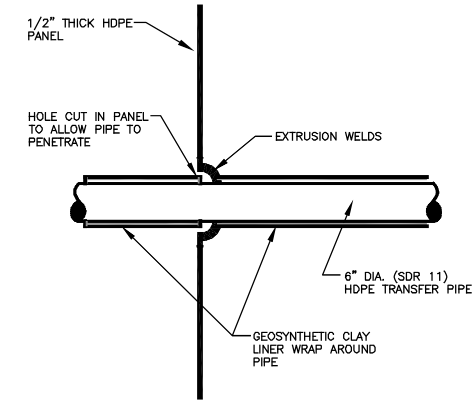
SECTION A-A'



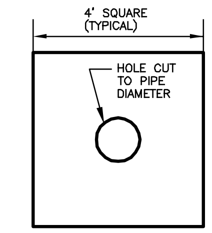
LEACHATE TRANSFER PIPE CLAY TRENCH CUT-OFF THROUGH PERIMETER BERM (TYPICAL)

4/17

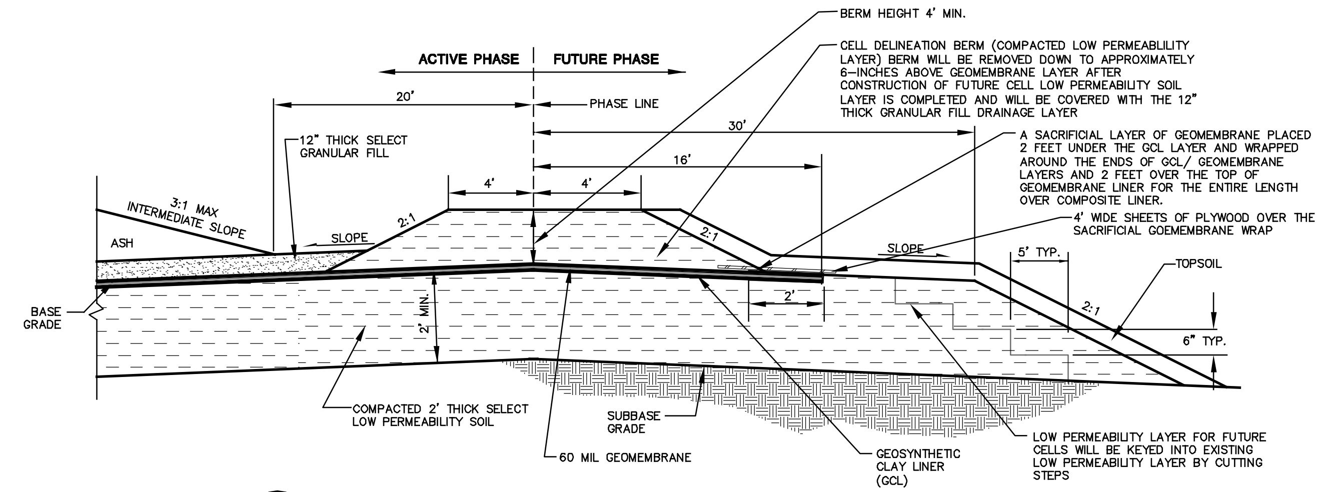
(NOT TO SCALE)



HDPE ANTI-SEEP COLLAR DETAIL (TYPICAL)



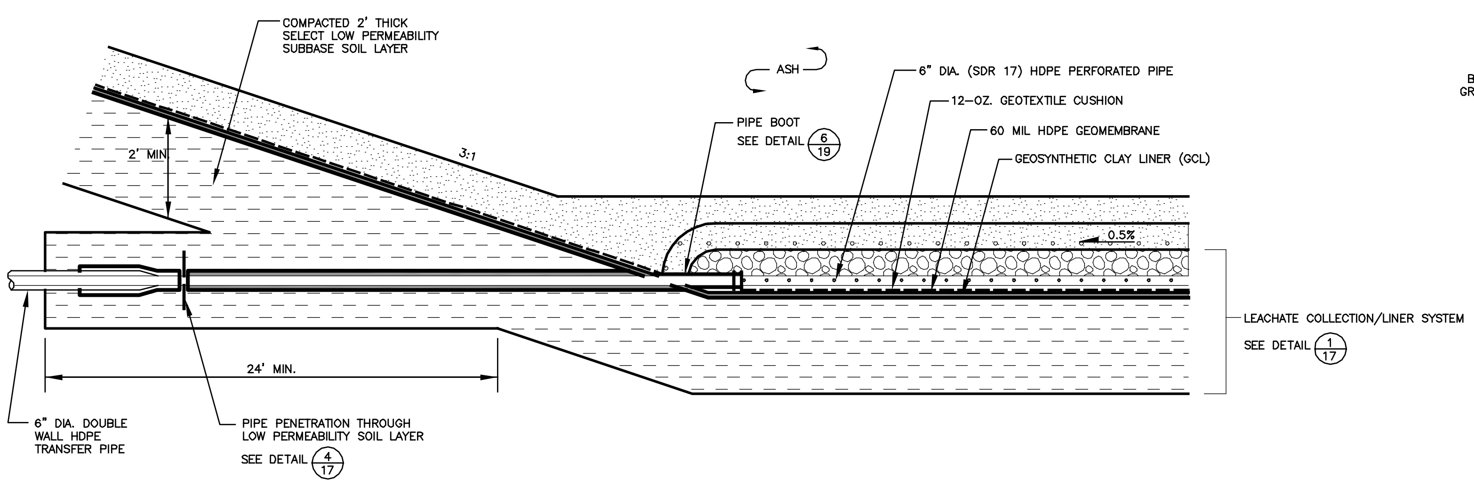
1/2" THICK HDPE PANEL



CELL DELINEATION BERM

5/17

(NOT TO SCALE)

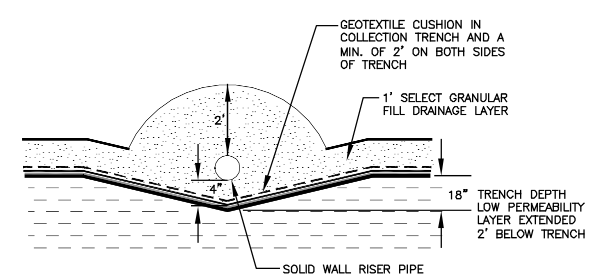


PIPE PENETRATION THROUGH LANDFILL PERIMETER BERM (TYPICAL)

2/17

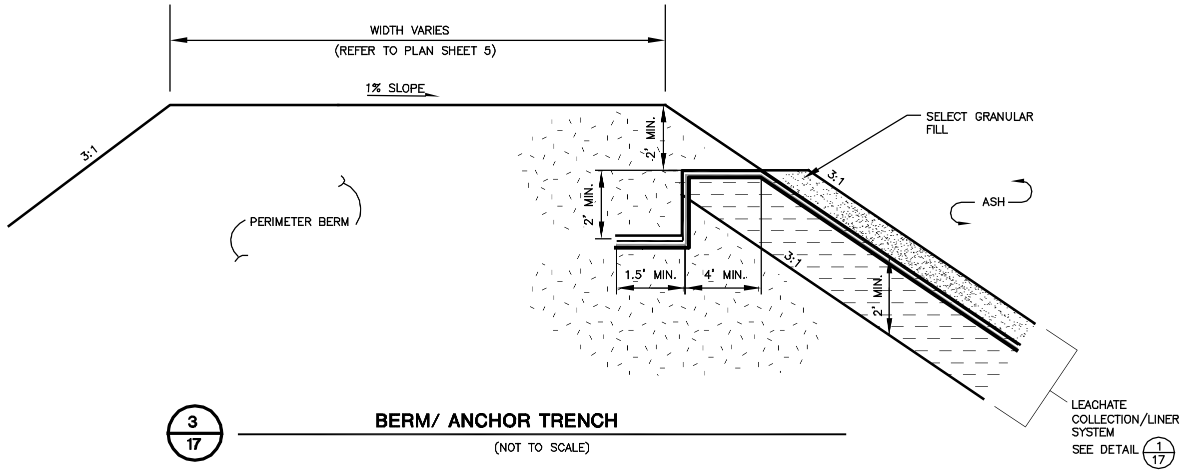
(NOT TO SCALE)

LOOKING EAST



CROSS SECTION A-A'

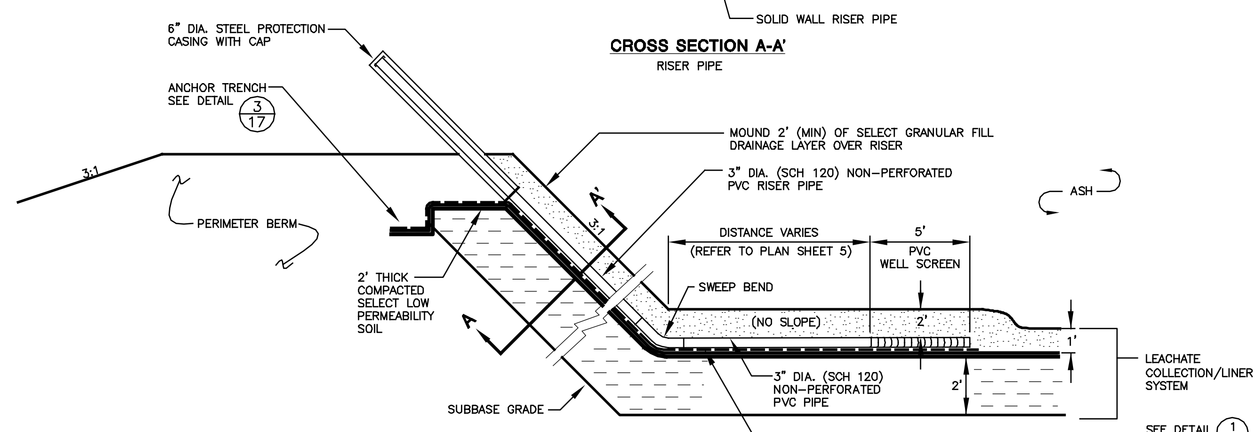
RISER PIPE



BERM/ ANCHOR TRENCH

3/17

(NOT TO SCALE)



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.

LEACHATE HEADWELL

6/17

(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- LINER AND COLLECTION PIPES**

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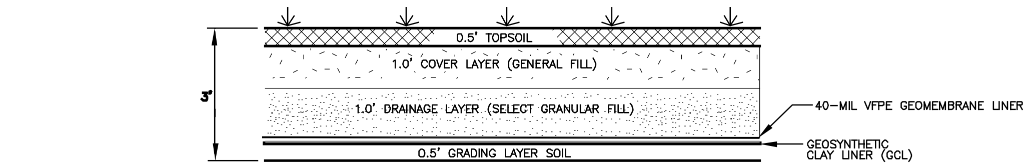
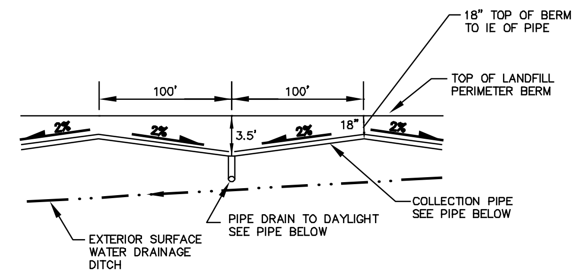


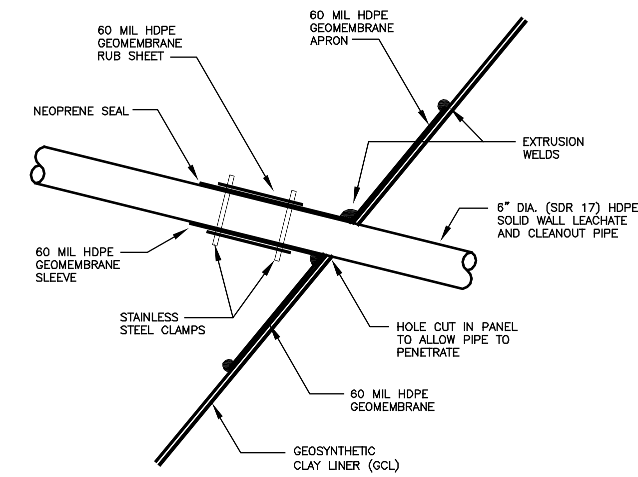
1/19 **FINAL COVER**

(NOT TO SCALE)



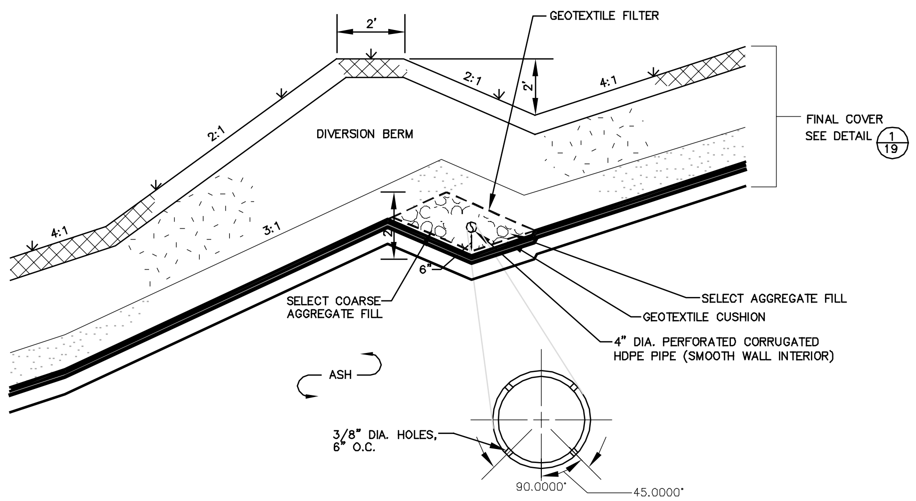
NOTE: IN AREAS WHERE THE TOP OF BERM SLOPES, THE COLLECTION PIPE WILL FOLLOW THE SAME SLOPE AS THE TOP OF BERM AND WILL OUTLET THROUGH DISCHARGE PIPES LOCATED AT SPECIFIED INTERVALS. REFER TO PLAN SHEET 12.

SECTION A-A' OF FINAL COVER DRAINAGE LAYER



6/19 **PIPE BOOT- PIPES PENETRATING THROUGH FINAL COVER AND LOW PERMEABILITY LAYER (TYPICAL)**

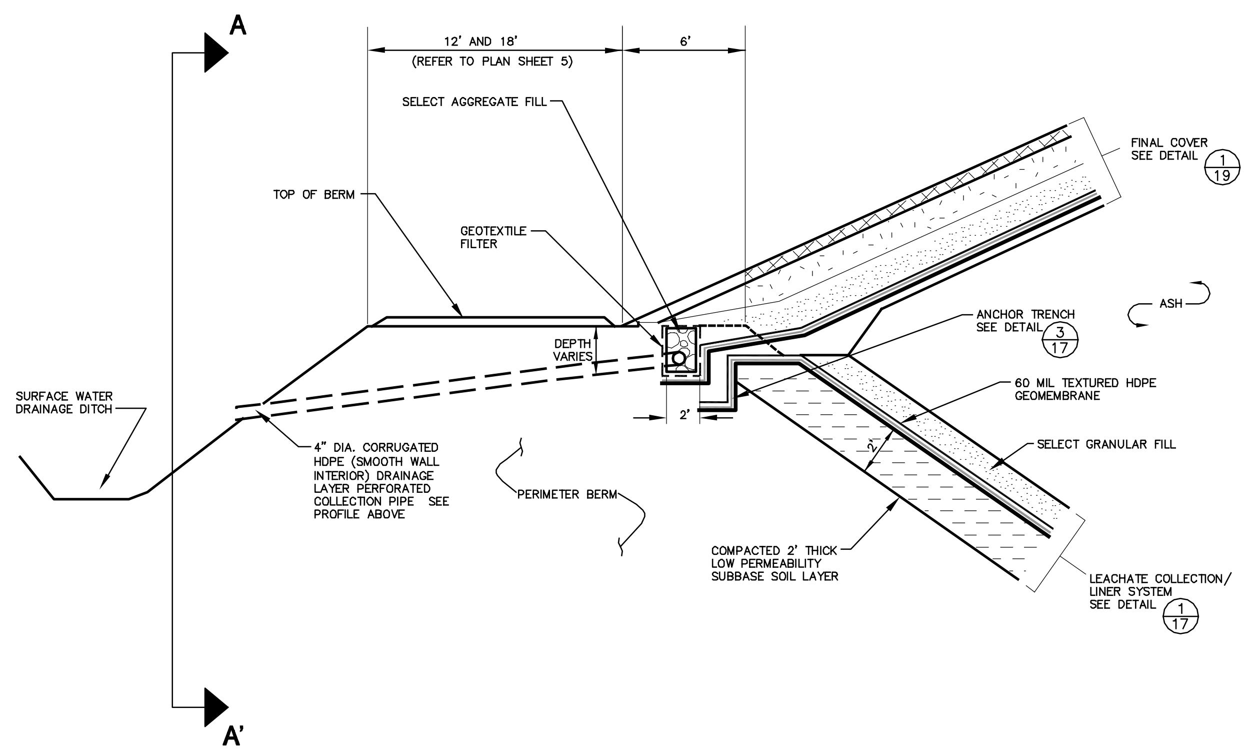
(NOT TO SCALE)



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.

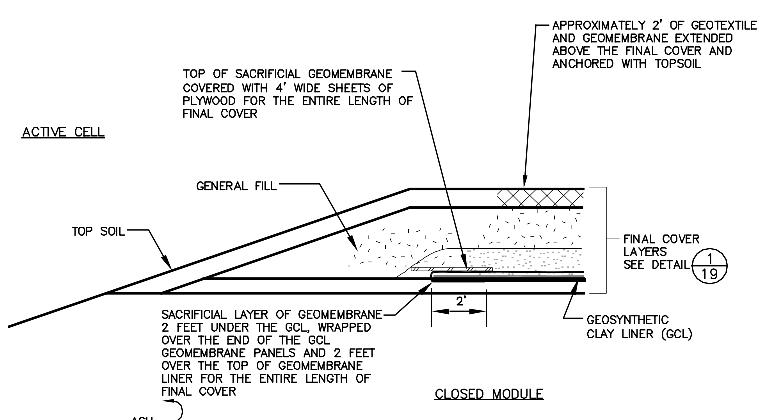
2/19 **SURFACE WATER DIVERSION BERM ON FINAL COVER (TYPICAL)**

(NOT TO SCALE)



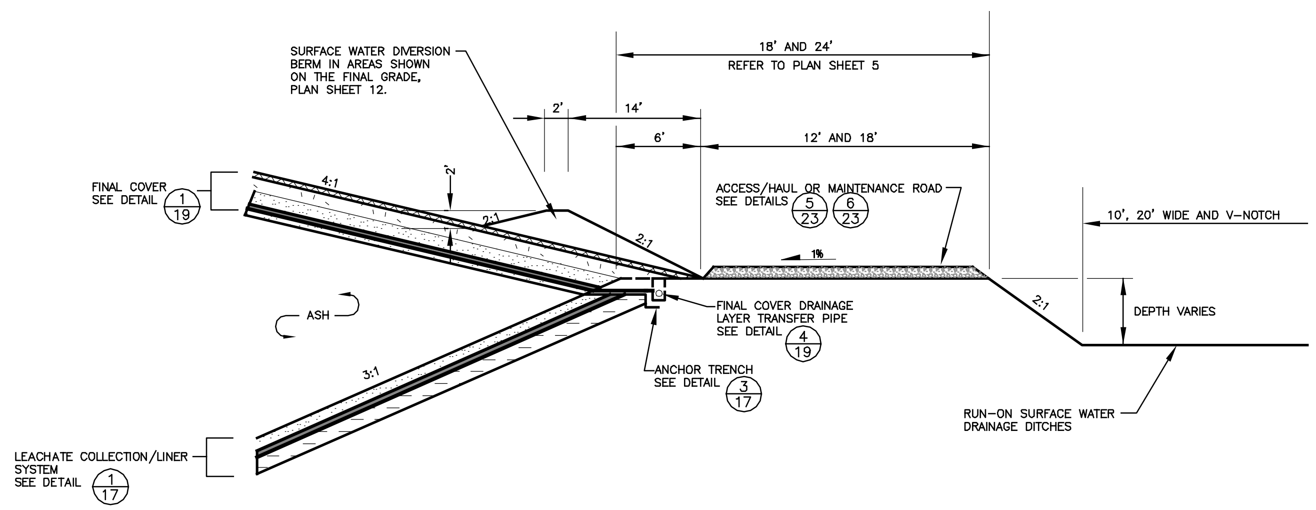
4/19 **PERIMETER BERM FINAL COVER DRAINAGE LAYER DISCHARGE PIPE (TYPICAL)**

(NOT TO SCALE)



3/19 **CONSTRUCTION OF FINAL COVER FOR SPLICING FUTURE FINAL COVER**

(NOT TO SCALE)



5/19 **LANDFILL PERIMETER BERM AND SURFACE WATER DRAINAGE DITCHES (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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PROJECT: DAIRYLAND POWER COOPERATIVE
PLAN OF OPERATION
BUFFALO COUNTY, WISCONSIN

SHEET TITLE: DETAILS- FINAL COVER

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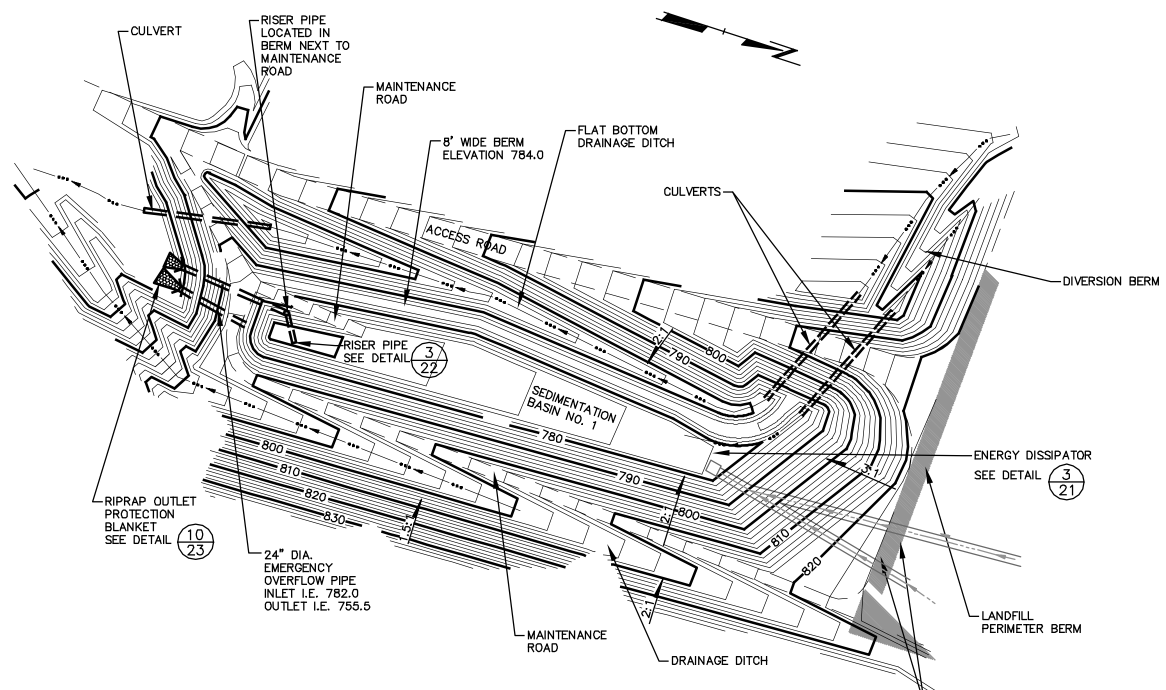
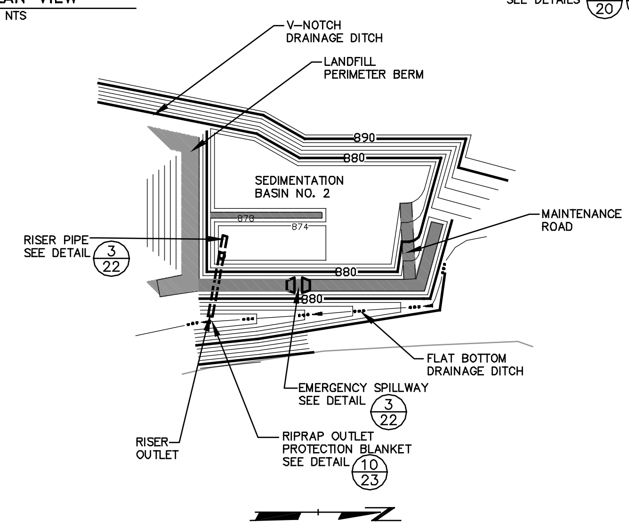


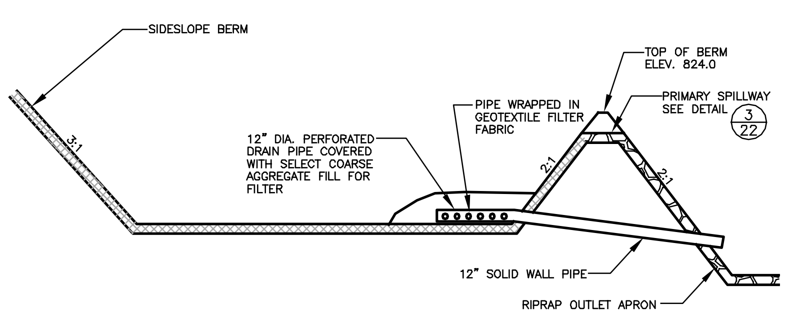
SEDIMENTATION BASIN #1
PLAN VIEW
NTS



SEDIMENTATION BASIN #2
PLAN VIEW
NTS

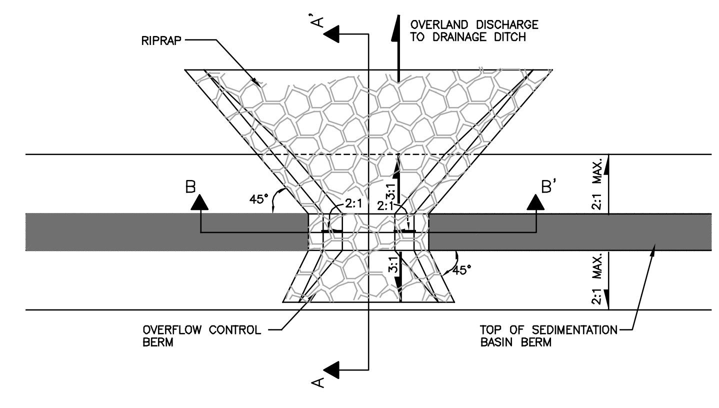
1/22 **SEDIMENTATION BASINS NO. 1 AND NO. 2**

(NOT TO SCALE)



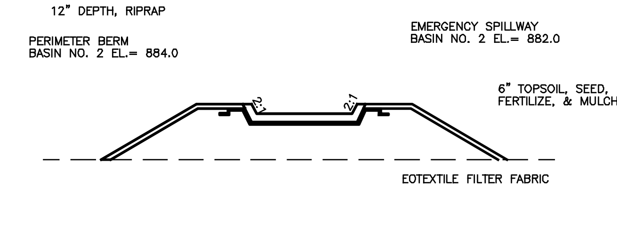
2/22 **TEMPORARY SEDIMENTATION BASIN (TYPICAL)**

(NOT TO SCALE)

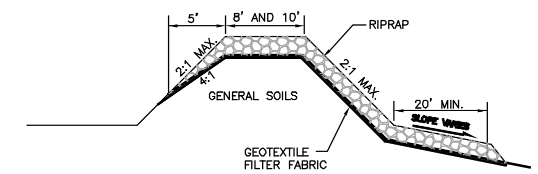


SURFACE WATER PRIMARY OR EMERGENCY SPILLWAY
PLAN VIEW

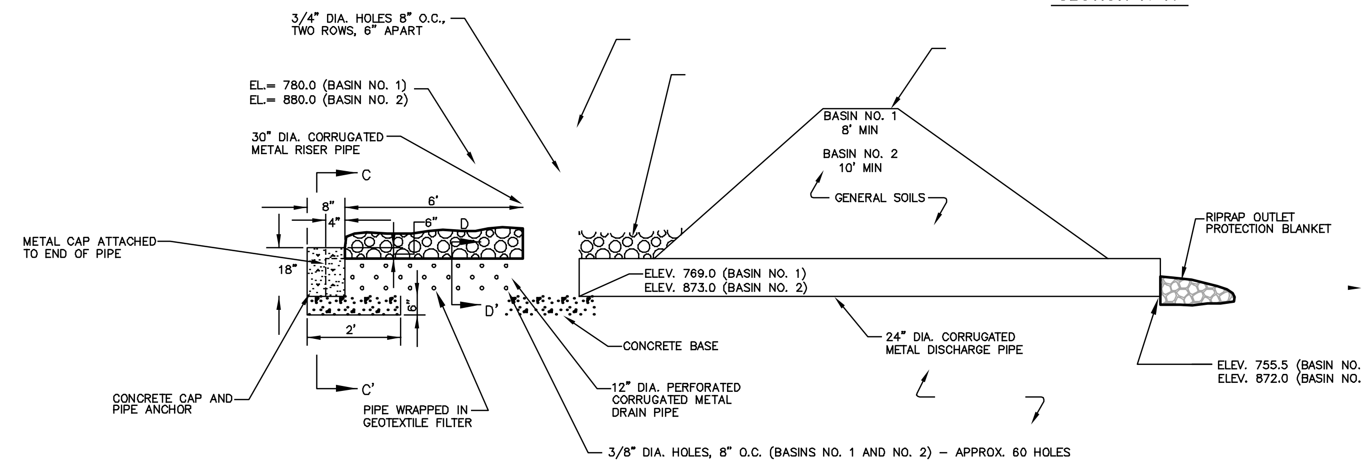
NOTE:
SEDIMENTATION BASIN NO. 1 WILL HAVE A CULVERT PIPE INSTALLED FOR THE EMERGENCY OVERFLOW. SEE DETAIL 1 OF 22.



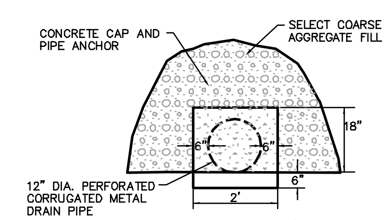
CROSSECTION B-B'



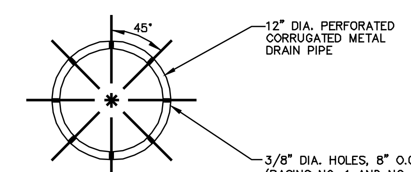
SECTION A-A'



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**

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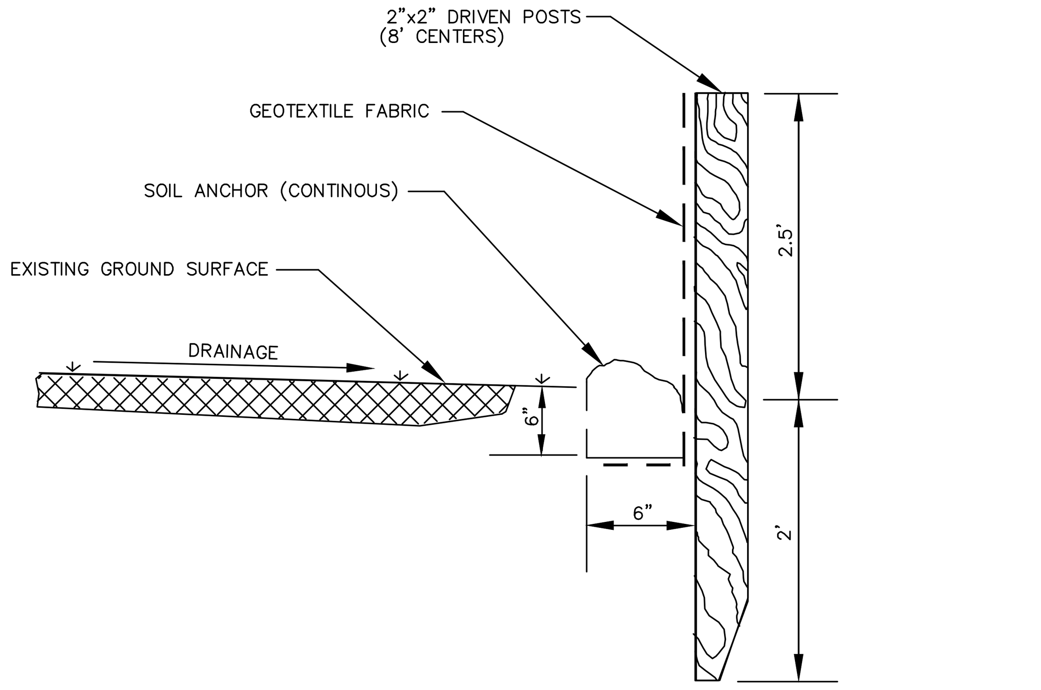
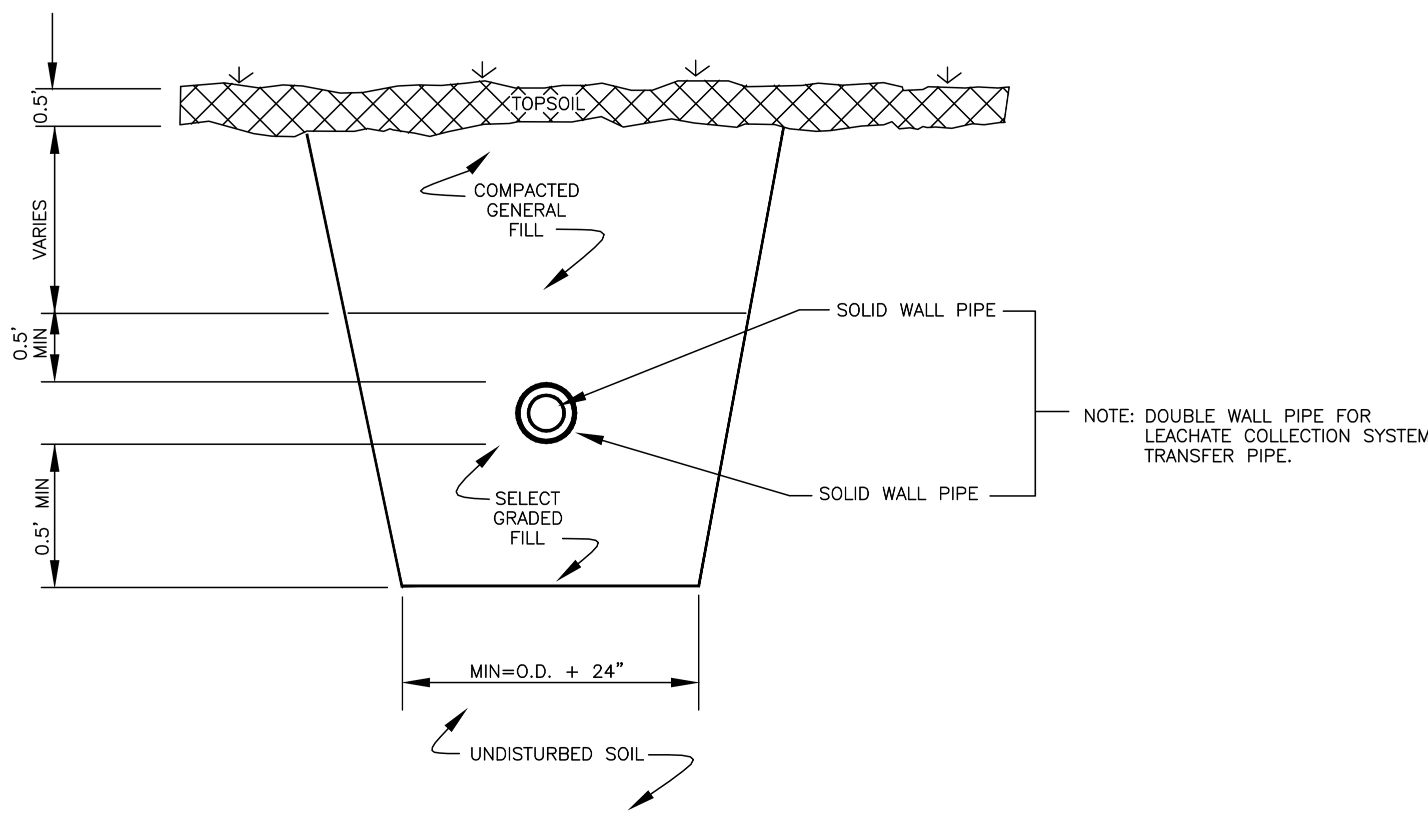
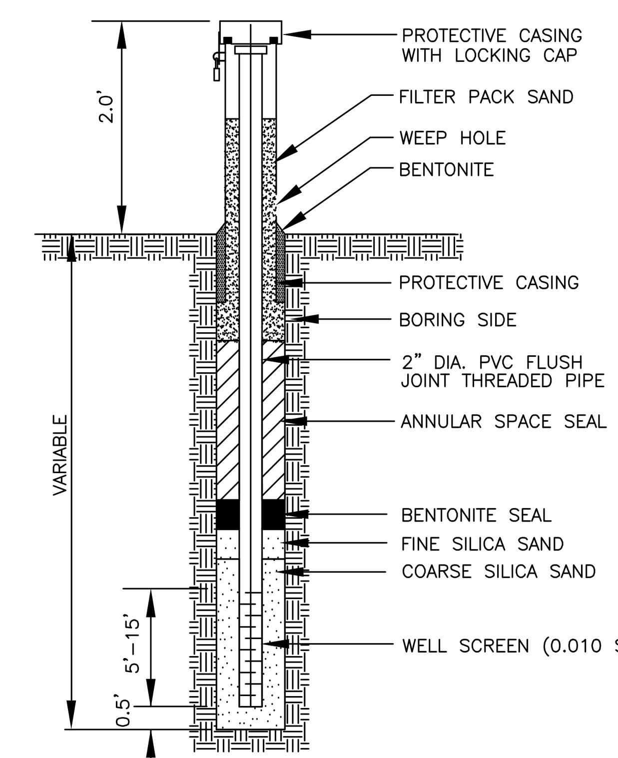


NOTE:
DETAIL SHOWN FOR PURPOSES OF IDENTIFYING INSTALLATION METHOD. LOCATION OF FENCE WILL BE DETERMINED AT DEVELOPMENT OF ENGINEERING PLANS FOR EACH PHASE OF CONSTRUCTION AND IN THE FIELD DURING ACTUAL CONSTRUCTION OF EACH PHASE.

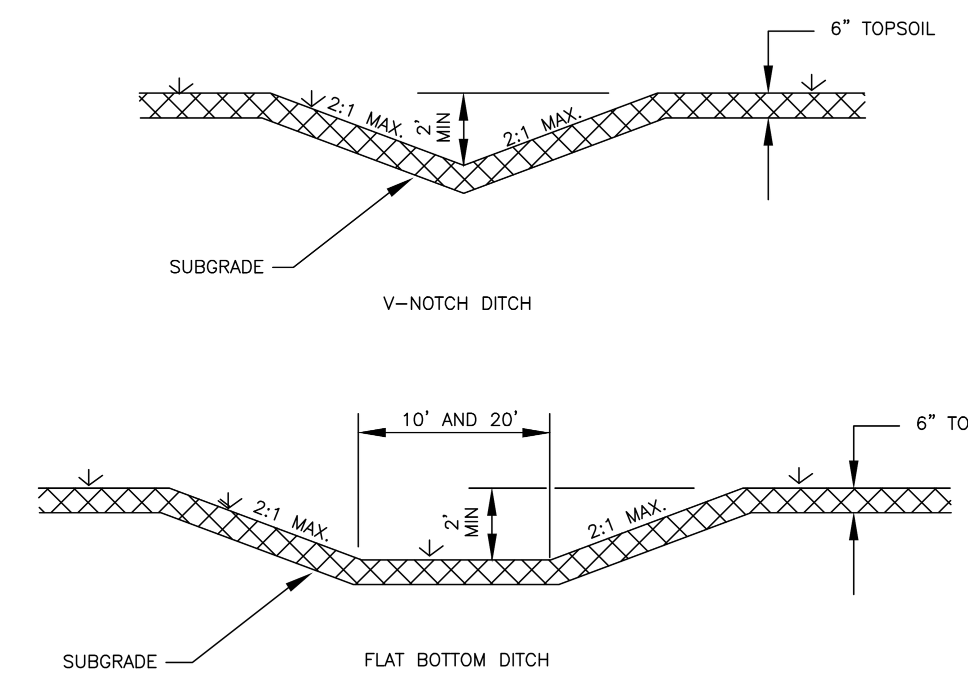
1/23 **SEDIMENT CONTROL FENCE**
(NOT TO SCALE)



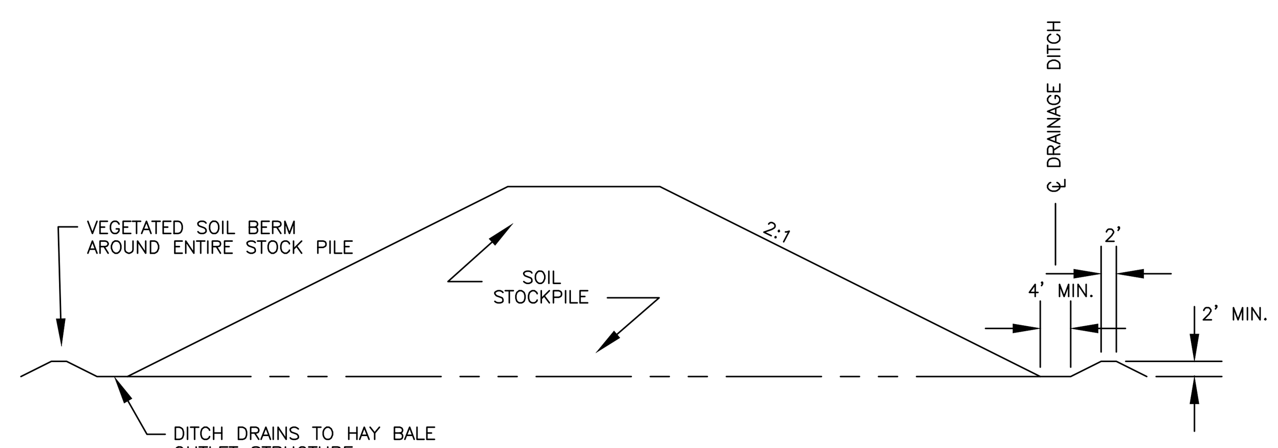
3/23 **DOUBLE WALL TRANSFER PIPE**
(NOT TO SCALE)



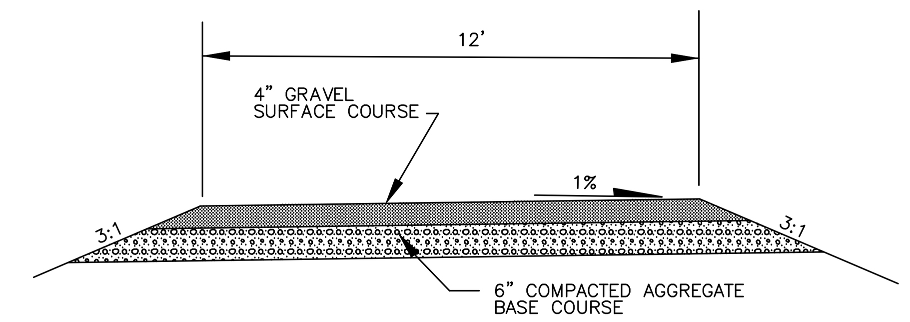
4/23 **WATER TABLE MONITORING WELL**
NOT TO SCALE



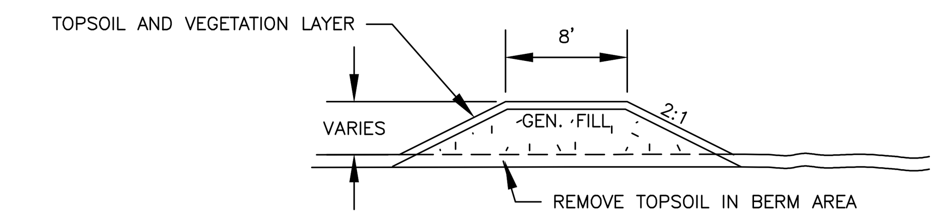
8/23 **DRAINAGE DITCH DETAILS OUTSIDE LANDFILL COVER**
(NOT TO SCALE)



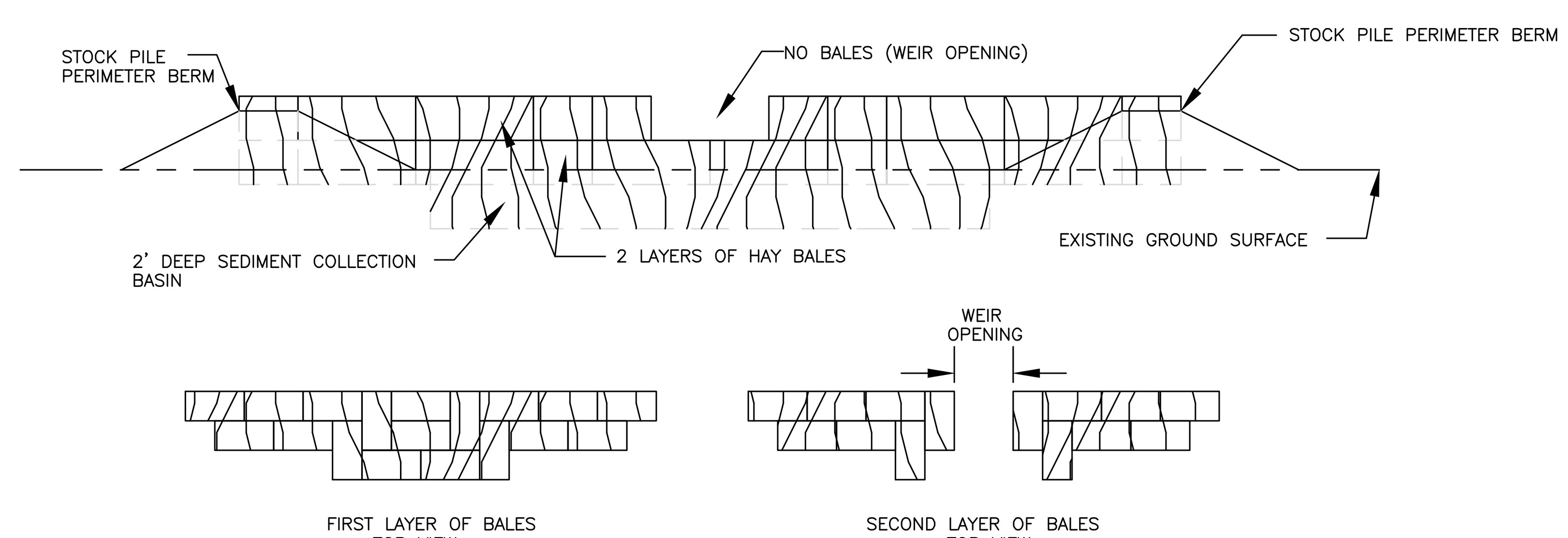
SECTION B-B'



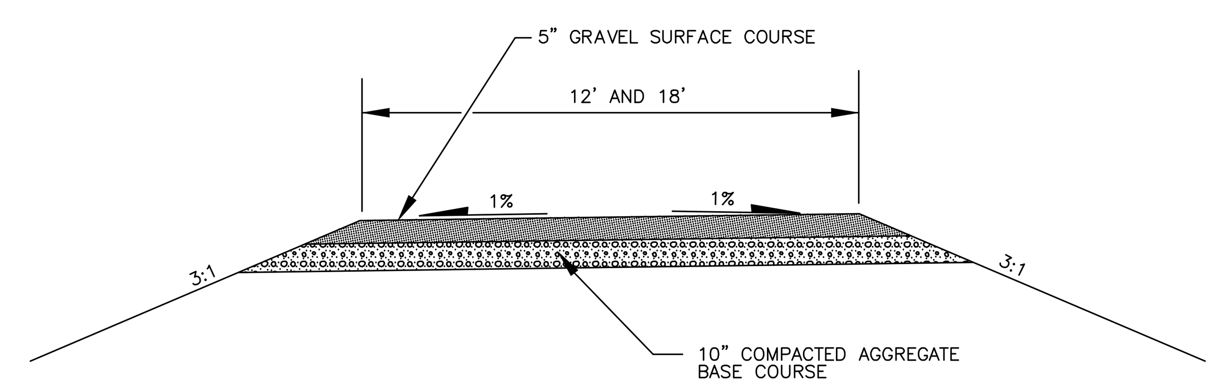
5/23 **MAINTENACE ROAD**
(NOT TO SCALE)



9/23 **TEMPORARY BERM FOR CONTROLLING WATER**
(NOT TO SCALE)



SECTION A-A'



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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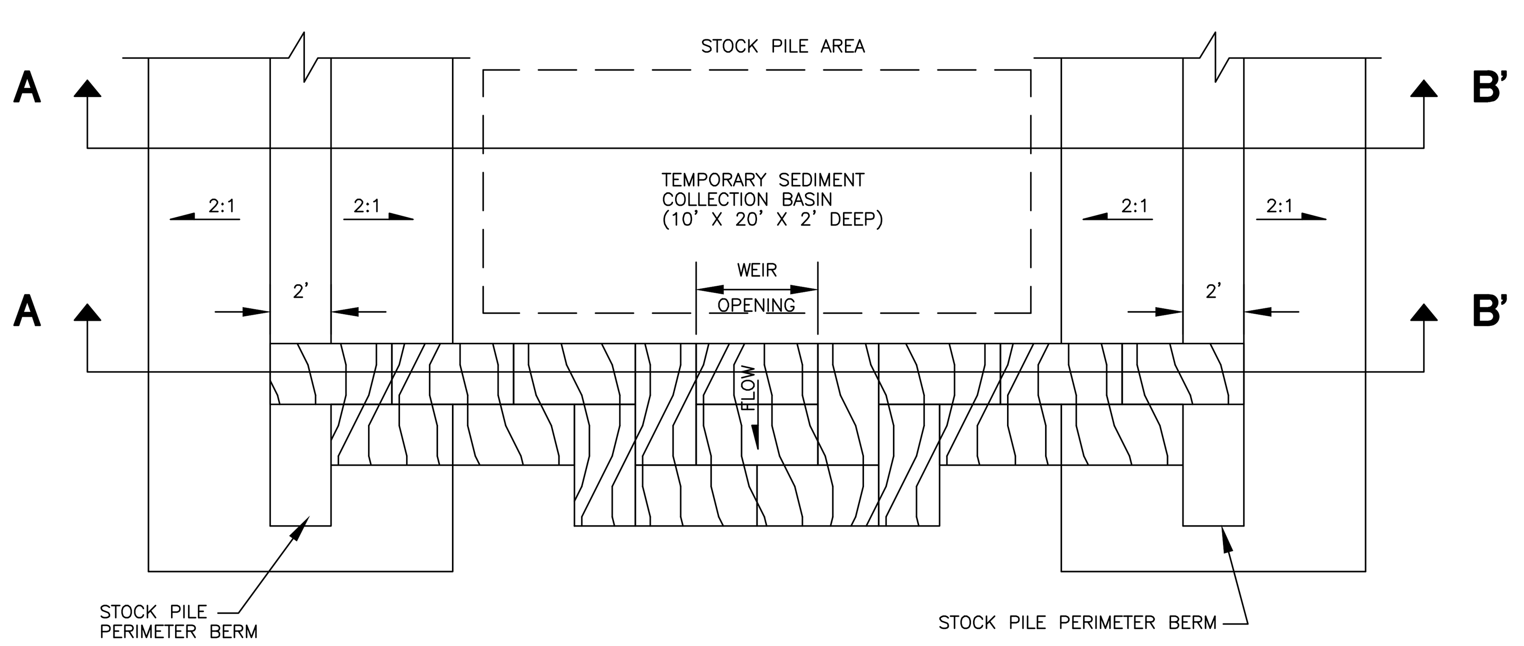
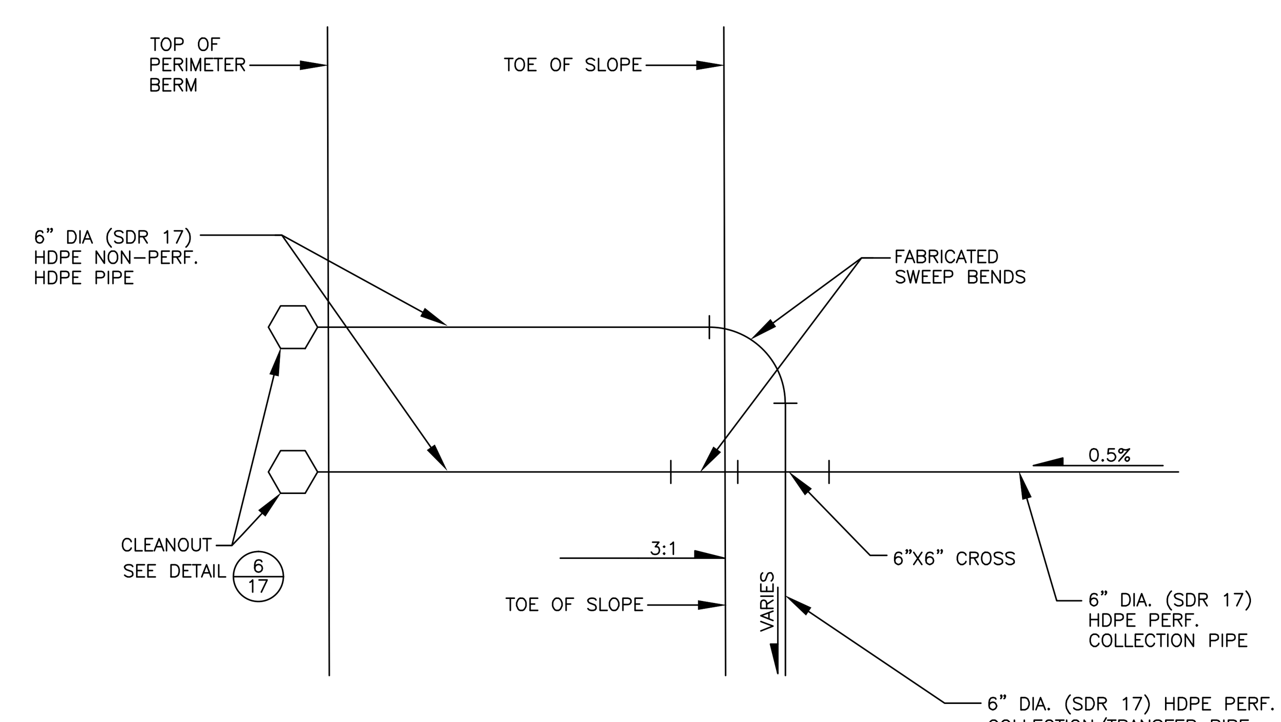
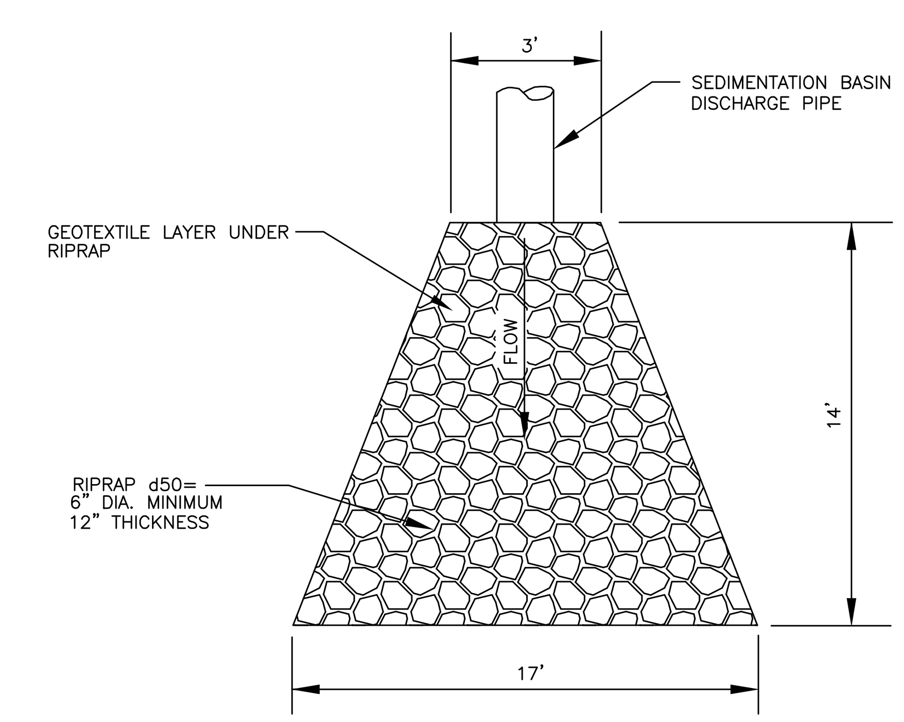


2/23 **SURFACE WATER OUTLET FOR STOCKPILES**
(NOT TO SCALE)



7/23 **PIPE CONNECTIONS (TYPICAL)**
(NOT TO SCALE)



10/23 **DISCHARGE PIPE RIPRAP OUTLET PROTECTION BLANKET**
(NOT TO SCALE)

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

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

SHEET TITLE: **DETAILS- MISCELLANEOUS**

DRAWN BY: DEFOEJ	SCALE: NOT TO SCALE	PROJ. NO. 3081.40
CHECKED BY: DM		FILE NO. 30814003.dwg
APPROVED BY: BJK	DATE PRINTED:	SHEET 23 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

Attachment 13

Revised Post Closure Care Plan

Post-Closure Plan

Alma Offsite Disposal Facility, Phase IV Landfill Alma, Wisconsin

January 2024

Prepared For:

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

Prepared By:

TRC
999 Fourier Drive, Suite 101
Madison, Wisconsin 53717

BreAnne Kahnk, P.E.
Project Engineer

Todd W. Martin
Principal Project Manager

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REVISION HISTORY

Revision Number	Revision Date	Section Revised	Summary of Revisions
01	01/12/2023	1-3	Updated text per WDNR regulations.
02	10/11/2023	2	Revised 2.3.5 to reference ch. NR 507

1.0 Introduction

This Post-Closure Care 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. DPC owns and operates the landfill in compliance with the Plan of Operation as permitted by the Wisconsin Department of Natural Resources (WDNR).

This Plan meets the post-closure (long-term) care requirements of the United States Environmental Protection Agency's (USEPA) CCR Rule, Title 40 Code of Federal Regulations (40 CFR) Parts 257 and 261 Subpart D - "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments" and s. NR 506.084. Post-closure care requirements apply to the owners or operators of CCR landfills subject to closure criteria under 40 CFR 257.102. Because DPC plans to conduct closure of the Landfill through leaving the CCR material in-place, post-closure/long-term care requirements are necessary. Following closure of the CCR landfill (placement of final cover), the owner or operator shall begin to conduct long-term care for the Landfill in accordance with this Plan.

2.0 Post-Closure Care

2.1 Post-Closure Period

Following closure of the CCR landfill, the site owner is required to maintain and monitor the closed site for a minimum of 40 years. The post-closure period begins on the date identified in the notification of closure of the CCR unit as required by 40 CFR 257.102(h) and s. NR 506.084(1). Post-closure care will be provided to maintain integrity and effectiveness of the final cover system, the leachate collection system in accordance with 40 CFR 257.70(d), and groundwater monitoring system in accordance with 40 CFR 257.90 through 40 CFR 257.98. These goals are consistent with those detailed in s. NR 514.07(10)(d)(1)(b),(c), and (d).

2.2 Post-Closure Contact

The post-closure contact for this facility will be:

Manager, Water and Waste Programs
Dairyland Power Cooperative
3200 East Avenue South
La Crosse, WI 54601
Phone: 608-787-1311
ccrinfodesk@dairylandpower.com

2.3 Inspection, Monitoring and Maintenance

The site will be inspected annually during the post-closure care period. The Landfill post-closure/long-term monitoring program was initially outlined in the 2000 Plan of Operation. A written record of the inspection(s) will be made and retained in the operating record. The inspector will assess the condition and need for repair of the final cover, vegetation, monitoring points, and storm water control features.

Minor repairs may be required to maintain the integrity and functionality of the drainage structures, roads, monitoring points, etc. Repairs will be made as warranted.

2.3.1 Final Cover Maintenance

Because the CCR is handled dry, moisture conditioned, and compacted in the Landfill, settlement of the final cover system is not anticipated. However, erosion may require minor final cover repairs. Areas of the final cover where ponding or erosion are observed will be repaired to maintain the integrity of the final cover system. Minor repairs may be required to maintain the integrity and functionality of the drainage structures, storm water controls, roads, monitoring points, etc.

2.3.2 Vegetation Maintenance

During inspections, areas lacking vegetation where it is required will be noted. Reworked surfaces, areas of failed or eroded vegetation, and repaired surfaces will be revegetated appropriately. Vegetation maintenance includes mowing. Mowing will be conducted as needed or on a semi-annual basis, whichever is more frequent. Mowing is not required where native prairie grass vegetative cover has been installed as previously approved by the WDNR.

2.3.3 Storm Water Runoff Management System Maintenance

Erosion controls and avoiding ponding of water are addressed by the design, grading, construction, and establishing vegetation on the landfill final cover to ensure proper run-on and run-off of storm water. During site inspections, diversion berms, perimeter dikes, roads, slopes, and storm water sedimentation basins will be inspected for erosion, seeps, depressions, obstructions to flow, vegetation cover, and other maintenance concerns. Maintenance associated with sediment accumulations and erosion will be performed as needed.

2.3.4 Leachate Collection System Maintenance and Monitoring

The leachate collection system will be maintained as needed during the post-closure care period. Features of the system that will be inspected annually include manholes, surface features, transfer piping, controls, the storage tank, and leachate collection volumes. Leachate lines will be cleaned and televised on an annual basis at a minimum. Miscellaneous repairs will be performed on an as-needed basis. The leachate storage tank will be replaced as necessary.

The leachate monitoring program will continue to be conducted during the post-closure period. At a minimum, leachate sampling from the storage tank will occur on a bi-annual basis and leachate head wells will be recorded annually, as presented in the 2000 Plan of Operation and the Environmental Sampling Plan.

Leachate collected in the leachate collection tanks will be utilized on-site for approved activities or hauled to the DPC wastewater treatment plant (WWTP), located in Alma, Wisconsin or the La Crosse Waste Water Utility WWTP location in La Crosse, Wisconsin for treatment and disposal. Miscellaneous repairs will be performed on an as-needed basis to maintain the integrity and effectiveness of the system.

2.3.5 Groundwater Monitoring Well Maintenance and Monitoring

The groundwater monitoring system will be maintained and monitored per ch. NR 507 throughout the post-closure care period. Groundwater monitoring wells will be sampled as outlined in the Environmental Sampling Plan during the post-closure care period. Results associated with CCR wells will be presented in the annual Groundwater Monitoring and Corrective Action Report submitted to the WDNR and posted to the publicly accessible website. The remainder of the results will be submitted to the WDNR as required. Groundwater monitoring records will be maintained in the operating record.

Sampling procedures and the groundwater monitoring program, as described in the Environmental Sampling Plan, will be followed throughout the post-closure care period. The parameters, frequency, and monitoring locations are summarized within the Environmental Sampling Plan.

If adverse trends develop, then the WDNR will be notified and further evaluation will be performed. If corrective action becomes necessary, then a plan will be developed and submitted to the WDNR for approval.

2.4 Post-Closure Uses

After the Landfill is closed, the site will be secured and maintained by the owner as open green space and recreation. These uses do not conflict with long-term care plans for the area. The final use is intended to prohibit agricultural uses, building construction, and excavation of the final cover or CCR. These uses are protective of the final cover system and do not increase the potential threat to human health or the environment.

2.5 Post-Closure Care Termination

Post-closure care termination may be considered after a period of 40 years from the notification of closure. In the event that the Landfill is operating under assessment groundwater monitoring in accordance with 40 CFR 257.95, the Owner will continue to perform post-closure care and groundwater monitoring in accordance with 40 CFR 257.95 until the Landfill returns to detection monitoring.

No later than 60 days following completion of the post-closure care period, the owner or operator of the CCR landfill shall post the notification of completion of post-closure care period to the operating record in accordance with 40 CFR 257.104(e) and s. NR 506.084(2)(b). Section 3 provides details on notification requirements.

2.6 Revision of the Post-Closure Plan

This Post-Closure Plan should be amended and submitted to the WDNR at least 60 days prior to a planned change that will substantially affect this plan or within 60 days of an unanticipated event after post-closure activities have commenced. If the Post-Closure Care Plan is revised after long-term care activities have commenced, the owner or operator shall submit the modification request to the WDNR no later than 30 days following the triggering event. Modifications to the Post-Closure Care Plan shall be completed in accordance with s. NR 514.04(6).

3.0 Notifications

3.1 Operating Record

The following items will be maintained in the operating record for a minimum of five years:

- 40 CFR 257.105(h): applicable requirements for groundwater monitoring
- 40 CFR 257.105(i)(12): the current post-closure plan and any amendment of the plan; the current version of the post-closure plan will be maintained in the facility's operating record irrespective of time,
- 40 CFR 257.105(i)(13): the notification of completing post-closure care
- Inspection reports

3.2 Notification Requirements

The following required notifications will be provided before the close of business on the day the notification is required to be completed:

- 40 CFR 257.106(h): *applicable* requirements for groundwater monitoring
- 40 CFR 257.106(i)(12): the availability of the written post-closure plan and any amendment of the plan
- 40 CFR 257.106(i)(13): the availability of completion of post-closure care

3.3 Publicly Accessible Internet Site

The following required items will be posted on the publicly accessible internet site:

- 40 CFR 257.107(h): *applicable* requirements for groundwater monitoring
- 40 CFR 257.107(i)(12): the written post-closure plan and any amendment of the plan
- 40 CFR 257.107(i)(13): the notification of completion of post-closure care

Information should be posted within 30 days of placing the pertinent information in the operating record. Records will be made available to the public for at least five years following the date on which the information was posted on the internet site.

4.0 Engineer's Certification

Pursuant to 40 CFR 257.104 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 Post-Closure Plan has been prepared in accordance with good engineering practice; and

(iii) this Post-Closure Plan meets the requirements of 40 CFR 257.104(d).

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.

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

Signature of Registered Professional Engineer

Registration No. E-46825 State: Wisconsin

Attachment 14

Revised Closure and Post-Closure Costs

Table 1: Engineering Opinion of Probable Cost
Site Closure - Phase IV Landfill
Dairyland Power Cooperative, Alma Off-Site Disposal Facility
Plan Modification - August 2023

Item No.	Major Cost Item	Unit	Unit Cost[1]	Quantity	Cost[2]
1	Mobilization[3]	LS	$110,000.00	1	$ 110,000
	Final Cover System:[4][5][6]				
2	Barrier Layer (24" Fine Grained Soil)	CY	$10.20	40,100	$ 410,000
3	GCL	SF	$0.75	540,200	$ 406,000
4	40-mil LLDPE Geomembrane	SF	$0.61	540,200	$ 330,000
5	Granular Drainage Layer (12")	SY	$9.45	60,100	$ 568,000
6	Vegetative Layer (18")	SY	$3.21	90,100	$ 290,000
7	Topsoil (6")	CY	$6.89	10,100	$ 70,000
8	Seed, Fertilize, and Mulch	Acre	$2,290.00	12.4	$ 29,000
9	Surface Water Control System[7]	LS	$150,000.00	1	$ 150,000
10	Silt Fence	LF	$3.50	1,000	$ 4,000
	Engineering Fees:				
11	Construction Plans	LS	$34,000.00	1	$ 34,000
12	Construction Observation	Week	$10,000.00	25	$ 250,000
13	Documentation Report	LS	$34,000.00	1	$ 34,000
				Subtotal:	$ 2,685,000
				Contingency (10 percent):	$ 268,500
				Total cost (2023 dollars):	**$ 2,953,500**

Assumptions:

(1) Unit cost were inflated to 2023 dollars from 2019 dollars through the Owner Financial Responsibility Inflation Factor Table. An inflation factor of 1.1477 was generally used on the previous 2019 unit costs.

(2) Some totals may not agree due to rounding.

(3) Mobilization is assumed to be approximately 5 percent of construction cost.

(4) The total final cover area is approximately 12.4 acres.

(5) Proper drainage grades are established upon closure, and no additional grading costs are assumed.

(6) Barrier layer, granular drainage layer, vegetative layer, and topsoil will be obtained from on-site stockpiles/borrow areas.

(7) Includes diversion berms, downslope flumes, energy dissipaters, final cover drainage piping. Second stormwater basin assumed to be constructed during liner event.

Updated By: B. Kahnk 08/03/2023
Checked By: T. Martin 10/11/2023

Table 2: Opinion of Probable Cost
Long-term Care, Phase IV Landfill
Dairyland Power Cooperative, Alma Off-Site Disposal Facility
Plan Modification - August 2023

Major Cost Item	Unit	Unit Cost (1)	Quantity	Average Cost Per Year
Land Surface Care and Site Maintenance				
Reseed/Erosion Damage	Acre	$ 830.00	32	$ 27,000.00
Lawn Mowing	LS	$ 5,310.00	1	$ 6,000.00
Snow Plowing	LS	$ 3,000.00	1	$ 3,000.00
Road Maintenance	LS	$ 2,000.00	1	$ 2,000.00
Storm Water Control Structures Maintenance	LS	$ 8,300.00	1	$ 9,000.00
Repair Cover from Settlement	Acre	$ 340.00	32	$ 11,000.00
Sedimentation Basin Cleaning	LS	$ 830.00	1	$ 1,000.00
Groundwater Monitoring Maintenance				
Inspections and Maintenance/Purge/Resurvey, Pumps (2)	LS	$ 4,000.00	0.025	$ 1,000.00
Well Replacement/Abandonment (3)	LS	$ 10,000.00	0.375	$ 4,000.00
Leachate Collection System				
Leachate Collection Line Cleaning	LS	$ 3,320.00	1	$ 4,000.00
Operation and Maintenance	LS	$ 4,980.00	1	$ 5,000.00
Leachate Disposal	Gallon	$ 0.0415	876,000	$ 37,000.00
Environmental Monitoring (4)				
Groundwater Monitoring (15 wells)	LS	$ 9,000.00	1	$ 9,000.00
Leachate Monitoring (1 tank)	LS	$ 1,000.00	1	$ 1,000.00
Surface Water Monitoring (2 locations)	LS	$ 1,000.00	1	$ 1,000.00
Data Preparation/Submittal	LS	$ 3,000.00	1	$ 3,000.00
Inspection and Reporting				
Annual Inspections	LS	$ 3,400.00	1	$ 4,000.00
Annual Report	LS	$ 5,000.00	1	$ 5,000.00
			Long-term Care Subtotal:	$ 133,000.00
			Contingency (10%):	$ 13,300.00
			Yearly Grand Total:	$ 146,300.00
			40-year Long-term Care Cost:	**$ 5,852,000.00**

Note:

(1) Costs are in 2023 dollars according to Wisconsin DNR Owner Financial Responsibility Inflation Factor Table. Some totals may not agree due to rounding.

(2) Resurvey/rehabilitation - Assumed to occur once per 40 years.

(3) Replace 15 wells over 40 years.

(4) Assumes semiannual monitoring.

Update By: B. Kahnk 8/10/2023
Checked By: T. Martin 10/11/2023

Attachment 15

PAL and ACL Calculations

Attachment 15.1: Summary Table of PAL Calculations
Plan of Operation Modification for Initial Permitting of CCR Landfill - Addendum 1
Dairyland Power Cooperative, Alma Off-Site Disposal Facility Phase IV Landfill
Town of Belvidere, Buffalo County, Wisconsin

Parameter (units)	Well	# Samples	# Samples for Calcs Count	Avg.	StDev for Calc(1)	Min. Increase(2)	Avg. + 3StDev	Avg. + Min. Increase	PAL, Calculated	PAL, Rounded(3)
Alkalinity (mg/L)	W-100R	8	8	299.375	2.875	100	308.00	399.38	399.38	400
Alkalinity (mg/L)	W-100AR	8	8	309.125	3.357	100	319.20	409.13	409.13	410
Alkalinity (mg/L)	W-101	8	8	291.125	3.182	100	300.67	391.13	391.13	400
Alkalinity (mg/L)	W-102R	8	8	277	2.000	100	283.00	377.00	377.00	380
Alkalinity (mg/L)	W-105	8	8	284	2.204	100	290.61	384.00	384.00	390
Alkalinity (mg/L)	W-106	8	8	292.5	1.195	100	296.09	392.50	392.50	400
Alkalinity (mg/L)	W-107	8	8	308.375	2.387	100	315.54	408.38	408.38	410
Calcium, total (µg/L)	W-100R	8	8	75518.75	5231.477	25	91213.18	75543.75	91213.18	92000
Calcium, total (µg/L)	W-100AR	8	8	76671.25	3905.825	25	88388.73	76696.25	88388.73	89000
Calcium, total (µg/L)	W-101	8	8	67706.25	3229.847	25	77395.79	67731.25	77395.79	78000
Calcium, total (µg/L)	W-102R	8	8	61010	2511.465	25	68544.40	61035.00	68544.40	69000
Calcium, total (µg/L)	W-105	8	8	64871.25	2930.039	25	73661.37	64896.25	73661.37	74000
Calcium, total (µg/L)	W-106	8	8	68117.5	2483.838	25	75569.01	68142.50	75569.01	76000
Calcium, total (µg/L)	W-107	8	8	71852.5	4584.507	25	85606.02	71877.50	85606.02	86000
Conductance (µmhos/cm)	W-100R	8	8	574.25	5.625	200	591.13	774.25	774.25	780
Conductance (µmhos/cm)	W-100AR	8	8	590.25	8.876	200	616.88	790.25	790.25	800
Conductance (µmhos/cm)	W-101	8	8	579.5	11.464	200	613.89	779.50	779.50	780
Conductance (µmhos/cm)	W-102R	8	8	528.625	7.726	200	551.80	728.63	728.63	730
Conductance (µmhos/cm)	W-105	8	8	547.75	7.402	200	569.96	747.75	747.75	750
Conductance (µmhos/cm)	W-106	8	8	597.375	8.070	200	621.59	797.38	797.38	800
Conductance (µmhos/cm)	W-107	8	8	661.375	11.686	200	696.43	861.38	861.38	870
Hardness, total (mg/L as CaCO3)	W-100R	8	8	322.25	17.027	100	373.33	422.25	422.25	430
Hardness, total (mg/L as CaCO3)	W-100AR	8	8	335.875	21.404	100	400.09	435.88	435.88	440
Hardness, total (mg/L as CaCO3)	W-101	8	8	327.125	21.788	100	392.49	427.13	427.13	430
Hardness, total (mg/L as CaCO3)	W-102R	8	8	300	16.178	100	348.53	400.00	400.00	400
Hardness, total (mg/L as CaCO3)	W-105	8	8	311.625	16.818	100	362.08	411.63	411.63	420
Hardness, total (mg/L as CaCO3)	W-106	8	8	337.75	21.171	100	401.26	437.75	437.75	440
Hardness, total (mg/L as CaCO3)	W-107	8	8	373	16.630	100	422.89	473.00	473.00	480

Attachment 15.1: Summary Table of PAL Calculations

Plan of Operation Modification for Initial Permitting of CCR Landfill - Addendum 1

Dairyland Power Cooperative, Alma Off-Site Disposal Facility Phase IV Landfill

Town of Belvidere, Buffalo County, Wisconsin

Parameter (units)	Well	# Samples	# Samples for Calcs Count	Avg.	StDev for Calc[1]	Min. Increase[2]	Avg. + 3StDev	Avg. + Min. Increase	PAL, Calculated	PAL, Rounded[3]
Lithium, total (µg/L)	W-100R	8	8	1.625	0.128	-	2.01	-	2.01	2.1
Lithium, total (µg/L)	W-100AR	8	8	1.9125	0.136	-	2.32	-	2.32	2.4
Lithium, total (µg/L)	W-101	8	8	1.6	0.233	-	2.30	-	2.30	2.3
Lithium, total (µg/L)	W-102R	8	8	1.18125	0.113	-	1.52	-	1.52	1.6
Lithium, total (µg/L)	W-105	8	8	1.4375	0.119	-	1.79	-	1.79	1.8
Lithium, total (µg/L)	W-106	8	8	1.45	0.093	-	1.73	-	1.73	1.8
Lithium, total (µg/L)	W-107	8	8	1.675	0.089	-	1.94	-	1.94	2.0
Total Dissolved Solids (TDS) (mg/L)	W-100R	8	8	377.75	34.648	200	481.69	577.75	577.75	580
Total Dissolved Solids (TDS) (mg/L)	W-100AR	8	8	379.25	53.893	200	540.93	579.25	579.25	580
Total Dissolved Solids (TDS) (mg/L)	W-101	8	8	352	31.924	200	447.77	552.00	552.00	560
Total Dissolved Solids (TDS) (mg/L)	W-102R	8	8	301.25	30.174	200	391.77	501.25	501.25	510
Total Dissolved Solids (TDS) (mg/L)	W-105	8	8	331.125	31.643	200	426.05	531.13	531.13	540
Total Dissolved Solids (TDS) (mg/L)	W-106	8	8	348	30.426	200	439.28	548.00	548.00	550
Total Dissolved Solids (TDS) (mg/L)	W-107	8	8	368.25	48.553	200	513.91	568.25	568.25	570

Notes:

Prepared by: L. Auner, 11/22/2023

Checked by: S. Sellwood, 11/27/2023

PAL = preventive action limit

PALs are calculated following NR 140.20(2), except lithium, which follows NR 507.18(5)(d).

Per NR 507.27, PALs are not required for pH or temperature; however, they have been included.

- = Not applicable

Footnotes:

(1) Determined per NR 140.20(2)

(2) Minimum increase as specified in NR 140.20 Table 3, except for pH and temperature, for which values are based on NR 140.20(2)(a) and (b), respectively.

(3) PALs are rounded up two significant figures following WDNR guidance document WA 1105.

Attachment 15.2: Summary Table of ACL Calculations

Plan of Operation Modification for Initial Permitting of CCR Landfill - Addendum 1

Dairyland Power Cooperative, Alma Off-Site Disposal Facility Phase IV Landfill

Town of Belvidere, Buffalo County, Wisconsin

Parameter (units)	Well	# Samples	# Samples for Calcs Count	Detects Count	ES Exc Count[1]	PAL Exc Count[1]	Average	StDev for Calc[2]	PAL	ES	≥1 ES Exc	≥2 PAL Exc	Avg. > PAL and at Least 1 Detect	ACL Calculated	ACL Rounded[3]
Nitrate + Nitrite (mg/L as N)	W-100R	8	8	8	0	8	2.2000	0.0926	2	10		Y	Y	2.385	2.4
Nitrate + Nitrite (mg/L as N)	W-100AR	8	8	8	0	5	2.0125	0.1246	2	10		Y	Y	2.262	2.3
Nitrate + Nitrite (mg/L as N)	W-101	8	8	8	0	8	3.0625	0.2387	2	10		Y	Y	3.540	3.6
Nitrate + Nitrite (mg/L as N)	W-102R	8	8	8	0	0	1.7375	0.1061	2	10					
Nitrate + Nitrite (mg/L as N)	W-105	8	8	8	0	8	2.1500	0.1195	2	10		Y	Y	2.389	2.4
Nitrate + Nitrite (mg/L as N)	W-106	8	8	8	0	8	3.8750	0.3495	2	10		Y	Y	4.574	4.6
Nitrate + Nitrite (mg/L as N)	W-107	8	8	8	0	8	6.0375	0.2560	2	10		Y	Y	6.549	6.6

Prepared by: L. Auner, 11/22/2023

Checked by: S. Sellwood, 11/27/2023

Notes:

ACL = alternative concentration limit

ACLs are proposed following WDNR guidance document WA 1105.

ES = NR 140 enforcement standard

PAL = NR 140 preventive action limit

Footnotes:

(1) Per WDNR guidance, concentrations below the limit of quantitation (i.e., J flagged results) are not counted as exceedances of NR 140 standards for the purpose of determining the need for ACLs.

(2) Determined per NR 140.20(2)

(3) ACLs were rounded up two significant figures.

Attachment 16

Additional Waste Stream Request

Additional Waste Stream Request

Alma Offsite Disposal Facility, Phase IV Landfill
Alma, Wisconsin

January 2024

Prepared For:

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

Prepared By:

TRC
999 Fourier Drive, Suite 101
Madison, Wisconsin 53717

TABLE OF CONTENTS

ATTACHMENTS

1.0 Introduction

On behalf of Dairyland Power Cooperative (DPC) TRC Environmental Corporation (TRC) is including a request to accept a new waste stream in this s. NR 514.075 Plan Modification for Initial Permitting response to Incompleteness Comments. The waste will originate from the temporarily closed EJ Stoneman Landfill (license #3122) in Cassville, Grant County, Wisconsin and be disposed of in the Alma Off-Site Ash Disposal Facility, Phase IV Landfill in Alma, WI (AOS Phase IV Landfill), License #4126. We request that the Wisconsin Department of Natural Resources (WDNR) review and approve this request.

2.0 Request of New Waste Stream Acceptance

2.1 Background and Waste Characterization

The proposed new waste stream will be generated from the removal of waste currently interred at the EJ Stoneman Landfill in Cassville, Wisconsin. This waste stream includes the coal combustion residual (CCR) waste material interred in the landfill (combination of fly ash and bottom ash) along with CCR contaminated soils encountered during the removal of the landfill. The CCR waste material was generated at the former EJ Stoneman Generating Station located adjacent to the landfill.

The EJ Stoneman Landfill was approved in November 1987 and was constructed and operated until 1998. Approximately 23,000 cubic yards (approximately 20,000 tons) of the permitted disposal capacity of 83,400 cubic yards was consumed prior to halting waste placement in 1998. A temporary cover consisting of 6-inches of vegetated cover soil was constructed over the 2.6-acre landfill in 1998 and the temporary cover currently remains in-place. It is DPC's intention to remove the CCR waste from the EJ Stoneman Landfill along with CCR contaminated soils to fully decommission this landfill. DPC's plan for removal, further management of potentially impacted soils, and decommissioning the landfill will be presented in a Plan Modification for license number 3122 (EJ Stoneman Landfill).

Testing of the existing waste in the EJ Stoneman was completed in 2009. This testing is included in **Attachment 16.1**. The waste material was categorized as a dark to black sand/silt mixed waste mixture. During sampling the waste material at the surface was not observed to be saturated; however, sampling at depth was not completed. DPC would complete paint filter testing and GCL compatibility testing for the material and supply that information to the WDNR prior to removal of the waste. If material is encountered that would not meet the paint filter test, the material would be dried out prior to its removal and transportation to the Alma Phase IV Landfill.

2.2 Schedule

Disposal of this material is anticipated to occur during a limited time period, within a span of a couple months during the course of one calendar year. The exact timing is yet to be determined. Prior to removal and disposal of the material, a plan modification for the EJ Stoneman Landfill will need to be submitted and approved. In addition, the next module of the Phase IV Disposal Area in Alma, Wisconsin will have been constructed. The overall timeline of this material's disposal is generally dependent on these two factors.

2.3 Handling

The waste material removed from the EJ Stoneman Landfill will increase the tonnage of ash waste residual material to be landfilled at the Alma Phase IV Landfill by approximately 20,000 tons to 21,000 tons during the year that it is landfilled. The potentially impacted soil is not anticipated to cause a significant increase in the tonnage. It is anticipated that all material will be moved to the Alma Phase IV Landfill within a one-year period, so in the years following this removal disposal rates are anticipated to return to normal.

Since the material is currently interred within the EJ Stoneman Landfill, the material will be excavated from the EJ Stoneman Landfill and placed within dump trucks and/or barges. The dump trucks and/or barges will be covered so that the release of dust particles is minimized during the haul between Cassville and Alma, Wisconsin. If additional moisture conditioning is required for the material, it will be moisture conditioned to approximately 10 to 15 percent (for dust control) before being placed in the landfill (followed by grading and compaction). These activities will be discussed in further detail in a Plan Modification for license number 3122 (EJ Stoneman Landfill).

Attachment 16.1: Laboratory Results

DAIRYLAND POWER
COOPERATIVE

2008 Ash Products

Data Package

August 13, 2008

A Touchstone Energy® Cooperative

3200 East Ave. S. • PO Box 817 • La Crosse, WI 54602-0817 • 608-788-4000 • 608-787-1420 fax • www.dairynet.com

DAIRYLAND POWER
COOPERATIVE

2008 Ash Products
Sample Sources and Classifications

Product	Sample Date	Wisconsin NR 538 Classification
Cassville Landfill Ash Old Landfill	7/23/08	Category 2
Cassville Leachate Pad Ash	7/23/08	Category 3

3200 East Ave. S. • PO Box 817 • La Crosse, WI 54602-0817 • 608-788-4000 • 608-787-1420 fax • www.dairynet.com

2008 ASTM Leachate Analyses

Cassville Landfill Products

Leachate Date: 7/31/08

Parameter	Req. Det. Limit (mg/L)	Reported Detection Limit (mg/L)	Wi DNR Cat. 2 & 3 Limits (from Table 2A) (mg/L)	Wi DNR Category 4 Limits (from Table 3) (mg/L)	ASTM Cassville Landfill Ash	ASTM Cassville Leachate Pad Ash	Analysis Date	Analysis Method
Aluminum	0.10	0.020			<0.020	<0.020	8/6/08	6010B
Antimony	0.005	0.002	0.012		0.0021	<0.002	8/5/08	7010
Arsenic	0.005	0.0010	0.050		0.016	0.012	8/5/08	7010
Barium	0.04	0.010	4.0		0.029	0.021	8/5/08	6010B
Beryllium	0.001	0.0005	0.004		<0.0005	<0.0005	8/5/08	6010B
Boron	0.004	0.020	1.9	4.8	0.25	0.16	8/5/08	6010B
Cadmium	0.0002	0.002	0.005	0.025	0.0022	0.0023	8/5/08	6010B
Calcium	1.0	0.50			11	7.7	8/6/08	6010B
Chromium	0.003	0.003	0.10	0.50	<0.0030	<0.0030	8/5/08	6010B
Copper	0.003	0.005			0.0053	<0.005	8/5/08	6010B
Iron	0.05	0.010			<0.010	<0.010	8/6/08	6010B
Lead	0.003	0.0020	0.015		<0.0020	<0.0020	8/5/08	7010
Magnesium	1.0	0.50			1.8	1.6	8/6/08	6010B
Manganese	0.01	0.005	0.25		0.022	<0.005	8/5/08	6010B
Nickel	0.01	0.015			<0.015	<0.015	8/5/08	6010B
Selenium	0.001	0.002	0.10	0.25	<0.0020	<0.0020	8/5/08	7010
Silver	0.0005	0.025	0.10	0.25	<0.025	<0.025	8/5/08	6010B
Thallium	0.003	0.0020	0.004		<0.0020	<0.0020	8/6/08	7010
Zinc	0.02	0.010			0.019	<0.010	8/5/08	6010B
Sulfate (mg/L)	1.0	1.1	1250	2500	<1.1	11	8/8/08	9038
pH	0.1 units	NA			9.35	9.62	7/31/08	Hydrolab
Conductivity	10 umhos/cm	10			85	125	7/31/08	Hydrolab
Mercury			0.002		<0.0024	<0.0048		Calc.

DAIRYLAND POWER
COOPERATIVE

Chemical Services Laboratory
3251 East Ave. South
La Crosse, WI 54601
(608)788-4000

Chemical Analysis Report Form

Sample ID: **EJS Landfill Ash**

Report Date: 8/13/08

Sampling Location: Cassville, WI
Collected By: Dave Lesky
Delivered By: Dave Lesky

Sample Type: ASTM D3987-85 Leachate
Leach Date 7/31/08
Date Collected: 7/23/08
Date Received: 7/23/08

Parameter	Method	LOD	LOQ	Result	Category 2 Limit	Units	Notes
Aluminum	6010B	0.020	0.067	<0.020	NA	mg/L	
Antimony	7010	0.0020	0.0067	0.0021	0.012	mg/L	A
Arsenic	7010	0.0010	0.0033	0.016	0.050	mg/L	
Barium	6010B	0.010	0.033	0.029	4.0	mg/L	#
Beryllium	6010B	0.0005	0.0017	<0.0005	0.004	mg/L	
Boron	6010B	0.020	0.067	0.25	1.9	mg/L	
Cadmium	6010B	0.0020	0.0067	0.0022	0.005	mg/L	#
Calcium	6010B	0.50	1.7	11	NA	mg/L	
Chromium	6010B	0.0030	0.010	<0.0030	0.10	mg/L	
Copper	6010B	0.0050	0.017	0.0053	1.3	mg/L	#
Iron	6010B	0.010	0.033	<0.010	1.5	mg/L	
Lead	7010	0.0020	0.0067	<0.0020	0.015	mg/L	
Magnesium	6010B	0.50	1.7	1.8	NA	mg/L	
Manganese	6010B	0.005	0.017	0.022	0.25	mg/L	
Nickel	6010B	0.015	0.050	<0.015	0.20	mg/L	
Selenium	7010	0.0020	0.0067	<0.0020	0.10	mg/L	
Silver	6010B	0.025	0.083	<0.025	0.10	mg/L	
Thallium	7010	0.0020	0.0067	<0.0020	0.004	mg/L	
Zinc	6010B	0.010	0.033	0.019	NA	mg/L	#
Sulfate	9038	1.1	3.7	<1.1	1250	mg/L	

LOD = Limit of Detection
LOQ = Limit of Quantitation
NA = Not Applicable

= Results between LOD and LOQ
A = Matrix Spike Recovery was outside of control limits
B = Matrix Duplicate recovery was outside of control limits

The laboratory analyses reported above were determined in accordance with approved EPA Methodology and the latest edition of STANDARD METHODS.

Dairyland Power Cooperative Chemical Services Laboratory is a Wisconsin Registered Testing Laboratory.
Our Wisconsin Registration ID Number is 632023810.

Submitted by:

Dairyland Power Cooperative Chemical Services Laboratory

Tad Schwartzhoff, Analytical Chemist II.

DAIRYLAND POWER COOPERATIVE

Chemical Services Laboratory
3251 East Ave. South
La Crosse, WI 54601
(608)788-4000

Chemical Analysis Report Form

Sample ID: **EJS Leachate Pad Ash**

Report Date: 8/13/08

Sampling Location: Cassville, WI
Collected By: Dave Lesky
Delivered By: Dave Lesky

Sample Type: ASTM D3987-85 Leachate
Leach Date 7/31/08
Date Collected: 7/23/08
Date Received: 7/23/08

Parameter	Method	LOD	LOQ	Result	Category 2 Limit	Units	Notes
Aluminum	6010B	0.020	0.067	<0.020	NA	mg/L	
Antimony	7010	0.0020	0.0067	<0.002	0.012	mg/L	A
Arsenic	7010	0.0010	0.0033	0.012	0.050	mg/L	
Barium	6010B	0.010	0.033	0.021	4.0	mg/L	#
Beryllium	6010B	0.0005	0.0017	<0.0005	0.004	mg/L	
Boron	6010B	0.020	0.067	0.16	1.9	mg/L	
Cadmium	6010B	0.0020	0.0067	0.0023	0.005	mg/L	#
Calcium	6010B	0.50	1.7	7.7	NA	mg/L	
Chromium	6010B	0.0030	0.010	<0.0030	0.10	mg/L	
Copper	6010B	0.0050	0.017	<0.005	1.3	mg/L	
Iron	6010B	0.010	0.033	<0.010	1.5	mg/L	
Lead	7010	0.0020	0.0067	<0.0020	0.015	mg/L	
Magnesium	6010B	0.50	1.7	1.6	NA	mg/L	#
Manganese	6010B	0.005	0.017	<0.005	0.25	mg/L	
Nickel	6010B	0.015	0.050	<0.015	0.20	mg/L	
Selenium	7010	0.0020	0.0067	<0.0020	0.10	mg/L	
Silver	6010B	0.025	0.083	<0.025	0.10	mg/L	
Thallium	7010	0.0020	0.0067	<0.0020	0.004	mg/L	
Zinc	6010B	0.010	0.033	<0.010	NA	mg/L	
Sulfate	9038	1.1	3.7	11	1250	mg/L	

LOD = Limit of Detection
LOQ = Limit of Quantitation
NA = Not Applicable

= Results between LOD and LOQ
A = Matrix Spike Recovery was outside of control limits
B = Matrix Duplicate recovery was outside of control limits

The laboratory analyses reported above were determined in accordance with approved EPA Methodology and the latest edition of STANDARD METHODS.

Dairyland Power Cooperative Chemical Services Laboratory is a Wisconsin Registered Testing Laboratory. Our Wisconsin Registration ID Number is 632023810.

Submitted by:

Dairyland Power Cooperative Chemical Services Laboratory

Tad Schwartzhoff

Tad Schwartzhoff, Analytical Chemist II.

2008 Total Elemental Analysis

Cassville Landfill Ash

Parameter	Reported Detection Limit (mg/kg)	WI DNR Category 2 Limits (From Table 2B) (mg/kg)	Cassville Landfill Ash (mg/kg)	Cassville Leachate Pad Ash (mg/kg)	Analysis Date	Analysis Method
Aluminum	50		7,726	8,708	8/6/08	6010B
Antimony	0.10		0.96	1.5	8/6/08	7010
Arsenic	0.10	21	8.5	40	7/30/08	7010
Barium	1.0		92	127	8/5/08	6010B
Beryllium	0.10	7	1.6	2.6	8/5/08	6010B
Boron	1.0		17	26	8/5/08	6010B
Cadmium	0.25		1.6	1.9	8/5/08	6010B
Calcium	50		9,186	5,822	8/6/08	6010B
Chromium	0.50		18	23	8/5/08	6010B
Cobalt	2.0		5.7	9.6	8/5/08	6010B
Copper	0.50		16	23	8/5/08	6010B
Iron	50		15,593	16,505	8/6/08	6010B
Lead	2.5		13	26	7/30/08	7010
Magnesium	50		2,544	2,481	8/6/08	6010B
Manganese	0.50		273	197	8/5/08	6010B
Molybdenum	2.0		<2.0	5.2	8/7/08	6010B
Nickel	1.0		17	26	8/5/08	6010B
Selenium	0.10		1.7	1.9	8/5/08	7010
Silver	1.3		<1.3	<1.3	8/5/08	6010B
Strontium	13		39	51	8/7/08	6010B
Thallium	0.10		0.53	0.68	7/30/08	7010
Vanadium	1.3		35	47	8/7/08	6010B
Zinc	0.50		73	66	8/5/08	6010B
% Solids			85%	79%	7/29/08	
Mercury			0.047	0.096	8/7/08	7471A

* **Notes** Values are reported on a dry weight basis

Merury was analyzed by TestAmerica in University Park, IL

DAIRYLAND POWER COOPERATIVE

Chemical Services Laboratory
3251 East Ave. South
La Crosse, WI 54601
(608)788-4000

Chemical Analysis Report Form

Sample ID: **EJS Landfill Ash**

Report Date: 8/7/08

Sampling Location: Cassville, WI
Collected By: Dave Lesky
Delivered By: Dave Lesky

Sample Type: Ash Mixture
Date Collected: 7/23/08
Date Received: 7/23/08

Parameter	Method	LOD	LOQ	Result	Notes
Aluminum, Total (mg/kg, dry wt.)	6010B	50	167	7,726	
Antimony, Total	7010	0.10	0.33	0.96	A
Arsenic, Total	7010	0.10	0.33	8.5	
Barium, Total	6010B	1.0	3.3	92	
Beryllium, Total	6010B	0.10	0.33	1.6	
Boron, Total	6010B	1.0	3.3	17	B
Cadmium, Total	6010B	0.25	0.83	1.6	A
Calcium, Total	6010B	50	167	9,186	
Chromium, Total	6010B	0.50	1.7	18	
Cobalt, Total	6010B	2.0	6.7	5.7	A, #
Copper, Total	6010B	0.50	1.7	16	
Iron, Total	6010B	50	167	15,593	B
Lead, Total	7010	2.5	8.3	13	B
Magnesium, Total	6010B	50	167	2,544	
Manganese, Total	6010B	0.50	1.7	273	
Molybdenum, Total	6010B	2.0	6.7	<2.0	
Nickel, Total	6010B	1.0	3.3	17	
Selenium, Total	7010	0.10	0.33	1.7	B
Silver, Total	6010B	1.3	4.3	<1.3	
Strontium, Total	6010B	13	42	39	
Thallium, Total	7010	0.10	0.33	0.53	
Vanadium, Total	6010B	1.3	4.3	35	
Zinc, Total	6010B	0.50	1.7	73	
% Solids		N/A	N/A	85%	

LOD = Limit of Detection
LOQ = Limit of Quantitation
= Results between LOD and LOQ
A = Matrix Spike Recovery was outside of control limits
B = Matrix Duplicate recovery was outside of control limits

The laboratory analyses reported above were determined in accordance with approved EPA Methodology and the latest edition of STANDARD METHODS.

Dairyland Power Cooperative Chemical Services Laboratory is a Wisconsin Registered Testing Laboratory. Our Wisconsin Registration ID Number is 632056590.

Submitted by:

Dairyland Power Cooperative Chemical Services Laboratory

Tad Schwartzhoff

Tad Schwartzhoff, Analytical Chemist II.

DAIRYLAND POWER
COOPERATIVE

Chemical Services Laboratory
3251 East Ave. South
La Crosse, WI 54601
(608)788-4000

Chemical Analysis Report Form

Sample ID: **EJS Leachate Pad Ash** Report Date: 8/7/08

Sampling Location:	Cassville, WI	Sample Type:	Ash Mixture
Collected By:	Dave Lesky	Date Collected:	7/23/08
Delivered By:	Dave Lesky	Date Received:	7/23/08

Parameter	Method	LOD	LOQ	Result	Notes
Aluminum, Total (mg/kg, dry wt.)	6010B	50	167	8,708	
Antimony, Total	7010	0.10	0.33	1.5	A
Arsenic, Total	7010	0.10	0.33	40	
Barium, Total	6010B	1.0	3.3	127	
Beryllium, Total	6010B	0.10	0.33	2.6	
Boron, Total	6010B	1.0	3.3	26	B
Cadmium, Total	6010B	0.25	0.83	1.9	A
Calcium, Total	6010B	50	167	5,822	
Chromium, Total	6010B	0.50	1.7	23	
Cobalt, Total	6010B	2.0	6.7	10	A
Copper, Total	6010B	0.50	1.7	23	
Iron, Total	6010B	50	167	16,505	B
Lead, Total	7010	2.5	8.3	26	B
Magnesium, Total	6010B	50	167	2,481	
Manganese, Total	6010B	0.50	1.7	197	
Molybdenum, Total	6010B	2.0	6.7	5.2	#
Nickel, Total	6010B	1.0	3.3	26	
Selenium, Total	7010	0.10	0.33	1.9	B
Silver, Total	6010B	1.3	4.3	<1.3	
Strontium, Total	6010B	13	42	51	
Thallium, Total	7010	0.10	0.33	0.68	
Vanadium, Total	6010B	1.3	4.3	47	
Zinc, Total	6010B	0.50	1.7	66	
% Solids		N/A	N/A	100%	

= Results between LOD and LOQ

LOD = Limit of Detection LOQ = Limit of Quantitation A = Matrix Spike Recovery was outside of control limits

B = Matrix Duplicate recovery was outside of control limits

The laboratory analyses reported above were determined in accordance with approved EPA Methodology and the latest edition of STANDARD METHODS.

Dairyland Power Cooperative Chemical Services Laboratory is a Wisconsin Registered Testing Laboratory. Our Wisconsin Registration ID Number is 632056590.

Submitted by:

Dairyland Power Cooperative Chemical Services Laboratory

Tad Schwartzhoff

Tad Schwartzhoff, Analytical Chemist II.

ANALYTICAL REPORT

Job Number: 500-13006-1

Job Description: Cassville Landfill

For:
Dairyland Power Co-op
PO BOX 817
3200 East Avenue South
La Crosse, WI 54602

Attention: Tad Schwartzhoff

Margaret Kniest

Margaret Kniest
Project Manager II
margaret.kniest@testamericainc.com
08/11/2008

These test results meet all the requirements of NELAC for accredited parameters.

The Lab Certification ID# is 100201.

All questions regarding this test report should be directed to the TestAmerica Project Manager whose signature appears on this report. All pages of this report are integral parts of the analytical data. Therefore, this report should be reproduced only in its entirety.

Reporting limits are adjusted for sample size used, dilutions and moisture content if applicable.

TestAmerica Laboratories, Inc.
TestAmerica Chicago 2417 Bond Street, University Park, IL 60466
Tel (708) 534-5200 Fax (708) 534-5211 www.testamericainc.com

Job Narrative
500-J13006-1

Comments
No additional comments.

Receipt
The samples were received at 16.8,17.2 degrees.

All other samples were received in good condition within temperature requirements.

Metals
No analytical or quality issues were noted.

EXECUTIVE SUMMARY - Detections

Client: Dairyland Power Co-op

Job Number: 500-13006-1

Lab Sample ID / Analyte	Client Sample ID	Result / Qualifier	Reporting Limit	Units	Method
500-13006-1	**CASSVILLE LANDFILL ASH**				
Mercury		47	21	ug/Kg	7471A
Percent Moisture		21	0.10	%	PercentMoisture
Percent Solids		79	0.10	%	PercentMoisture
500-13006-2	**CASSVILLE LEACHATE PAD ASH**				
Mercury		96	21	ug/Kg	7471A
Percent Moisture		19	0.10	%	PercentMoisture
Percent Solids		81	0.10	%	PercentMoisture

METHOD SUMMARY

Client: Dairyland Power Co-op

Job Number: 500-13006-1

Description	Lab Location	Method	Preparation Method
Matrix: Solid			
Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique)	TAL CHI	SW846 7471A	
Mercury in Solid or Semi-Solid Waste (Manual Cold	TAL CHI		SW846 7471A

Lab References:

TAL CHI = TestAmerica Chicago

Method References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

METHOD / ANALYST SUMMARY

Client: Dairyland Power Co-op

Job Number: 500-13006-1

Method	Analyst	Analyst ID
SW846 7471A	Klee, George O	GOK
EPA PercentMoisture	Boyd, Cheryl L	CLB

SAMPLE SUMMARY

Client: Dairyland Power Co-op

Job Number: 500-13006-1

Lab Sample ID	Client Sample ID	Client Matrix	Date/Time Sampled	Date/Time Received
500-13006-1	CASSVILLE LANDFILL ASH	Solid	07/23/2008 1200	08/05/2008 0945
500-13006-2	CASSVILLE LEACHATE PAD ASH	Solid	07/23/2008 1200	08/05/2008 0945

SAMPLE RESULTS

Analytical Data

Client: Dairyland Power Co-op

Job Number: 500-13006-1

Client Sample ID: CASSVILLE LANDFILL ASH

Lab Sample ID:	500-13006-1	Date Sampled:	07/23/2008 1200
Client Matrix:	Solid	Date Received:	08/05/2008 0945
% Moisture:	20.6		

7471A Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique)

Method:	7471A	Analysis Batch:	500-43989	Instrument ID:	Leeman Labs PS200
Preparation:	7471A	Prep Batch:	500-43984	Lab File ID:	N/A
Dilution:	1.0			Initial Weight/Volume:	0.60 g
Date Analyzed:	08/07/2008 1237			Final Weight/Volume:	50 mL
Date Prepared:	08/07/2008 0900				

Analyte	DryWt Corrected: Y	Result (ug/Kg)	Qualifier	RL
Mercury		47		21

Client: Dairyland Power Co-op | Job Number: 500-13006-1

Client Sample ID: CASSVILLE LEACHATE PAD ASH

Lab Sample ID:	500-13006-2			Date Sampled:	07/23/2008 1200
Client Matrix:	Solid	% Moisture:	18.6	Date Received:	08/05/2008 0945

7471A Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique)

Method:	7471A	Analysis Batch:	500-43989	Instrument ID:	Leeman Labs PS200
Preparation:	7471A	Prep Batch:	500-43984	Lab File ID:	N/A
Dilution:	1.0			Initial Weight/Volume:	0.60 g
Date Analyzed:	08/07/2008 1239			Final Weight/Volume:	50 mL
Date Prepared:	08/07/2008 0900				

Analyte	DryWt Corrected: Y	Result (ug/Kg)	Qualifier	RL
Mercury		96		21

General Chemistry

Client Sample ID: **CASSVILLE LANDFILL ASH**

Lab Sample ID: 500-13006-1
Client Matrix: Solid

Date Sampled: 07/23/2008 1200
Date Received: 08/05/2008 0945

Analyte	Result	Qual	Units		RL	Dil	Method
Percent Moisture	21		%		0.10	1.0	PercentMoisture
	Anly Batch: 500-43817		Date Analyzed	08/06/2008 0138			
Percent Solids	79		%		0.10	1.0	PercentMoisture
	Anly Batch: 500-43817		Date Analyzed	08/06/2008 0138			

Client Sample ID: **CASSVILLE LEACHATE PAD ASH**

Lab Sample ID: 500-13006-2
Client Matrix: Solid

Date Sampled: 07/23/2008 1200
Date Received: 08/05/2008 0945

Analyte	Result	Qual	Units		RL	Dil	Method
Percent Moisture	19		%		0.10	1.0	PercentMoisture
	Anly Batch: 500-43817		Date Analyzed	08/06/2008 0138			
Percent Solids	81		%		0.10	1.0	PercentMoisture
	Anly Batch: 500-43817		Date Analyzed	08/06/2008 0138			

QUALITY CONTROL RESULTS

Client: Dairyland Power Co-op

Job Number: 500-13006-1

QC Association Summary

Lab Sample ID	Client Sample ID	Report Basis	Client Matrix	Method	Prep Batch
Metals					
Prep Batch: 500-43984					
LCS 500-43984/2-A	Lab Control Spike	T	Solid	7471A	
MB 500-43984/1-A	Method Blank	T	Solid	7471A	
500-13006-1	CASSVILLE LANDFILL ASH	T	Solid	7471A	
500-13006-2	CASSVILLE LEACHATE PAD ASH	T	Solid	7471A	
Analysis Batch:500-43989					
LCS 500-43984/2-A	Lab Control Spike	T	Solid	7471A	500-43984
MB 500-43984/1-A	Method Blank	T	Solid	7471A	500-43984
500-13006-1	CASSVILLE LANDFILL ASH	T	Solid	7471A	500-43984
500-13006-2	CASSVILLE LEACHATE PAD ASH	T	Solid	7471A	500-43984

Report Basis

T = Total

Lab Sample ID	Client Sample ID	Report Basis	Client Matrix	Method	Prep Batch
General Chemistry					
Analysis Batch:500-43817					
500-13006-1	CASSVILLE LANDFILL ASH	T	Solid	PercentMoisture	
500-13006-2	CASSVILLE LEACHATE PAD ASH	T	Solid	PercentMoisture	

Report Basis

T = Total

Quality Control Results

Client: Dairyland Power Co-op

Job Number: 500-13006-1

Method Blank - Batch: 500-43984

Method: 7471A
Preparation: 7471A

Lab Sample ID: MB 500-43984/1-A
Client Matrix: Solid
Dilution: 1.0
Date Analyzed: 08/07/2008 1227
Date Prepared: 08/07/2008 0900

Analysis Batch: 500-43989
Prep Batch: 500-43984
Units: ug/Kg

Instrument ID: Leeman Labs PS200 Merc
Lab File ID: N/A
Initial Weight/Volume: 0.60 g
Final Weight/Volume: 50 mL

Analyte	Result	Qual	RL
Mercury	ND		17

Lab Control Spike - Batch: 500-43984

Method: 7471A
Preparation: 7471A

Lab Sample ID: LCS 500-43984/2-A
Client Matrix: Solid
Dilution: 1.0
Date Analyzed: 08/07/2008 1229
Date Prepared: 08/07/2008 0900

Analysis Batch: 500-43989
Prep Batch: 500-43984
Units: ug/Kg

Instrument ID: Leeman Labs PS200 Merc
Lab File ID: N/A
Initial Weight/Volume: 0.60 g
Final Weight/Volume: 50 mL

Analyte	Spike Amount	Result	% Rec.	Limit	Qual
Mercury	167	167	100	80 - 120	

Calculations are performed before rounding to avoid round-off errors in calculated results.

TestAmerica
ANALYTICAL TESTING CORPORATION

CHAIN OF CUSTODY REPORT

1380 Busch Parkway
Buffalo Grove, Illinois 60089-4505
(847) 808-7766
FAX (847) 808-7772

500-13006

Client: Dairyland Power Cooperative
Address: 3251 East Ave, South
La Crosse, WI 54601
Phone #: (608) 787-1441
Fax #: ( )

Project Name: Cassville Landfill
Project Number:
PO#:
Quote ID:
State & Program:
Invoice will be sent to the Client Address unless other arrangements have been made.

TAT (in days): Std (5-7) 4 3 2 1
DATE RESULTS NEEDED:
For RUSH requests:
Received at laboratory: ☐ ambient ☐ ice
Lab temp.
Deliverable Package: ☒ STD ☐ Other
Delivery Method: TA☐ Client☐
Shipped

PM/Report to: Tod Schwartzhoff
Email: TCS@DAIRYNET.COM
Sampler: Dave Lesky

	FIELD ID, LOCATION	PID Readings	DATE COLLECTED	TIME COLLECTED	SAMPLE MATRIX	MeOH	NaHSO4	HCl	HNO3	H2SO4	NaOH	NONE	TOTAL # OF BOTTLES	Mercury Total										LABORATORY ID NUMBER (THIS SECTION FOR LAB USE ONLY)
1	1 Cassville Landfill Ash		7/23/08		Ash							1	1	X										
2	2 Cassville Leachate Pad Ash		7/23/08		Ash							1	1	X										
	3																							
	4																							
	5																							
	6																							
	7																							
	8																							
	9																							
	10																							

ANALYSIS TYPE

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RELINQUISHED	DATE / TIME	RECEIVED	DATE / TIME	RELINQUISHED	DATE / TIME	RECEIVED	DATE / TIME
T. Schwartzhoff	8/4/08 1400	[signature]	8/5/08 0945				
RELINQUISHED	DATE / TIME	RECEIVED	DATE / TIME	RELINQUISHED	DATE / TIME	RECEIVED	DATE / TIME

COMMENTS:

PAGE 1 OF 1

Login Sample Receipt Check List

Client: Dairyland Power Co-op

Job Number: 500-13006-1

Login Number: 13006
Creator: Lunt, Jeff T
List Number: 1

List Source: TestAmerica Chicago

Question	T / F/ NA	Comment
Radioactivity either was not measured or, if measured, is at or below background	True	
The cooler's custody seal, if present, is intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	False	
Cooler Temperature is recorded.	True	16.8,17.2
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	True	
If necessary, staff have been informed of any short hold time or quick TAT needs	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	

DAIRYLAND POWER COOPERATIVE
AS RECEIVED COAL ANALYSIS
Special Tests From ID Number 532 To ID Number540

29-May-09

Sample Date	ID Number	Air Dry Moisture	Inherent Moisture	Total Moisture	BTU	Ash	Sulfur	Volatiles	Fixed Carbon	MAF BTU	SO2 lb/MBTU	Special Test	Comments
5/20/2009	532	25.60	1.74	26.89	3247	0.00	0.000	0.00	0.00	4441	0.00		-1# AD LOI=18.78
5/20/2009	533	20.99	1.40	22.10	2742	0.00	0.000	0.00	0.00	3519	0.00		-1# AE LOI=12.79
5/20/2009	534	22.60	1.96	24.11	3330	0.00	0.000	0.00	0.00	4388	0.00		-1# AF LOI=16.42
5/20/2009	535	13.75	1.30	14.88	3099	0.00	0.000	0.00	0.00	3640	0.00		-1# BD LOI =11.29
5/20/2009	536	14.12	1.82	15.68	3646	0.00	0.000	0.00	0.00	4325	0.00		-1# BE LOI=20.14
5/20/2009	537	17.04	1.73	18.48	3109	0.00	0.000	0.00	0.00	3814	0.00		-1# BF LOI=15.88
5/20/2009	538	22.80	1.73	24.13	2718	0.00	0.000	0.00	0.00	3583	0.00		-1# CD LOI=15.88
5/20/2009	539	15.59	1.85	17.15	3280	0.00	0.000	0.00	0.00	3959	0.00		-1# CE LOI=18.55
5/20/2009	540	22.31	1.60	23.55	3040	0.00	0.000	0.00	0.00	3977	0.00		-1# CF LOI=18.17

Cassville Sample ID

[redacted]